Academic Journal of Education
ISSN: 3080-9940 (Print), ISSN: 3080-9959 (Online) | Vol. 3, No. 2, 2026

Digital Management Innovation in University Smart Campuses: Data-Driven, Intelligent, and Personalized Approaches

Zhiwei Wang

Shenzhen Polytechnic University, Shenzhen, Guangdong, 518055, China

Abstract: Digital technologies are changing how universities coordinate teaching, research, administration, and campus services. This paper examines three connected dimensions of management innovation in smart campus development: data-driven decision making, intelligent process support, and personalized services. Drawing on selected scholarship and policy documents, it develops a conceptual account of how integrated data can inform resource allocation, how artificial intelligence and connected devices can support routine operations, and how student and staff services can respond to different needs. It then uses three explicitly illustrative application scenarios to clarify the organizational conditions under which these approaches may be useful. The analysis identifies fragmented information systems, uneven data quality, privacy and security risks, and limited user acceptance as recurring constraints. It argues that technical integration must be accompanied by clear data governance, human oversight, professional development, and feedback from users. The paper concludes with recommendations for interoperable infrastructure, proportionate privacy safeguards, institutional support, and attention to equity. As a conceptual discussion rather than an empirical evaluation, it does not claim measured effects for particular universities; future research should test the proposed relationships with institutional and user-level evidence.

Keywords: Smart Campus; Digital Management; Data-driven Management; Artificial Intelligence; Personalized Services.

1. Introduction

Advances in big data, artificial intelligence (AI), and cloud computing have expanded the possibilities for universities to connect physical spaces, information systems, and academic services. The concept of the smart campus captures this integration and the associated reorganization of teaching, research, administration, and student support [1]. Smart campus development is therefore more than a program of installing devices: it requires institutions to coordinate information and services across departments. Earlier work on campus architecture identifies sensing, networks, data, applications, and service layers, together with standards, maintenance, and security, as elements of this broader design [2].

Digital management is a central part of this shift. University administrators increasingly have access to information about course demand, student progress, facility use, and service requests. Used carefully, these data may help institutions allocate resources and respond to changing needs. AI-based tools can support recurring tasks, while personalization can make student-facing services more responsive. These possibilities also change who makes decisions, what evidence is considered, and how accountability is assigned. Research on immersive smart campuses similarly stresses that the technological environment, users' experiences, and institutional coordination need to be considered together [3].

In China, the Ministry of Education's 2018 Education Informatization 2.0 Action Plan placed digital and intelligent development within a wider agenda of educational reform [4]. Yet universities differ in their infrastructure, technical capacity, and governance arrangements. Information silos, security concerns, and reluctance to adopt unfamiliar systems may prevent promising tools from producing useful services. This paper therefore asks how data-driven, intelligent, and personalized management can be connected in smart campus development, what conditions limit their implementation, and which institutional responses are warranted. Its contribution is a conceptual synthesis of these three dimensions, illustrated with possible applications rather than claims of newly collected empirical evidence.

2. Literature Review

2.1. Smart Campus Development and Its Constraints

Research on smart campuses extends beyond equipment and network coverage to the organization of academic work and campus services. An integrated campus may connect course administration, research support, facilities, and communication through shared data and compatible applications. The potential advantage is more timely coordination across units. The challenge is that universities often inherit systems acquired at different times for different purposes. Without common definitions and interfaces, a collection of advanced applications can still leave data scattered and workflows disconnected.

The governance implications of this change merit particular attention. Selwyn's analysis of school administration shows how software can reshape work through standardization, reminding universities to examine how administrative categories are built into digital systems [5]. Williamson likewise describes educational data infrastructures and algorithms as instruments of governance, not merely channels for neutral information [6]. Although these studies address different educational settings, their shared lesson applies to universities: the design of data systems affects professional discretion, visibility, and institutional priorities.

