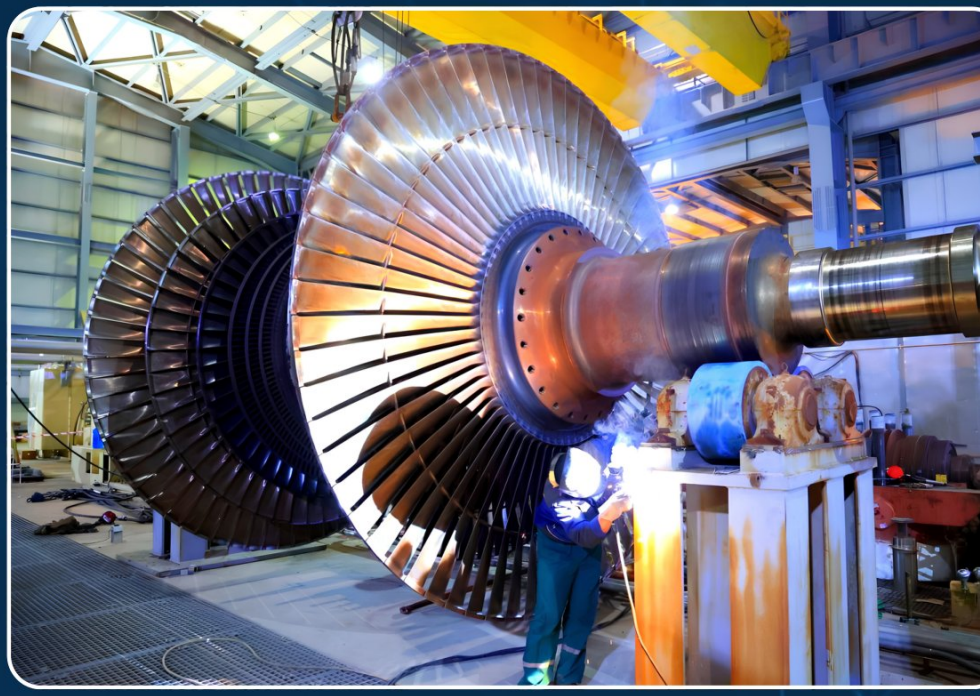
MUHANDISLIK & IQTISODIYOT

ijtimoiy-iqtisodiy, innovatsion texnik, fan va ta'limga oid ilmiy-amaliy jurnal

2026-YIL
IYUN/6-SON, III-QISM



Milliy nashrlar

OAK: https://oak.uz/pages/4802

05.00.00 - Texnika fanlari
08.00.00 - Iqtisodiyot fanlar

ISSN: 3060-463X

muhandislik & iqtisodiyot

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Elektron nashr, 2026-yil, iyun.

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05.01.00 – Axborot texnologiyalari, boshqaruv va kompyuter grafikasi
05.01.01 – Muhandislik geometriyasi va kompyuter grafikasi. Audio va video texnologiyalari
05.01.02 – Tizimli tahlil, boshqaruv va axborotni qayta ishlash
05.01.03 – Informatikaning nazariy asoslari
05.01.04 – Hisoblash mashinalari, majmualari va kompyuter tarmoqlarining matematik va dasturiy ta'minoti
05.01.05 – Axborotlarni himoyalash usullari va tizimlari. Axborot xavfsizligi
05.01.06 – Hisoblash texnikasi va boshqaruv tizimlarining elementlari va qurilmalari
05.01.07 – Matematik modellashtirish
05.01.11 – Raqamli texnologiyalar va sun'iy intellekt
05.02.00 – Mashinasozlik va mashinashunoslik
05.02.08 – Yer usti majmualari va uchish apparatlari
05.03.02 – Metrologiya va metrologiya ta'minoti
05.04.01 – Telekommunikasiya va kompyuter tizimlari, telekommunikasiya tarmoqlari va qurilmalari. Axborotlarni taqsimlash
05.05.03 – Yorug'lik texnikasi. Maxsus yoritish texnologiyasi
05.05.05 – Issiqlik texnikasining nazariy asoslari
05.05.06 – Qayta tiklanadigan energiya turlari asosidagi energiya qurilmalari
05.06.01 – To'qimachilik va yengil sanoat ishlab chiqarishlari materialshunosligi
05.08.03 – Temir yo'l transportini ishlatish
05.08.06 – "G'ildirakli va gusenisali mashinalar va ularni ishlatish" (texnika fanlari)
05.09.01 – Qurilish konstruksiyalari, bino va inshootlar
05.09.04 – Suv ta'minoti. Kanalizatsiya. Suv havzalarini muhofazalovchi qurilish tizimlari
10.00.06 – Qiyosiy adabiyotshunoslik, chog'ishtirma tilshunoslik va tarjimashunoslik
10.00.04 – Yevropa, Amerika va Avstraliya xalqlari tili va adabiyoti
08.00.01 – Iqtisodiyot nazariyasi
08.00.02 – Makroiqtisodiyot
08.00.03 – Sanoat iqtisodiyoti
08.00.04 – Qishloq xo'jaligi iqtisodiyoti
08.00.05 – Xizmat ko'rsatish tarmoqlari iqtisodiyoti
08.00.06 – Ekonometrika va statistika
08.00.07 – Moliya, pul muomalasi va kredit
08.00.08 – Buxgalteriya hisobi, iqtisodiy tahlil va audit
08.00.09 – Jahon iqtisodiyoti
08.00.10 – Demografiya. Mehnat iqtisodiyoti
08.00.11 – Marketing
08.00.12 – Mintaqaviy iqtisodiyot
08.00.13 – Menejment
08.00.14 – Iqtisodiyotda axborot tizimlari va texnologiyalari
08.00.15 – Tadbirkorlik va kichik biznes iqtisodiyoti
08.00.16 – Raqamli iqtisodiyot va xalqaro raqamli integratsiya
08.00.17 – Turizm va mehmonxona faoliyati

