Journal of Computer Technology and Applied Mathematics
Journal Home: http://jctam.suaspress.org | CODEN: JCTAAD
Vol. 2, No. 3, 2025 | ISSN 3007-4126 (Print) | ISSN 3007-4134 (Online) | ISSN 3007-4142 (Digital)

SUAS Press

Construction of Intelligent Perception and Operation Control Framework of Education Platform

ZHAO, Zhonglin [1*]

[1] Imperial College London, UK

**** ZHAO, Zhonglin is the corresponding author, E-mail: zhonglintj@outlook.com***

Abstract: With the continuous advancement of the digital transformation of education and the increasing scale of the smart education platform system at all levels and across regions, how to achieve efficient operation monitoring to support the construction of the education big data system has become a key topic to promote the modernization of education. In order to address this challenge, this paper first summarizes the development trend of the smart education platform system and the current status of its operation monitoring. Subsequently, the monitoring agent mechanism and data collection model were proposed, a monitoring framework suitable for the smart education platform was constructed, and the corresponding operation monitoring process was clarified. Furthermore, a set of technical architecture including "multi-dimensional cross-structure" was designed to support the dynamic operation monitoring of the platform system. Finally, the analysis and application path based on the monitoring data of the platform are discussed. This paper conducts research from multiple levels such as system architecture, data model and technical implementation, aiming to provide reference and technical support for relevant institutions to build an education platform monitoring system and explore data-driven educational innovation applications.

Keywords: Smart Education, Platform Monitoring, Educational Technology, Data-driven.

Disciplines: Computer Technology Application. **Subjects:** Computer Application Development.

DOI: https://doi.org/10.70393/6a6374616d.323839 **ARK:** https://n2t.net/ark:/40704/JCTAM.v2n3a01

1 INTRODUCTION

At present, the global wave of digitalization is accelerating, profoundly reshaping the operational models of society and driving deep transformations across all sectors—including the education field, which is now facing unprecedented pressures and opportunities for development. Many international organizations and national governments have identified the advancement of digital education as a core strategic objective, aiming to enhance the flexibility, accessibility, and intelligence of educational systems through the application of emerging technologies.

In this context, building a unified and efficient digital infrastructure for education has emerged as a pivotal challenge. Governments around the world are continuously strengthening their investments in educational technologies, policy formulation, resource integration, and international cooperation, advancing digital education strategies from conceptual advocacy to systemic implementation. For instance, an increasing number of regions are establishing national or regional education big data centers, which serve as hubs for resource sharing, platforms for public service integration, and critical nodes for data governance and evaluation.

Aligned with the practical development needs of smart education platforms, this study concentrates on the core functional positioning of education big data centers and specifically targets the key aspect of operational status monitoring. By deploying intelligent monitoring agents and establishing robust data collection mechanisms, the system achieves comprehensive integration and analysis of both static and dynamic data generated during platform operations. This not only supports educational and instructional activities but also provides critical data-driven foundations for modernizing educational governance capabilities, thereby continuously advancing the deep evolution of digital education systems.

Moreover, considering the foundational importance of high-quality data input in such digital infrastructures, the study draws on insights from Hu, Niu, and Tang (2021), who emphasized the value of integrating lexical and semantic domain features during the preprocessing stage. Their approach to fault text data processing in complex systems offers important methodological guidance for ensuring that upstream data handling maintains both precision and interpretability—principles equally applicable to the educational domain, where accurate data preprocessing is essential for reliable analysis and intelligent decision-making [1].