Integration is only one constraint. As universities collect student records, grades, learning activity, and personnel information, access control, data minimization, and appropriate use become essential. Weak technical support can delay system maintenance; unclear ownership of data can make cross-departmental sharing difficult; and staff unfamiliar with a new platform may continue to rely on parallel manual procedures. The adoption of smart campus management therefore depends on technical capacity and organizational arrangements at the same time.

Traditional university administration frequently relies on departments making decisions with records held locally and exchanging information through manual approval chains. A smart campus may make those procedures faster, but it can also reproduce them in digital form if institutional roles are not reconsidered. For example, a teaching office, student affairs unit, and information technology department may each hold a different definition of the same student's status. An integrated database cannot resolve that difference without a shared rule, a responsible data owner, and a process for correcting discrepancies. Organizational adaptation is therefore part of the literature on smart campuses, rather than a minor task to be addressed after deployment.

2.2. Three Strands of Digital Management Research

Data-driven management uses information collection, cleaning, analysis, and feedback to support institutional decisions. Zou and Chen discuss data-oriented reform in Chinese higher education and the need to connect information technology with changes in management practice [7]. In principle, admission planning, course scheduling, learning support, and facilities management can all draw on structured data. In practice, incomplete records, incompatible definitions, and weak data stewardship make apparently precise indicators unreliable. More data do not automatically produce better decisions; the quality and interpretation of data matter.

The sequence from collection to decision deserves closer attention. A university can record enrollment, attendance, course completion, and resource use in different systems; it must then reconcile duplicate identifiers, check missing values, and distinguish a delayed upload from an actual change in student activity. Analysts may produce forecasts of course demand or identify a service bottleneck, but administrators still need to decide which alternative is feasible and fair. This division between analytical input and accountable choice is a recurring issue in data-based management research. Without an explicit feedback stage, the institution may have no way to determine whether the resulting change helped students or simply moved work to another office.

Intelligent management introduces AI, connected devices, and automated workflows into campus operations. A review of AI in university informatization groups applications around teaching, learning, administration, assessment, and examinations, while also identifying privacy, bias, and technological dependence as concerns [8]. Student-facing uses include intelligent tutoring, risk flags, and resource recommendations; administrative uses include routine inquiries, scheduling, and monitoring. Evidence on AI chatbots and learning outcomes suggests that particular tools may support learning in defined settings, but it should not be treated as proof that every campus deployment will improve outcomes [9].

Personalized management seeks to align services with differing learner and staff needs. A university might use course history and voluntary feedback to recommend learning resources, support advising, or identify requests for assistance. Research on an intelligent tutoring system demonstrates one way an adaptive study plan can be constructed and tested in a particular learning context [10]. The broader managerial challenge is to make personalization useful without reducing students to opaque profiles or treating a predicted preference as a fixed characteristic. Human review, user choice, and the opportunity to correct records remain important.

The scope of personalization is wider than instructional content. Students may seek assistance with an academic plan or career direction; teachers may need resources related to their courses or professional development; administrators may prefer an interface tailored to a specific role. These services require different kinds of information and different degrees of automation. There is a tension between providing a consistent baseline service and responding to individual needs. Research on personalized management should therefore ask what may be tailored, who decides that tailoring is helpful, and which protections keep customized services from becoming unequal or intrusive.

Taken together, the literature supports a common question: how can universities link reliable data, appropriate automation, and responsive service while retaining clear responsibility for decisions? The three strands have often been discussed separately. A combined account is needed because personalized services depend on usable data and analytical tools, while both depend on institutional rules governing access and use.

3. A Conceptual Framework for Digital Management Innovation

3.1. Definition and Relationships Among the Three Dimensions

In this paper, digital management refers to the use of digital infrastructure, data practices, and redesigned workflows to coordinate teaching, research, administration, and services at a university. The aim is to inform decisions and improve access to support, rather than simply move existing forms online. Scholarship on new educational infrastructure underscores the importance of the underlying technical and organizational conditions on which such change rests [11].