Ma'lumot uchun, OAK Rayosatining 2024-yil 28-avgustdagi 360/5-son qarori bilan "Dissertatsiyalar asosiy ilmiy natijalarini chop etishga tavsiya etilgan milliy ilmiy nashrlar ro'yxati"ga texnika va iqtisodiyot fanlari bo'yicha "Muhandislik va iqtisodiyot" jurnali ro'yxatga kiritilgan.

Muassis: "Tadbirkor va ishbilarmon" MChJ

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2. Toshkent davlat iqtisodiyot universiteti
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KNOWLEDGE ASSESSMENT AND RESULTS VISUALIZATION BASED ON TEXT MINING IN E-LEARNING PLATFORMS

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Abstract. This article explores the application of Text Mining technologies for assessing learners' knowledge levels and analyzing educational activities in E-learning platforms. The main objective of the study is to develop methods for the automatic evaluation of students' knowledge and the visualization of learning outcomes based on the analysis of textual data generated during the learning process. The research methodology includes text preprocessing, keyword extraction using the TF-IDF algorithm, sentiment analysis, and K-Means clustering techniques. The findings demonstrate that Text Mining technologies are effective tools for identifying students' knowledge levels and learning engagement. Furthermore, visualization techniques, including charts and graphs, significantly improve the monitoring of educational processes, the analysis of learning outcomes, and the efficiency of decision-making.

Keywords: E-learning, Text Mining, knowledge assessment, TF-IDF, sentiment analysis, clustering, data visualization, learning analytics, artificial intelligence.

Annotatsiya. Mazkur maqolada elektron ta'lim (E-learning) platformalarida foydalanuvchilarning bilim darajasini baholash va o'quv faoliyatini tahlil qilishda Text Mining texnologiyalaridan foydalanish imkoniyatlari o'rganilgan. Tadqiqotning asosiy maqsadi ta'lim jarayonida shakllanadigan matnli ma'lumotlarni qayta ishlash va tahlil qilish orqali talabalar bilimini avtomatik baholash hamda olingan natijalarni vizuallashtirish usullarini ishlab chiqishdan iborat. Tadqiqot metodologiyasi sifatida matnlarni oldindan qayta ishlash, TF-IDF algoritmi yordamida kalit so'zlarni aniqlash, sentiment tahlili va K-Means klasterlash usullaridan foydalanildi. Tadqiqot natijalari Text Mining texnologiyalari talabalarning bilim darajasi va o'quv faolligini aniqlashda samarali vosita ekanligini ko'rsatdi. Shuningdek, grafik va diagrammalar asosidagi vizualizatsiya usullari ta'lim jarayonini monitoring qilish, natijalarni tahlil etish hamda boshqaruv qarorlarini qabul qilish samaradorligini oshirishi aniqlandi.