2 OVERVIEW OF THE SMART EDUCATION PLATFORM SYSTEM

Although the construction of the smart education platform system has achieved initial results, it still faces many challenges at the level of operation monitoring, which are mainly reflected in the following aspects: Since the platform system is composed of multiple sources, architectures and construction subjects, there are significant differences in deployment mode, technical standards and management methods of different platforms. The existing system includes a number of national education platform portals, sub-platforms of different stages and functions, and multiple social online learning platforms[2]. The data collection mechanisms and storage strategies of these platforms are different, resulting in scattered data, inconsistent interfaces, and high information barriers, making it difficult to achieve efficient monitoring data integration and sharing. The platform covers a wide range of data types, including structured data (such as user basic information, evaluation indicators, etc.), semi-structured data (course metadata, service items, etc.), and a large amount of unstructured data (text, audio and video, images, etc.)[3-5]. While data diversity provides a richer dimension to analysis, it also greatly increases the difficulty of data standardization and fusion processing. Differences in the standards used to collect data across platforms lead to significant resource consumption in harmonizing field and metric definitions, making it difficult to ensure data quality and comparability. Traditional operation monitoring methods mostly rely on basic data such as the number of visits and activity reported by various platforms, and can only present a rough usage. This kind of single monitoring method lacks in-depth insight into user behavior, and it is difficult to reflect the personalized learning path of students, the characteristics of teachers' teaching behavior, or the actual effectiveness of platform services. At the same time, the instability of the data collection link may also affect the integrity and timeliness of the data, limiting the accurate grasp of the platform's operating status and the continuous optimization of data[6-7].

3 RUN THE CONSTRUCTION OF THE MONITORING MODEL

With the continuous advancement of the education digitalization strategy, the smart education platform system has gradually evolved into a composite system covering multiple levels, multiple service forms and multiple data structures. In this process, the operational efficiency, user experience, and service responsiveness of the platform become key indicators to evaluate the quality of its development. However, the diversity and complexity of the current smart education platform also make it difficult to systematically monitor and understand its operating status. The inconsistency of technical architectures between platforms, the non-uniformity of data standards, and the wide range of service objects have all posed new challenges to the construction of the operation monitoring system. Based on this background, the construction of a scientific, flexible and scalable operation monitoring model has become the basic task to promote the high-quality development of the smart education platform[8].

In order to improve the visualization and evaluation ability of the platform operation status, this study proposes to introduce the "monitoring messenger" mechanism as a bridge to realize the information exchange between the platform and the monitoring system. In this study, the term "messenger" was originally used as a medium to convey information, but in this study, it is redefined as a logical component of information transmission and behavior collection, which is specifically used to perceive, collect and transmit various types of data generated during the operation of the platform. Through this mechanism, the operation monitoring system can realize the active perception and immediate response of the platform behavior, and provide the necessary data basis for subsequent data analysis, behavior modeling and intelligent feedback.

In the implementation process, the mechanism relies on lightweight technical components embedded in the smart education platform system, which are configured on key nodes such as user access paths, resource loading modules and data sharing interfaces, and can complete the real-time recording of user behavior tracks, platform service status and system interaction events without affecting the performance of the platform. Through the continuous monitoring of user identity information, platform access behavior, resource use process and interactive feedback, the platform can form a set of dynamically updated operation portraits. This portrait not only describes the use of the platform in a given period of time, but also reveals its comprehensive performance in terms of user habits, service matching efficiency, and system operation security[9-10].

In addition, on the basis of the monitoring mechanism, this paper constructs a data collection model that is highly adaptable. The model models around the core objects and key behavioral events in the operation of the platform to ensure the systematic, coherent and scalable data collection. Specifically, the model design adheres to the principle of "minimum necessary collection", and strives to capture the most critical information content through the fewest data fields to avoid information redundancy and waste of system resources. The model covers multiple dimensions such as platform structure, access behavior, resource directory, content use, user identity, interactive feedback, and system security, aiming to achieve a comprehensive and multi-angle description of the operating environment.

At the level of platform structure, the model provides a basic reference for subsequent data classification and behavior positioning by collecting the mapping relationship between the platform page structure and functional modules. At the level of user behavior, the model focuses on the user's

Journal of Computer Technology and Applied Mathematics
Journal Home: http://jctam.suaspress.org | CODEN: JCTAAD
Vol. 2, No. 3, 2025 | ISSN 3007-4126 (Print) | ISSN 3007-4134 (Online) | ISSN 3007-4142 (Digital)

behavioral characteristics such as access path, dwell time, and operation sequence in the platform, so as to reveal the user's preferences and behavior patterns. At the resource usage level, the model provides a basis for the content recommendation mechanism and resource scheduling strategy by monitoring the playback behavior, loading frequency and reuse rate of resources. At the interaction level, the user's feedback behavior, including content ratings, comments, favorites and sharing, etc., is recorded to evaluate the quality of resources and user satisfaction. In terms of security assurance, the model integrates monitoring indicators for network anomalies, malicious attacks, and abnormal data traffic, building the first line of defense for the stable operation of the platform[11].