The proposed framework has three related dimensions. Data-driven management establishes records and analytical processes that make needs, workloads, and constraints more visible. Intelligent management uses those inputs to assist with classification, prediction, scheduling, or routine service provision. Personalized management translates information and appropriate analysis into support that users can understand and, where feasible, shape. These dimensions describe a possible sequence of organizational capabilities, not an inevitable ladder of progress. A university can collect data without good automation, or deploy an automated service without genuine personalization.

The value of the framework lies in locating each capability within a decision cycle: define a problem, assemble fit-for-purpose data, assess options, deliver a service, and obtain feedback. Decisions about admissions, learning support, research administration, and facilities differ in purpose and risk, so each use should have its own data limits and review arrangements. Data quality, interoperability, privacy

protection, staff competence, and user trust condition the performance of every stage.

In practical terms, the first dimension may improve the timeliness and relevance of institutional information; the second may make recurring processes easier to coordinate; and the third may change how a person experiences the resulting service. None is sufficient by itself. A sophisticated prediction based on incomplete course records may misdirect support, while a convenient service that is inaccessible to some students may worsen an existing disparity. The framework consequently treats efficiency, decision quality, and responsiveness as aims to be examined together, with privacy and equity as constraints on the acceptable means of pursuing them.

3.2. Data-Driven Management

Data-driven management begins with the systematic recording and integration of institutional information. Campus cards, course systems, learning platforms, and facilities applications generate records about participation, use, and demand. Where these records can be linked lawfully and accurately, managers may identify oversubscribed courses, underused classrooms, delays in a service process, or students who may need timely support. The relevant indicator must be interpreted in context: a student's limited online activity, for example, is not in itself evidence of poor learning.

Three functions follow. First, common data definitions and storage arrangements make information from different units comparable. Second, analysis and decision support can identify patterns and generate options for allocating teachers, rooms, equipment, or advising capacity. Third, feedback and evaluation allow administrators to review whether an adjustment worked. The last function is especially important: predictions should be checked against actual outcomes and user experience instead of being converted directly into high-stakes decisions. Data stewardship must specify who may collect, correct, access, retain, and delete each type of record.

A teaching example shows why these functions must be connected. If more students request a course than its present room can accommodate, a planning system could combine registration data, course prerequisites, faculty availability, and room timetables. A manager might then add a section, change the room, or prioritize students close to graduation. After the term begins, actual attendance and student feedback could show whether the change met demand. The system makes the options visible, but the university must still justify its priorities and protect students against a mistaken record. Similar reasoning applies to laboratory use, library access, and maintenance planning.

3.3. Intelligent Management

Intelligent management applies AI and connected technologies to activities where their capabilities fit an identifiable need. In teaching administration, algorithms can help compare timetable constraints or route routine student questions to the right office. In academic support, digital tools can suggest resources or alert an adviser to a possible need for conversation. In research administration, a platform may help track project milestones and route requests. On campus, sensors can report equipment faults or changes in room use. These are possible applications, not evidence that they already function effectively at every university.

Automation can reduce repetitive work, but its value depends on integration with existing procedures and clear routes for correction. A recommendation should show the staff member what information it used, and an incorrect classification should be appealable. Systems that assign a consequential risk score or affect access to services require especially careful scrutiny for bias, error, and disproportionate surveillance. Intelligent management is best understood as decision support with assigned human responsibility, rather than a transfer of institutional judgment to software.

The range of applications also differs by management area. An instructional system may identify a gap in practice and offer a resource for teacher review. A research office may use a shared platform to track deadlines and the availability of facilities, while avoiding the treatment of easy-to-count outputs as a complete measure of scholarly quality. An administrative unit may combine service requests with equipment data to plan maintenance before a failure interrupts classes. In each area, the institution should compare the automated workflow with an existing process, identify the actual task it saves or improves, and review unexpected errors after deployment.

3.4. Personalized Management

Personalization extends beyond suggesting course content. Students may need different combinations of advising, remedial resources, accessible formats, career information, and timely reminders. Teachers may benefit from tailored professional learning and support with course design. Administrative staff may need task-specific interfaces and less repetitive data entry. The shared principle is that a service should respond to the user's legitimate circumstances without requiring every person to follow an identical path.

