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IMPROVING INFORMATION-ANALYTICAL MECHANISMS FOR EDUCATIONAL PROCESS MANAGEMENT IN HIGHER EDUCATION: EVIDENCE FROM A DUAL-PLATFORM WORKLOAD AND SCHEDULING SYSTEM

Umidjon Narziev
Bukhara state technical university. Bukhara. Uzbekistan
E-mail: unarziyev@bstu.uz ORCID: 0009-0001-0284-7411
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Abstract: This article examines how an operational dual-platform software system can be reinterpreted not merely as a timetable generator, but as an information-analytical mechanism for educational process management in higher education. The study uses a design-oriented qualitative case approach based on functional documentation, system descriptions, database-level materials, and interface reports for a software environment that integrates class scheduling, faculty workload distribution, classroom occupancy monitoring, reporting, and KPI-linked managerial views. The analysis identified a three-level management contour involving the academic affairs office, department heads, and university leadership. The system supports operational coordination, visual monitoring, comparative analytics, and evidence-based decision making through unified data flows and role-based access. At the same time, the study revealed important limitations: KPI values are imported from an external system rather than calculated natively, and attendance, assessment, and student progression modules are not fully integrated. The article proposes an improved information-analytical mechanism that links workload, schedule, room occupancy, reporting, and leadership analytics into a single managerial contour for higher education institutions.

Keywords: educational management; educational process management; information-analytical mechanism; digital monitoring; faculty workload; class scheduling; decision support; higher education.

Introduction

Effective management of the educational process has become a decisive condition of institutional performance in higher education. In contemporary universities, planning and control are no longer limited to preparing class timetables or distributing faculty workloads. They require continuous collection, processing, coordination, analysis, and interpretation of operational data for different management levels. In this sense, educational management increasingly depends on information-rich environments that can support evidence-based decision making rather than fragmented administrative routines.

UNESCO defines education management information systems as central instruments for decision making, steering, and management across different levels of an education system. The UNESCO EMIS-PATT framework similarly treats EMIS as a core mechanism for strengthening governance, data quality, and institutional responsiveness. OECD publications on digital education and education policy likewise emphasise that digital transformation should not be understood as a purely technical upgrade, but as a strategic process linked to management quality, planning capacity, and institutional effectiveness.

Within higher education practice, however, many digital systems remain narrowly operational. Scheduling modules are often treated as technical utilities, while managerial reporting, resource coordination, workload transparency, and analytical oversight are handled separately or manually. This fragmentation weakens the institutional value of academic data. A

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software environment may technically solve scheduling conflicts, yet still fail to support managerial reflection, interdepartmental coordination, and strategic control.

This article addresses that problem through the analysis of an operational dual-platform software system used in a higher education institution in Uzbekistan. The system includes timetable generation, faculty workload allocation, room occupancy control, role-based access, comparative reporting, and KPI-linked leadership views. The central argument of the article is that such a system should be evaluated not only through its technical scheduling capacity, but also through its contribution to educational process management. The purpose of the study is to analyse the management potential of the existing system and to propose an improved information-analytical mechanism capable of strengthening coordination, monitoring, and decision support in higher education.

Literature Review

The conceptual foundation of the present study lies at the intersection of education management information systems, learning analytics, and higher education governance. Abdul-Hamid argues that an effective EMIS is not merely a database, but an institutional framework that organises educational information for planning, monitoring, and policy action. From this perspective, the value of a digital system depends on whether it produces actionable knowledge for administrative and academic management.

UNESCO's current EMIS resources reinforce this interpretation by positioning education data infrastructures as instruments that support governance, planning, budgeting, and institutional management. The implication for higher education is clear: information systems should enable academic leadership to coordinate operational processes and evaluate institutional performance in a structured way. This is especially important in contexts where academic management is still shaped by dispersed spreadsheets, paper-based reporting, or disconnected software modules.

Research on learning analytics offers an additional perspective. Gašević, Dawson, and Siemens famously warned that analytics should remain focused on learning and management improvement rather than on data collection for its own sake. Tsai and Gašević further showed that analytics adoption in higher education is constrained not only by technical factors but also by policy, governance, ethics, and managerial readiness. More recent reviews by Márquez et al. and Pan et al. confirm that higher education institutions increasingly value analytics for coordination, intervention, and improvement, yet adoption remains uneven when institutional systems are fragmented or poorly aligned with management processes.