It is worth emphasizing that the model is not designed only for monitoring, and its deeper goal is to drive the continuous optimization of the service capabilities of the education platform through monitoring the collected data. In long-term operation, the operation monitoring system can form a comprehensive evaluation index system on platform efficiency, resource adaptability, user satisfaction and system load capacity. This system can not only serve the iterative upgrading of the platform itself, but also provide quantitative reference for education managers to assist them in making more scientific decisions in terms of resource allocation, content optimization, and policy regulation.

To sum up, by building an operation monitoring model with highly integrated and agile response capabilities, the smart education platform system can realize the transformation from passive supervision to active regulation, and from static display to dynamic optimization. This model not only improves the manageability and maintainability of the platform at the technical level, but also provides data support at the level of education governance, which is expected to lay a solid foundation for the intelligent evolution of the future education digital system[12].

4 OPTIMIZATION OF THE OPERATION MONITORING PROCESS

In the process of building a monitoring system for the operation of the smart education platform, how to realize the efficient coordination and system governance of the monitoring mechanism driven by data has become one of the key technical links. To this end, based on the design concept of "data-centric", this paper proposes a complete set of operation monitoring processes, covering five core stages: indicator system construction, data collection specifications, data governance strategies, feedback mechanism construction and data application scenario integration, and strives to build a closed-loop and intelligent monitoring ecosystem, so as to achieve the goals of platform self-perception, self-evaluation and self-optimization.

First of all, the construction of a scientific monitoring index system is the starting point of the entire monitoring process. The design of the indicator system should be able to comprehensively and objectively reflect the status and change trend of the education platform in the process of operation, and provide a quantitative basis for horizontal comparison and longitudinal evaluation between the platforms. The indicator framework should be developed from the multi-dimensional perspectives of platform structure performance, service quality and user behavior feedback. At the platform level, focus on its functional integrity, technical response speed and safe operation ability; At the business level, key data indicators such as resource supply, service usage frequency, and user evaluation distribution should be included, which can not only quantify the content contribution of the platform, but also reflect user satisfaction and usage stickiness. At the user level, it focuses on evaluating the geographical distribution of users, login frequency, active time period, and user loyalty, etc., and then depicts user portraits to provide basic support for personalized service optimization[13-16].

$$I = w_p I_p + w_s I_s + w_u I_u, where\ w_p + w_s + w_u = 1$$

Secondly, the construction of the data collection mechanism must realize the dual capture of the static structure and dynamic behavior of the platform. Static data is usually relatively stable, including the platform page structure, resource directory, user basic information, etc., which is the basic description of the platform's operation logic. Dynamic data has the characteristics of real-time and high-frequency updates, such as user access behavior, resource playback behavior, interactive feedback information and network operation security, etc., which can reflect the activity and change trend of platform operation in real time. In order to ensure the systematization and standardization of data collection, it is necessary to formulate a unified data collection standard and implement it through various technical means such as interface services, database exchange, and front-end script embedding. At the same time, the accurate positioning of data sources with the help of platform unique identifiers can improve the traceability and clarity of data attribution, thereby enhancing the feasibility and security of cross-platform data fusion[17-20].

Third, in the face of massive data from multiple sources and heterogeneous sources, data fusion governance has become a core step to improve data quality. In the specific operation process, it is necessary to realize the standardization and structured management of the collected data through a multi-link data processing process. The first is data verification, which verifies the legitimacy of user identity and platform structure through comparison with authoritative databases (such as educational institution databases, population information databases, etc.) to ensure the credibility of data sources. The second is data matching, which realizes the logical mapping of static and dynamic data through the association between platform identity and user identity, and opens up a channel for data fusion; Finally, data

Journal of Computer Technology and Applied Mathematics
Journal Home: http://jctam.suaspress.org | CODEN: JCTAAD
Vol. 2, No. 3, 2025 | ISSN 3007-4126 (Print) | ISSN 3007-4134 (Online) | ISSN 3007-4142 (Digital)
SUAS Press

cleaning uses a series of technical rules to eliminate redundant values, outliers and missing values, improve the integrity, consistency and timeliness of data, and provide a reliable basis for subsequent analysis. This governance process not only improves data quality, but also helps to establish a data management mechanism for the whole life cycle.