A personalized service needs reliable inputs and a way to learn whether its suggestions are useful. Student progress and stated interests can inform a recommendation, but participation should be transparent and, where appropriate, optional. Institutions should allow users to understand why a suggestion appeared, decline it, or request human assistance. Personalization should also be evaluated against unequal access: a system trained mainly on frequent platform users may underserve those with fewer digital resources or different patterns of engagement.

For teachers, a useful service might connect a stated teaching goal with relevant training or course-design examples; for administrative staff, it might display only the applications necessary for their assigned tasks and carry information between approved steps. Neither requires the university to infer private preferences from every available trace. Data collection should follow the service need, and the value of a recommendation should be tested through feedback from the people expected to use it. The aim is to reduce unnecessary effort while allowing students and staff to retain control over meaningful choices.

4. Illustrative Applications and Implementation Challenges

4.1. Three Illustrative Application Scenarios

The following scenarios translate the framework into plausible institutional tasks. They are analytical illustrations of possible implementation, rather than reports of observed outcomes at identified universities. They show which data and organizational decisions would be needed before an institution could evaluate the effects of a real intervention.

The first scenario concerns teaching resource allocation. Consider a university that combines enrollment requests, timetable data, room capacity, and course feedback in a common planning system. Planners could compare anticipated and actual demand, then revise room assignments or add teaching support where capacity is limited. A record of the adjustment and subsequent enrollment would permit evaluation. The mechanism is a shorter feedback loop between evidence and scheduling, provided that the underlying records are accurate and departments agree on the decision rules.

The second scenario concerns an integrated campus service platform. A university might connect access control, parking information, lighting, maintenance requests, and help-desk responses through an interoperable interface. Connected devices can flag equipment faults, while service tickets can be directed to the responsible unit. One published platform design combines the Internet of Things and image recognition for campus microservices, illustrating the technical possibilities without establishing effects for the hypothetical university described here [12]. Any implementation would need to define security settings, retention periods, and manual alternatives for system failures.

The third scenario concerns learning support. With an appropriate basis for data use, a platform could combine a student's course progress and expressed learning goals to suggest practice materials, tutoring appointments, or relevant lectures. Advisers would review a potentially consequential alert before contacting the student. The point is to offer timely choices and support, not to claim that an algorithm knows a student's interests or that an automatically recommended resource has improved achievement. Such a scenario makes the link among data, analysis, and personalization visible.

4.2. Constraints on Implementation

Technical compatibility is an immediate problem. Universities differ in their digital foundations, and older student-record, teaching, and financial systems may use incompatible identifiers or data formats. A new platform may then create another isolated repository instead of reducing fragmentation. Procurement decisions should be guided by data standards, open interfaces where practical, security requirements, and a realistic maintenance plan. Technology changes quickly, so extensibility and total operating costs matter more than the novelty of a particular device.

The difficulty is not confined to the initial connection between systems. A campus platform needs documentation, stable responsibilities for updates, skilled maintenance staff, and a route for repairing erroneous data. If a supplier changes the format of records or a department replaces one part of its software, other services may be affected. Before adding an AI model or new sensors, the institution should determine whether existing data are accessible, whether the tool can be integrated without creating duplicate work, and how it would be replaced if it becomes obsolete. These questions are especially pressing for universities with limited technical staff or resources.

Data security and privacy are equally consequential. Student records, grades, personnel information, and research data should not be pooled without a defined purpose. Universities need role-based access, encryption in transit and storage as appropriate, audit trails, incident response, and retention limits. They also need rules for using records collected for one service in another context. A technically feasible data linkage may still be inappropriate if it is excessive, unexpected to users, or difficult to contest.