These studies are highly relevant to educational process management. Although the literature often emphasises student-facing analytics and learning management systems, the same logic applies to institutional operations such as workload planning, timetable coordination, room utilisation, and leadership reporting. In practice, these operational datasets shape academic quality, resource allocation, and organisational transparency. A system that links them coherently can therefore function as a managerial analytics infrastructure, not just as an administrative tool.

At the same time, the literature also suggests that successful adoption depends on deployment practices, role clarity, and the organisational embedding of data use. For that reason, the present article does not treat the software under study as a purely technical artefact. Instead, it examines how the system structures information flows between management levels, what kinds of decisions it supports, and how its architecture can be improved from an educational management perspective.

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Materials and Methods

The study employed a design-oriented qualitative case analysis. The empirical basis consisted of institutional system materials related to a functioning dual-platform environment for academic workload and class scheduling management. The analysed materials included: (1) a functional report describing the system's interfaces, roles, and monitoring modules; (2) an analytical report describing the software architecture and the relationship between the computational core and the web-based management layer; and (3) database-level documentation identifying the main entities used for rooms, subjects, groups, faculty members, workloads, and schedule records.

The analytical logic was based on functional decomposition and management mapping. Each major function of the system was examined using four questions: Which level of management does it serve? What data does it collect or visualise? What analytical value does it create? Which decisions does it facilitate? This approach made it possible to reinterpret the software from an educational management perspective rather than from a purely technical or algorithmic one.

In methodological terms, the study combined document analysis, interface-level content analysis, and role-based systems mapping. The objective was not to measure algorithmic efficiency or scheduling optimality, but to identify the information-analytical mechanisms embedded in the system and to evaluate their managerial significance. Accordingly, the output of the analysis is presented as a structured model of educational process management supported by the existing software environment.

Results

The analysis showed that the existing software environment forms a three-level management contour rather than a single-purpose scheduling tool. Its dual-platform architecture combines a computational core for schedule generation and workload handling with a web-based managerial layer for data input, visual monitoring, reporting, and oversight. This separation is important because it allows operational planning and managerial analytics to function as interconnected but distinct components.

The first management level is the academic affairs office. At this level, semester parameters, programme structures, group-related information, teaching loads, and room availability are coordinated centrally. The system therefore supports cross-department consistency and institution-wide alignment of the academic timetable. This level can be interpreted as the central coordination contour of the educational process.

The second level is the department. Here the software enables department heads to inspect faculty lists, workload distribution, weekly schedules, and calculated teaching indicators. The managerial value of this layer lies in tactical oversight: it allows departments to detect workload imbalance, identify scheduling density or underutilisation, and compare teaching assignments across staff members.

The third level is university leadership. In the analysed materials, rector-level and senior leadership views include faculty-, department-, and teacher-level drill-down reports. In some cases, these views are linked to KPI indicators imported from an external system. This transforms the software from an operational scheduler into a leadership dashboard capable of supporting comparative institutional analysis.

Table 1. Role-based management contour of the analysed system

Management level	Core functions	Analytical outputs	Managerial value

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Academic affairs office	Semester settings; workload coordination; schedule consolidation; classroom occupancy control	Institution-wide schedule status; room-use overview; cross-department comparisons	Central coordination and operational consistency
Department head	Faculty workload review; weekly teaching schedule monitoring; local timetable control	Workload balance by teacher; schedule density; local resource use	Tactical control and workload redistribution
University leadership	Faculty/department/teacher drill-down; aggregate reporting; KPI-linked view	Comparative dashboards; consolidated teaching load; KPI-informed overview	Strategic oversight and evidence-based decisions

Another significant finding concerns visual monitoring. The system does not present schedule information merely as raw lists. It offers weekly timetable views for groups and teachers, room occupancy matrices, and day-by-building consolidated reports. Such visualisation has direct management relevance: it allows users to detect overload, free capacity, timing conflicts, and structural imbalances before they escalate into operational problems. In managerial terms, this supports a shift from reactive control to proactive oversight.

Reporting and export functions further enhance this management contour. The possibility of generating consolidated reports and exporting them for administrative use improves documentation, transparency, and communication across institutional levels. In other words, the software not only stores data but also translates operational records into administratively usable evidence.