$$\forall e \in E, valid(e) \Leftrightarrow \exists a \in A, e \equiv a$$

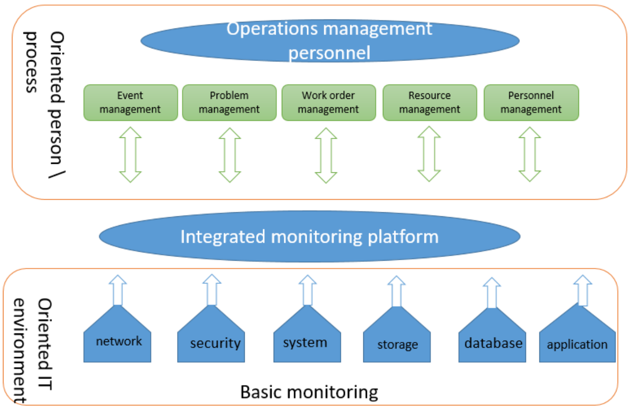

FIG. 1 GRAPH CONVOLUTIONAL RECOMMENDATION ENGINE BASED ON IMPLICIT MULTI-BEHAVIOR AND KNOWLEDGE

On the basis of data governance, building an efficient data feedback mechanism is the key to realize the application of data circulation. The monitoring system needs to organize and store the data that has been governed and classified according to topics, and form a well-structured thematic database such as an indicator library, a platform library, a service library, and a resource library, so as to provide basic data support for education management and platform self-assessment. Data feedback should not only stay in the result presentation stage, but should be sent back to the data source platform in a timely manner through the data sharing interface, so that the platform can carry out function optimization and service adjustment based on the feedback results. By deploying visual analysis tools, each access platform can quickly grasp the operating status, identify potential problems, and propose improvement plans. At the same time, the monitoring system needs to strengthen de-identification processing in the process of data transmission and use, ensure user privacy and institutional data security, and create prerequisites for linkage analysis and sharing and comparison between multiple platforms[21].

Finally, operation monitoring data should be actively integrated into education application scenarios to further release its potential value in supporting education decision-making and service optimization. With the continuous expansion of data scale and the accumulation of historical data, operation monitoring data can be used in a variety of educational digital applications. For example, at the student learning level, learning rhythm and interest preferences can be analyzed based on behavioral data, and learning resources can be accurately recommended. At the teaching level, with the help of student learning feedback data, teachers can be assisted in adjusting teaching strategies to achieve personalized teaching. At the school management level, the platform uses behavioral data to evaluate the curriculum effect and the rationality of resource allocation, and optimizes the school governance process. At the level of educational research, operational monitoring data can provide multi-dimensional data support for academic researchers, and promote the cross-integration of educational theory research and practical paths. At the policy level, education managers can rely on operational data to dynamically grasp key information such as resource distribution, teaching activities, and user behavior, so as to provide a quantitative basis for the allocation of educational resources, development strategies, and governance mechanisms.

To sum up, optimizing the operation monitoring process is not only a technical path to improve the operation efficiency of the smart education platform, but also a basic support to promote the sustainable development of the education digital system. Through the establishment of a complete monitoring closed loop, from data collection, integrated governance to data feedback and in-depth application, the platform can realize an intelligent and adaptive development path, and further promote the evolution of the education system in the direction of intelligent governance and precise services[22].

5 OPERATIONAL MONITORING SYSTEM DESIGN

In order to realize the efficient operation monitoring and continuous evolution of the smart education platform system, it is very important to build a monitoring system architecture with advanced technology, reasonable structure and sustainable development. Based on the comprehensive analysis of the current trend of international education digital reform and the experience of platform system engineering, this paper draws on the design principles of multi-domain digital architecture, and proposes a comprehensive operation monitoring system architecture model including horizontal support system, vertical governance mechanism and front-end and back-end collaborative linkage, which is used to guide the technical deployment and operation support of the smart education platform.