Kalit so'zlar: E-learning, Text Mining, bilimni baholash, TF-IDF, sentiment tahlili, klasterlash, ma'lumotlarni vizuallashtirish, ta'lim analitikasi, sun'iy intellekt.

Аннотация. В данной статье исследуются возможности использования технологий Text Mining для оценки уровня знаний пользователей и анализа учебной деятельности на платформах электронного обучения (E-learning). Основной целью исследования является разработка методов автоматизированной оценки знаний студентов и визуализации результатов обучения на основе анализа текстовых данных, формируемых в процессе обучения. В качестве методологии исследования использованы предварительная обработка текстов, выделение ключевых слов с помощью алгоритма TF-IDF, анализ тональности (Sentiment Analysis) и метод кластеризации K-Means. Полученные результаты показали, что технологии Text Mining являются эффективным инструментом для определения уровня знаний и учебной активности студентов. Кроме того, применение средств визуализации в виде графиков и диаграмм способствует повышению эффективности мониторинга образовательного процесса, анализа результатов обучения и принятия управленческих решений.

Ключевые слова: E-learning, Text Mining, оценка знаний, TF-IDF, анализ тональности, кластеризация, визуализация данных, образовательная аналитика, искусственный интеллект.

INTRODUCTION

The rapid development of digital technologies has led to the widespread adoption of E-learning platforms in modern education systems. The volume of textual data generated by students on platforms such as Moodle, Google Classroom, Coursera, and similar learning environments is increasing every year. These data are generated in the form of forum discussions, test responses, essays, assignments, and feedback comments.

Traditional assessment methods often do not allow for the rapid and accurate analysis of large volumes of educational data. Therefore, the application of Text Mining technologies has become one of the most relevant areas of research in contemporary education. Text Mining enables the automatic assessment of

students' cognitive abilities, knowledge acquisition levels, and learning activities through the analysis of textual information.

The main hypothesis of this study is that the analysis of textual data collected from E-learning platforms using Text Mining techniques can provide accurate knowledge assessment and effective visualization of learning outcomes. Such an approach can improve the quality of educational analytics, support evidence-based decision-making, and enhance the overall effectiveness of the learning process.

In recent years, numerous scientific studies have been conducted in the fields of Learning Analytics and Text Mining. These studies demonstrate that the integration of artificial intelligence and data analytics technologies into educational environments creates new opportunities for monitoring student performance, identifying learning patterns, and improving educational outcomes.

LITERATURE REVIEW

Romero and Ventura (2020) investigated the application of data mining technologies in E-learning systems and analyzed their potential for predicting student performance. Their study demonstrated that data mining techniques are effective in forecasting learning outcomes.

Baker and Inventado (2018) highlighted the advantages of Data Mining and Learning Analytics in educational data analysis. The researchers emphasized the importance of artificial intelligence methods in monitoring, analyzing, and evaluating student behavior.

Aggarwal and Zhai (2019) described Text Mining technologies as effective tools for the automatic processing of large-scale textual data. Their work revealed the practical significance of text classification, clustering, and information extraction methods.

Local researchers have also conducted studies on data analysis and quality improvement in digital learning environments. Their findings indicate that artificial intelligence and analytical technologies significantly contribute to enhancing the effectiveness of education and improving learning outcomes.

RESEARCH METHODOLOGY

Student-generated textual responses collected from E-learning platforms were selected as the research object.

The study was conducted in the following stages:

1. Data collection
- Forum discussions on the Moodle platform;
- Descriptive answers to test questions;
- Student essays and assignments.

2. Text preprocessing
- Tokenization;
- Stop-word removal;
- Lemmatization;
- Text normalization.

3. Application of Text Mining techniques
- TF-IDF algorithm;
- Keyword extraction;
- Sentiment analysis;
- K-Means clustering.

4. Results visualization
- Word clouds;
- Bar charts;
- Heat maps;
- Dashboard visualizations.

A dataset consisting of more than 10,000 textual records from 500 students was created for the study.

ANALYSIS AND RESULTS

The analysis identified the most frequently used academic terms in students' responses. Important subject-related concepts were extracted using the TF-IDF algorithm (Table 1).

Table 1
Results of Knowledge Assessment Based on Text Mining[1]

Knowledge Level	Number of Students	Percentage (%)
High	185	37
Medium	220	44
Low	95	19

The results indicate that 37% of students demonstrated a high level of knowledge, 44% showed a medium level, and 19% exhibited a low level (Table 2).