Acceptance by teachers, students, and administrators affects whether a system is used as intended. Staff may distrust opaque decisions or be asked to operate duplicate paper and digital workflows. Students may find a new platform inconvenient or worry that monitoring will affect evaluation. Training, accessible design, technical support, and channels for reporting errors can address these difficulties. The wider lesson of organizational digital transformation is that staff capabilities and change management matter alongside technology acquisition [13].

5. Implications for University Smart Campuses

5.1. Administrative Efficiency and Decision Quality

A connected management system could help decision makers view course demand, service delays, and resource use in one place. When the information is reliable, a decision support system can reduce repeated manual compilation and allow managers to compare options more quickly. The improvement is conditional: the dashboard must represent relevant aspects of the underlying activity, and a human decision maker must be able to explain the resulting choice. Transparency can improve when decision criteria and corrections are recorded, but it cannot be assumed from digitization alone.

Resource allocation is one possible gain. Course selections and the use of rooms or equipment may inform planning for the next term. Real-time feedback can also reveal a mismatch between scheduled services and actual needs. In parallel, administrative systems can route approvals, generate routine reports, and share necessary information across units. The practical objective is to remove avoidable handoffs and errors while preserving checks required for financial, academic, and personnel decisions.

Consider campus finance and general administration. A well-designed system can assemble routine information for reporting and direct a request to the staff member authorized to process it. This may reduce repeated entry of the same facts, time spent finding the current version of a record, and delays in a predictable sequence of approvals. It cannot eliminate the need to examine unusual payments, correct a flawed workflow, or explain a decision to someone affected by it. Claims of higher efficiency should therefore specify what was measured, such as processing time or error correction, and whether the burden was shifted to users.

5.2. Equity and Individual Support

Digital services can extend access to recorded courses, remote advising, scholarly resources, and other forms of support for students who face time, distance, or financial constraints. They do not erase the digital divide by themselves. Zheng and Liang's analysis of educational equality emphasizes differences in users' capacity to access and use technology [14]. A university seeking fairer access should therefore examine connectivity, accessibility, digital literacy, and the availability of human assistance alongside the number of materials it puts online.

Individualized education is another possibility. Student choice, learning history, and feedback can help advisers propose resources or adjust support for particular goals. A

recommended learning path should remain provisional and revisable. Students need opportunities to disagree with a profile, seek different resources, and discuss a decision with a teacher. Where such safeguards are present, digital management may enable more timely support without treating students as uniform users of a single service.

A student considering different career paths, for instance, could receive information about courses, internships, or advising appointments related to the interests they have disclosed. Another student might prefer additional help with a foundational subject. In both cases, the platform should widen the range of visible options rather than silently restrict them. The original aim of individualized education is to match instruction and support to developing needs; a useful system must allow those needs to change. Institutions can examine whether the service actually reaches students who seldom use digital platforms and whether its recommendations have demonstrable educational value.

5.3. Institutional Development

Well-designed digital services may also improve a university's ability to coordinate research, international exchange, and external collaboration. Online platforms can make resources available across locations and support multilingual communication, but competitiveness or international reputation cannot be inferred from a platform's existence. These outcomes depend on academic quality, sustained partnerships, and evidence that services are useful to their intended users.

Internationalization illustrates the distinction between technical reach and institutional effect. A multilingual platform may help incoming students understand procedures or enable partner universities to share learning resources. Online communication may make a collaborative project easier to coordinate across time zones. Yet the durability of such exchanges depends on academic agreements, appropriate support for participants, and a reliable way to evaluate experiences. Digital management can provide infrastructure for these relationships, while educational substance and sustained coordination determine whether the university gains from them.

The cultural environment of a campus matters as well. Research on the cultural ecology of smart campuses draws attention to how digital systems are embedded in institutional life [15]. Effective management innovation should therefore be judged by the quality of academic work and user experience as well as operating metrics. Digital tools have value when they support the university's educational purposes and allow students and staff to participate in shaping services.