Based on the functional analysis, an improved information-analytical mechanism can be proposed. In this mechanism, workload, schedule, room occupancy, reporting, and KPI-linked analytical views are treated as components of a single management loop. The purpose of the improved mechanism is to ensure that information moves from data registration to comparative analysis and finally to management action without being broken into isolated modules.

Table 2. Components of the proposed information-analytical mechanism

Component	Operational content	Management effect
Unified academic data environment	Groups, subjects, faculty, workloads, rooms, and schedules maintained in one integrated structure	Reduces fragmentation and improves consistency of academic records
Role-based access and responsibility	Different views for central administration, department heads, and leadership	Aligns information with decision authority and managerial accountability
Visual monitoring layer	Weekly schedules, occupancy matrices, and comparative views	Improves transparency and early detection of management problems
Comparative analytics	Faculty-, department-, and university-level	Supports resource balancing and evidence-

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	workload comparisons	based planning
KPI-linked external integration	Imported KPI values displayed alongside workload indicators	Enables broader performance interpretation at leadership level
Reporting and export loop	Consolidated lists and exportable managerial reports	Strengthens documentation, communication, and institutional transparency

At the same time, the analysis identified important limitations. First, KPI indicators are not calculated inside the system; they are displayed through integration with an external KPI environment. This means that the software supports KPI-informed managerial interpretation, but does not constitute a full performance management system on its own. Second, attendance monitoring, assessment management, and student progression tracking are not fully integrated into the present contour. Therefore, the system should not be described as a complete educational lifecycle platform, but more precisely as an information-analytical mechanism for the operational management of the educational process.

Discussion

The findings of this study have several implications for higher education management. First, they demonstrate that operational academic software can become strategically valuable when it structures information flows across levels of authority. In the analysed case, the software's significance does not lie only in timetable production. Its actual management value emerges from the integration of coordination, monitoring, reporting, and comparative analysis in a single environment.

Second, the case highlights the importance of role-based design. Educational data become useful only when they are transformed into role-specific views. Central administration requires coordination indicators, departments require tactical workload control, and senior leadership requires comparative analytics for strategic decisions. A uniform interface for all actors would produce overload rather than managerial clarity. The analysed system avoids that problem by distributing information according to role and function.

Third, the case extends the usual discussion of learning analytics. Much of the existing literature focuses on learner behaviour in LMS environments, predictive interventions, or student-facing dashboards. The present study suggests that higher education institutions also need analytics for operational governance: room allocation, workload balancing, schedule transparency, and leadership oversight. These are not peripheral administrative concerns; they directly influence teaching quality, staff performance, and institutional efficiency.

Fourth, the case is particularly relevant for institutions operating in resource-constrained or administratively fragmented contexts. Where separate systems exist for schedules, workloads, reporting, and KPI monitoring, academic leadership often depends on manual reconciliation and delayed reporting. An integrated mechanism reduces these transaction costs and improves the quality of managerial responses. In this sense, the proposed model may be useful beyond the specific institutional context examined here.

Nevertheless, the study also points to the need for further development. A more mature managerial ecosystem would connect the present mechanism with attendance, assessment, student pathway data, and quality assurance indicators. Such expansion would allow institutions to move from operational analytics to broader academic intelligence. Future research may

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therefore focus on extending the proposed mechanism into a more comprehensive digital governance ecosystem for higher education.

Conclusion

The study concludes that the analysed dual-platform software system should be interpreted as an information-analytical mechanism for educational process management rather than as a narrow scheduling utility. Its managerial value lies in combining workload control, timetable coordination, classroom occupancy monitoring, comparative reporting, and KPI-linked leadership views within a structured role-based environment.

The proposed improved mechanism integrates unified academic data, role-specific access, visual monitoring, comparative analytics, and reporting loops into a single management contour. This contour strengthens coordination between the academic affairs office, departments, and university leadership, thereby improving transparency, responsiveness, and the evidence base of managerial decisions.

At the same time, the system remains partial: it does not yet incorporate full KPI calculation, attendance tracking, assessment management, or student progression analytics. These limitations do not diminish its current importance, but they define the next stage of development. Future work should therefore focus on extending the mechanism into a broader digital governance framework for higher education institutions.

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