Based on the basic idea of multi-dimensional integration, the architecture model designs a structural framework of "four horizontal, four vertical and two ends": the horizontal architecture focuses on the basic technology and data resource support required for the operation of the platform, the vertical system emphasizes the guarantee role of policies, systems and operation specifications, and the double-end structure is oriented to the application operation and management decision-making needs of the system to ensure the monitoring ability of the whole chain from operation to governance of the platform[23-25].

In the horizontal dimension, the first is the infrastructure layer, which forms the foundation of the platform's technical operation. It usually includes a cloud computing platform and a high-speed private network system built for the education industry, which supports large-scale computing resource scheduling, distributed storage, and interconnection between platforms, ensures the stability and elasticity of data flow, and adapts to the growing monitoring data flow. Secondly, the data resource layer is responsible for the collection, aggregation, and governance of various types of data in the operation process. This system is based on an efficient data pipeline and realizes real-time collection of infrastructure operation logs, user interaction information, resource call records, service request data and security events through multi-source data interfaces. After the data is preprocessed, it is organized and stored according to the dimensions of platform resources, service usage, system behavior, and user portraits, and multiple thematic datasets are constructed to serve subsequent analysis and decision-making.

The common support layer provides the common components and capabilities required for system operation, including authentication, permission control, process engine, visual analysis tools, algorithm model services, etc. This layer realizes the reuse and standardization of various functions to ensure the consistency of data analysis and indicator extraction of all participating systems. The business application layer provides specific operation interfaces and functional support for different types of users, such as monitoring data management, access platform joint commissioning, data sharing management, indicator configuration and report generation, etc., providing a complete closed-loop operation for technicians and managers.

In vertical systems, policy and institutional frameworks provide legitimacy and sustainability support for system building. The operation monitoring system must comply with relevant local laws and regulations, respect user privacy and information use norms in the process of data collection, processing and application, and establish a supporting management system to ensure the transparency, standardization and accountability mechanism of system operation. The standard specification system provides a unified interface definition and data format convention for the technical implementation of the system, clarifies the transmission protocol, security standards and processing specifications of the monitoring data, and ensures that the data from different platforms can be integrated and interoperable.

The organizational assurance mechanism emphasizes the systematic construction of the operation and maintenance system, including the collaborative workflow between the technical support team, the data governance team and the manager. The mechanism must ensure that the operation monitoring tasks of all access platforms are clearly divided and responsibilities are clear, and at the same time provide a training mechanism to improve the technical ability and system operation proficiency of personnel. In addition, the network security system runs through the system design to ensure the security of data circulation and storage on the platform. The system should adopt multiple protection mechanisms, including access control, intrusion detection, data encryption, and early warning of abnormal behavior, combined with dynamic risk assessment methods, to build a security-centric operating environment.

In terms of double-end design, the front-end working system provides an entrance for the daily operation and maintenance and monitoring operations of the platform, integrates identity management, access control and functional navigation, and supports various technical and management roles to manage the whole process of access process, data status and system health indicators. The back-end governance system focuses on data-driven decision support, and provides managers with real-time insight into core indicators such as platform operation situation, user behavior characteristics, and resource allocation efficiency by building comprehensive visualization panels, trend analysis reports, and thematic evaluation modules, and assists in policy optimization and platform planning[26].

In summary, the architecture integrates the three dimensions of technical support, institutional norms and application requirements, and strives to realize the intelligent management of the whole process of operation and monitoring of the smart education platform on the basis of ensuring data quality and system stability, and provides a feasible technical path and organizational support for the digital transformation and governance innovation of the future education system.

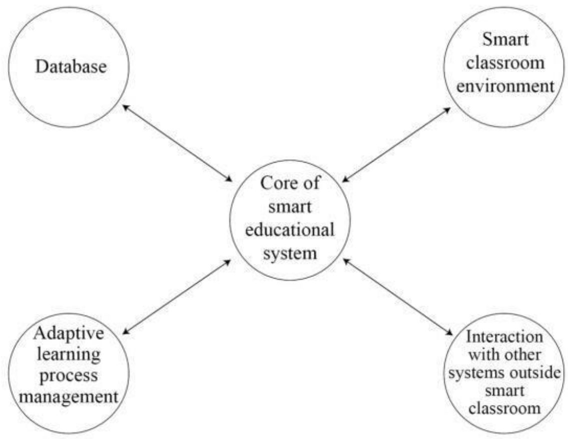

FIG. 2 THE TECHNICAL ARCHITECTURE OF THE OPERATION MONITORING SYSTEM OF THE SMART EDUCATION PLATFORM SYSTEM.