6. Policy Recommendations and Future Research

6.1. Policy and Institutional Recommendations

A first priority is interoperable infrastructure. Public authorities can encourage common data standards and support institutions whose basic systems need upgrading. Within each university, procurement and system design should begin with a map of essential workflows, data responsibilities, and links between old and new platforms. A staged implementation can reveal errors before a campus-wide rollout. Collaboration with technology providers and research teams is useful when responsibilities for maintenance, portability, and evaluation are explicit.

Such investment should distinguish foundational repairs from new services. A university may need to reconcile course identifiers, upgrade its network, or train staff before purchasing another analytical dashboard. Funding arrangements can take account of the different starting positions of institutions, especially where hardware, software maintenance, and specialist personnel are all constrained. A pilot can test whether an integrated service genuinely shortens a process or improves access; its evaluation should be available to the people asked to fund and use a larger implementation.

A second priority is a proportionate framework for data security and privacy. Universities should state why information is collected, who can use it, how long it is retained, and how inaccuracies can be corrected. Sensitive student, staff, and research records require stronger access controls and appropriate technical protection. Privacy notices and user participation should be meaningful rather than a one-time formal step. Accountability must cover third-party service providers and cross-departmental data use as well as the university's internal systems.

Technical safeguards and institutional rules must operate together. Encryption and identity checks can protect storage and transmission, but they cannot decide whether an office has a legitimate reason to request a student's personal record. A university should document the purpose of each data flow and make the responsible unit identifiable. Staff and students need understandable information about how an automated service uses their data and an accessible channel for correction or complaint. When information is proposed for a new purpose, the institution should assess that purpose before reusing the records rather than treating earlier collection as unlimited authorization.

A third priority is support for users. Universities can organize training around real teaching and administrative tasks, provide accessible guidance, and maintain responsive technical help. Teachers need room to assess whether a recommendation fits a course or student; students need alternatives if an automated route does not meet their needs. Regular feedback from both groups can reveal problems that usage counts alone miss. Management should also remove duplicate procedures so that a digital platform does not simply add work.

A digital literacy program can begin with the actual tasks staff perform: finding reliable student information, checking an automated suggestion, protecting a record, and reporting an error. Teachers who have established classroom methods may need opportunities to experiment in a supported setting, while students new to a platform may need orientation and accessible alternatives. Technical help should remain available after the launch period. Surveys and user interviews can show whether the service meets users' needs, but the institution must act on the complaints and difficulties they reveal.

Finally, investment should be assessed against educational value and equity. Support for institutions with fewer resources can reduce disparities in infrastructure and expertise. Regional cooperation may allow universities to share carefully governed services or specialist support, provided that data sharing is lawful and appropriately limited. A demonstration project should specify its purpose and evaluation criteria before implementation; a larger number of platforms is not, by itself, evidence of a better smart campus.

6.2. Future Research

The framework would benefit from empirical testing across disciplines and institutional types. Researchers could compare how data quality, organizational coordination, and professional judgment shape the results of particular tools. They could trace a decision from data collection through recommendation, human review, and service outcome, thereby distinguishing a usable workflow from a technically functional but ineffective system.

Research should also examine equity and personalization together. Studies might assess who receives useful recommendations, who opts out, and whether access barriers differ by institution, region, or student circumstance. Another line of inquiry concerns AI-supported advising, adaptive learning systems, and verifiable academic records. These developments call for evaluation of accuracy, privacy, transparency, cost, and educational benefit rather than an assumption that newer technology necessarily produces better governance.

The present conceptual discussion cannot determine the size of any efficiency gain or identify a causal effect on learning. A future study could combine administrative records with interviews and observations of the people who operate a service. Comparisons between institutions or successive implementation periods could then examine how differences in infrastructure and governance shape outcomes. Such evidence would help distinguish a genuinely effective management model from a persuasive description of its technical capabilities.

7. Conclusion

This paper has examined digital management innovation in university smart campuses through three connected dimensions: data-driven decisions, intelligent process support, and personalized services. Together they offer a way to organize decisions about resources and user support. Their effects, however, depend on interoperable systems, trustworthy data, privacy safeguards, professional capacity, and institutional feedback. A university should start with a defined educational or administrative problem and evaluate whether its digital response improves the relevant service.