Table 2
Data Sources Used in the Study[2]

Data Source	Data Type	Number of Records
Moodle Forums	Textual comments	4,200
Test Responses	Short texts	2,800
Essay Assignments	Extended texts	2,100
Online Discussions	Forum posts	900
Total	—	10,000

Note: A total of 10,000 textual records obtained from E-learning platforms were analyzed in this study (Table 3).

Table 3
Main Stages of the Text Mining Process[3]

Stage	Process Performed	Outcome
1	Data Collection	Text database created
2	Tokenization	Words segmented
3	Stop-word Removal	Irrelevant terms removed
4	Lemmatization	Base forms of words obtained
5	TF-IDF Calculation	Important keywords identified
6	Clustering	Students grouped into clusters
7	Visualization	Charts and diagrams generated

Table 4
Most Frequently Occurring Keywords (TF-IDF Results)[4]

Keyword	Frequency	TF-IDF Score
Algorithm	742	0.89
Data	695	0.86
Artificial Intelligence	634	0.84
Text Mining	598	0.82
Analytics	521	0.79
Visualization	488	0.76

The analysis showed that the concepts of “algorithm,” “data,” and “artificial intelligence” were the most significant terms in students’ responses.

The use of visualization tools enabled educators to monitor students’ learning progress more efficiently. Dashboard-based visualizations improved the identification of problematic areas in the learning process and supported more effective decision-making.

The results of this study demonstrate that Text Mining technologies can facilitate the automatic assessment of students’ knowledge levels in E-learning platforms. Through the analysis of textual data, it is possible to identify students’ learning activities, academic performance, and challenges encountered during the educational process.

1 author’s development
2 author’s development
3 author’s development
4 author’s development

Based on the results of the study, the following recommendations are proposed:

1. Integrate Text Mining modules into E-learning platforms.
2. Implement automated knowledge assessment systems.
3. Develop real-time analytical dashboards.
4. Use artificial intelligence-based recommendation systems.
5. Promote the widespread adoption of Learning Analytics technologies in higher education institutions.

As a result, these approaches can contribute to improving the quality of education, accurately assessing students' knowledge, and developing personalized learning pathways.

CONCLUSION AND RECOMMENDATIONS

The study demonstrated that Text Mining technologies provide effective solutions for assessing students' knowledge levels and analyzing educational activities in E-learning environments. The increasing volume of textual data generated through online learning platforms creates new opportunities for applying artificial intelligence and learning analytics techniques to improve the quality of education.

The research findings confirmed that the use of text preprocessing methods, TF-IDF-based keyword extraction, sentiment analysis, and K-Means clustering enables the automatic identification of students' learning performance, engagement levels, and learning difficulties. The analysis revealed that Text Mining techniques can significantly reduce the time required for educational assessment while improving the objectivity and consistency of evaluation processes.

Based on the results of the study, the following recommendations are proposed:

1. Integrate Text Mining modules into existing E-learning platforms to enable automated analysis of student-generated textual content.

2. Develop intelligent knowledge assessment systems that combine natural language processing and machine learning techniques for more accurate evaluation of learning outcomes.

3. Implement real-time analytical dashboards to support continuous monitoring of student engagement, academic performance, and learning progress.

4. Introduce artificial intelligence-based recommendation systems capable of providing personalized learning materials and adaptive educational support.

5. Expand the application of Learning Analytics technologies in higher education institutions to improve educational quality, optimize teaching strategies, and enhance student success rates.

The effective application of Text Mining technologies in E-learning platforms can significantly improve knowledge assessment processes, strengthen educational analytics, and support evidence-based educational management. The integration of advanced analytical tools and visualization techniques represents an important step toward the development of intelligent, data-driven, and learner-centered educational environments.

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Ingliz tili muharriri: Feruz Hakimov

Musahhih: Zokir Alibekov

Sahifalovchi va dizayner: Abdurahmon Qurbonov

2026. № 6

"Muhandislik va iqtisodiyot" jurnali 26.06.2023-yildan
O'zbekiston Respublikasi Prezidenti Adminstratsiyasi huzuridagi
Axborot va ommaviy kommunikatsiyalar agentligi tomonidan
№S–5669245 reyestr raqami tartibi bo'yicha ro'yxatdan o'tkazilgan.
Litsenziya raqami: №095310.

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