6 OPERATIONAL MONITORING DATA IN PRACTICE

Journal of Computer Technology and Applied Mathematics
Journal Home: http://jctam.suaspress.org | CODEN: JCTAAD
Vol. 2, No. 3, 2025 | ISSN 3007-4126 (Print) | ISSN 3007-4134 (Online) | ISSN 3007-4142 (Digital)

6.1 Intelligent Improvement of Platform Operation Efficiency

The data collected by the operation monitoring system has significant spatiotemporal distribution characteristics, which provides conditional support for understanding the performance of the platform in different user groups and different use time periods. Through in-depth analysis of core data such as user access tracks, page response times, and system load status, the platform can dynamically assess its infrastructure operating environment and accurately identify performance bottlenecks. For example, when the system load is too high or the response delay increases, the real-time alert mechanism can be used to quickly adjust the resource scheduling strategy to avoid platform service interruption.

In addition, through the predictive analytics model, the platform can predict the peak period of the business and complete the resource reservation and load balancing deployment in advance, thereby improving the efficiency of cloud computing resources. The detailed depiction of user behavior path by the monitoring data also provides an important feedback basis for the iteration of interface design and interaction process, so that the platform can better fit the user's operation habits for interface optimization. This data-driven interface upgrade not only improves the user experience, but also enhances the stickiness and activity of the platform, helping to build a more stable and efficient smart education ecosystem[27].

6.2 Structural Optimization of the Supply of Digital Education Resources

In the context of the continuous expansion of digital education resources, how to accurately match the needs of users has become the key to the content operation of the platform. The value of the operation monitoring system in this regard is reflected in its ability to track the fine-grained behavior of resource use. Through the aggregation and analysis of data such as resource access frequency, playback duration, user ratings, and interactive behaviors, the platform can identify the structural differences between high-frequency content and marginalized resources, so as to optimize the resource layout[28].

In addition, the system supports horizontal statistics on resource design, update frequency, user characteristics, etc., to assist education platform managers to identify key areas and weak links in content development. Combined with natural language processing and graph algorithms, the platform can also automatically update the label system and content classification logic based on user behavior data, improve the accuracy of resource retrieval and recommendation, and better support the construction of personalized learning paths and interdisciplinary learning needs. In this process, the deep integration of artificial intelligence technology and operation monitoring data has injected a new intelligent engine into the allocation mode of educational resources[29-30].

6.3 Innovative Exploration of Education and Teaching Evaluation Models

The traditional education evaluation model mostly relies on periodic assessment and subjective feedback, which is difficult to fully reflect the dynamic changes in the teaching process. The continuous collection mechanism based on operation monitoring data effectively makes up for this limitation. Since the relevant data is automatically generated during the actual operation of the platform, it is not easy to be interfered with by humans, so it is more objective and stable. Based on these data, platform managers and educational researchers can build an evaluation index system covering the dimensions of resource supply, user participation, teaching interaction, and learning feedback.

At the same time, the operation monitoring system is equipped with visual analysis tools and data modeling capabilities, so that the competent departments or users of the education platform can flexibly configure the evaluation model according to specific needs, and generate multi-dimensional analysis reports for teachers, students, schools and even at the regional level. These reports not only support the quantitative evaluation of teaching effectiveness, but also provide solid data support for resource investment decision-making, teaching process design and teacher development strategies. More importantly, this data-based multi-agent evaluation method improves the transparency and feedback efficiency of teaching activities, and promotes the internal motivation of all participants to form collaborative optimization and continuous improvement in the teaching ecology.