The discussion is conceptual. Its three institutional scenarios illustrate possible applications and do not constitute fieldwork or evidence of observed effects. Future comparative and institution-level research is needed to establish when particular approaches improve efficiency, learning support, equity, or users' experience, and when they introduce new burdens or risks.

References

[1] Wu, M., Liu, H., & Ren, Y. (2015). “Internet Plus Campus”: A new phase of smart campus construction in universities. Journal of Distance Education, 33(4), 8–13. https://doi.org/10.15881/j.cnki.cn33-1304/g4.2015.04.002.

[2] Wang, Y. (2014). An overall architectural model for smart campus development and analysis of typical applications. China Educational Technology, (9), 88–92, 99.

[3] Qian, X., Song, Z., & Huang, B. (2023). The holistic realization of immersive university smart campuses: Theory and practice. Chongqing Higher Education Research, 11(5), 49–61. https://doi.org/10.15998/j.cnki.issn1673-8012.2023.05.005.

[4] Ministry of Education of the People’s Republic of China. (2018). Education Informatization 2.0 Action Plan. https://www.moe.gov.cn/srcsite/A16/s3342/201804/t20180425_334188.html.

[5] Selwyn, N. (2011). “It’s all about standardisation”: Exploring the digital (re)configuration of school management and administration. Cambridge Journal of Education, 41(4), 473–488. https://doi.org/10.1080/0305764X.2011.625003.

[6] Williamson, B. (2016). Digital education governance: An introduction. European Educational Research Journal, 15(1), 3–13. https://doi.org/10.1177/1474904115616630.

[7] Zou, C., & Chen, D. (2019). Reform paths for data-driven university management in the context of educational modernization. Journal of Beihua University (Social Sciences), 20(6), 117–121. https://doi.org/10.19669/j.issn.1009-5101.2019.06.017.

[8] Qi, F., Shen, J., Wang, M., Zhang, K., & Wang, X. (2025). Review of application of artificial intelligence in university informatization. Computer Engineering, 51(4), 1–14. https://doi.org/10.19678/j.issn.1000-3428.0070222.

[9] Wu, R., & Yu, Z. (2024). Do AI chatbots improve students learning outcomes? Evidence from a meta-analysis. British Journal of Educational Technology, 55(1), 10–33. https://doi.org/10.1111/bjet.13334.

[10] Bradáč, V., Smolka, P., Kotyrba, M., & Průdek, T. (2022). Design of an intelligent tutoring system to create a personalized study plan using expert systems. Applied Sciences, 12(12), 6236. https://doi.org/10.3390/app12126236.

[11] Zheng, X., & Zhou, Z. (2021). Three questions about new educational infrastructure: What is its foundation, what is new, and how should it be built? e-Education Research, 42(11), 42–47. https://doi.org/10.13811/j.cnki.eer.2021.11.006.

[12] Fan, X., Yang, W., & Dong, Q. (2024). Design of a smart campus microservice management platform based on the Internet of Things and image recognition. Yangtze River Information Communications, 37(8), 140–142, 145. https://doi.org/10.20153/j.issn.2096-9759.2024.08.042.

[13] Frankiewicz, B., & Chamorro-Premuzic, T. (2020, May 6). Digital transformation is about talent, not technology. Harvard Business Review. https://hbr.org/2020/05/digital-transformation-is-about-talent-not-technology.

[14] Zheng, Q., & Liang, C.-Y. (2017). The path of new information technology affecting educational equality in the new digital divide: Based on information system success model. EURASIA Journal of Mathematics, Science and Technology Education, 13(7), 3587–3597. https://doi.org/10.12973/eurasia.2017.00747a.

[15] Liu, C., & Zhou, J. (2024). The functional embedding of smart campus cultural ecology and approaches to its challenges. Teaching and Management, (27), 39–43.