7 SUMMARY AND OUTLOOK

With the deepening of global education digitalization, the operation monitoring system of the smart education platform is becoming the key to ensuring the stability of the platform and promoting teaching innovation and data governance. In the face of the challenges of system heterogeneity, diverse data and limitations of traditional monitoring, this study proposes a theoretical framework and technical path for operation monitoring, from model construction, process optimization to technical architecture design, and explores the application of monitoring data in improving efficiency, optimizing resources and innovating teaching evaluation. However, the completeness and timeliness of data collection still need to be improved, and the research on dynamic analysis and personalized feedback is still shallow. In the future, it is necessary to deepen the integration of AI technology, build intelligent behavior analysis models, promote the reform of evaluation mechanisms, and realize intelligent and scientific governance of education platforms.

ACKNOWLEDGMENTS

The authors thank the editor and anonymous reviewers for their helpful comments and valuable suggestions.

FUNDING

Not applicable.

INSTITUTIONAL REVIEW BOARD STATEMENT

Not applicable.

INFORMED CONSENT STATEMENT

Not applicable.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

PUBLISHER'S NOTE

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

AUTHOR CONTRIBUTIONS

Not applicable.

ABOUT THE AUTHORS

ZHAO, Zhonglin

Strategic Marketing, Imperial College London, UK.

REFERENCES

[1] Hu, X., Niu, R., & Tang, T. (2021). Pre-processing of metro signaling equipment fault text based on fusion of lexical domain and semantic domain. Journal of the China Railway Society, 43(02), 78-85.

[2] Huang, C. K. (2012). Learner satisfaction with blog-and wiki-supported writing in an EFL course in Taiwan.

[3] Zhong, Y. N. (2024). Optimizing the Structural Design of Computing Units in Autonomous Driving Systems and Electric Vehicles to Enhance Overall Performance Stability. International Journal of Advance in Applied Science Research, 3, 93-98.

[4] Yonezawa, A., Hoshino, A., & Shimauchi, S. (2017). Inter-and intra-regional dynamics on the idea of universities in East Asia: perspectives from Japan. Studies in Higher Education, 42(10), 1839-1852.

[5] Ma, C., Hou, D., Jiang, J., Fan, Y., Li, X., Li, T., ... & Xiong, H. (2022). Elucidating the Synergic Effect in Nanoscale MoS2/TiO2 Heterointerface for Na - Ion Storage. Advanced Science, 9(35), 2204837.

[6] Guo, Z. B., Xu, L. F., Zheng, Y. H., Xie, J. S., & Wang, T. T. (2025). Bearing fault diagnostic framework under unknown working conditions based on condition-guided diffusion model. Measurement, 242, Article 115951. https://doi.org/10.1016/j.measurement.2024.115951

[7] Cen, Z., & Zhao, Y. (2024). Investigating the Impact of AI-Driven Voice Assistants on User Productivity and Satisfaction in Smart Homes. Journal of Economic Theory and Business Management, 1(6), 8-14.

[8] Xu, X. S. (2022). SINOFUTURISM: DREAMS AND NIGHTMARES IN POSTSOCIALIST CHINA.

[9] Pearson, W. S. (2021). Student engagement with teacher written feedback on IELTS Writing Task 2 rehearsal essays.

[10] Zhao, Y., & Cen, Z. (2024). Exploring Multimodal Feedback Mechanisms for Improving User Interaction in Virtual Reality Environments. Journal of Industrial Engineering and Applied Science, 2(6), 35-41.

[11] Bultron, A. L. (2014). The use of teacher-written feedback and computer-mediated feedback to enhance Puerto Rican English as a Second Language (ESL) high school students' essay writing (Doctoral dissertation, Universidad del Turabo (Puerto Rico)).

[12] Zhao, Y., & Wu, J. (2024). Enhancing User Engagement and Behavior Change in Healthy Eating Apps: A Human-Computer Interaction Perspective. Journal of Industrial Engineering and Applied Science, 2(6), 27-34.

[13] Zhao, Y., Qu, P., Xiao, J., Wu, J., & Zhang, B. (2024). Optimizing Telehealth Services with LILM-Driven Conversational Agents: An HCI Evaluation. Journal of Industrial Engineering and Applied Science, 2(4), 122-131.

[14] Yuan, Y., Li, H., & Sawaengdist, A. (2024). The impact of ChatGPT on learners in English academic writing: Opportunities and challenges in education. Language

Learning in Higher Education, 14(1), 41-56.

[15] Perez Vico, E., Hellsmark, H., & Jacob, M. (2015). Enacting knowledge exchange: a context dependent and 'role-based'typology for capturing utility from university research. Prometheus, 33(1), 3-20.

[16] Zhao, Y., Wu, J., Qu, P., Zhang, B., & Yan, H. (2024). Assessing User Trust in LLM-based Mental Health Applications: Perceptions of Reliability and Effectiveness. Journal of Computer Technology and Applied Mathematics, 1(2), 19-26.

[17] Huang, C. L., & Huang, C. C. (2021). Study on customized knowledge graph of student pilot learning in FITS training. Journal of Intelligent & Fuzzy Systems, 40(4), 7969-7979.

[18] Jiang, C., Ding, R., Cui, X., Xie, Y., Zhao, Z., Wang, X., & Qiao, Y. Industry enters the XPU era: from an educational view.

[19] Sheng, Z., Wu, F., Zuo, X., Li, C., Qiao, Y., & Lei, H. (2024, November). Research on the LLM-Driven Vulnerability Detection System Using LProtector. In 2024 IEEE 4th International Conference on Data Science and Computer Application (ICDSCA) (pp. 192-196). IEEE.

[20] Sirico, F., Fernando, F., Di Paolo, F., Adami, P. E., Signorello, M. G., Sannino, G., ... & Biffi, A. (2019). Exercise stress test in apparently healthy individuals–where to place the finish line? The Ferrari corporate wellness programme experience. European Journal of Preventive Cardiology, 26(7), 731-738.

[21] Zhang, W., Huang, J., Wang, R., Wei, C., Huang, W., & Qiao, Y. (2024, October). Integration of Mamba and Transformer-MAT for Long-Short Range Time Series Forecasting with Application to Weather Dynamics. In 2024 International Conference on Electrical, Communication and Computer Engineering (ICECCE) (pp. 1-6). IEEE.

[22] Van der Pol, J., Van den Berg, B. A. M., Admiraal, W. F., & Simons, P. R. J. (2008). The nature, reception, and use of online peer feedback in higher education. Computers & Education, 51(4), 1804-1817.

[23] Qiao, Y., Li, K., Lin, J., Wei, R., Jiang, C., Luo, Y., & Yang, H. (2024, June). Robust domain generalization for multi-modal object recognition. In 2024 5th International Conference on Artificial Intelligence and Electromechanical Automation (AIEA) (pp. 392-397). IEEE.

[24] Shahbazi, S. (2019). Finding the right fit: Exploring ESL teachers and students' perceptions of iLit ELL, a technology-based literacy program's use with high school English language learners (Doctoral dissertation, University of Windsor (Canada)).

[25] Su, J., Jiang, C., Jin, X., Qiao, Y., Xiao, T., Ma, H., ... & Lin, J. (2024). Large language models for forecasting and anomaly detection: A systematic literature review. arXiv preprint arXiv:2402.10350.

[26] Wei, P., Wang, X., & Dong, H. (2023). The impact of automated writing evaluation on second language writing skills of Chinese EFL learners: A randomized controlled trial. Frontiers in Psychology, 14, 1249991.

[27] Wang, X., Qiao, Y., Xiong, J., Zhao, Z., Zhang, N., Feng, M., & Jiang, C. (2024). Advanced network intrusion detection with tabtransformer. Journal of Theory and Practice of Engineering Science, 4(03), 191-198.

[28] Kara, P. A., Ognjanovic, I., Maindorfer, I., Mantas, J., Wippelhauser, A., Šendelj, R., ... & Bokor, L. (2023). The present and future of a digital Montenegro: Analysis of C-ITS, agriculture, and healthcare. Eng, 4(1), 341-366.

[29] Zhang, N., Xiong, J., Zhao, Z., Feng, M., Wang, X., Qiao, Y., & Jiang, C. (2024). Dose my opinion count? A CNN-LSTM approach for sentiment analysis of Indian general elections. Journal of Theory and Practice of Engineering Science, 4(05), 40-50.

[30] Seliem, S., & Ahmed, A. (2009). Missing: Electronic Feedback in Egyptian EFL Essay Writing Classes. Online Submission.