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Research on the Application of Artificial Intelligence Technology in Data-Driven Course Scheduling of Private Colleges

LIU Jie*
Tianfu College of SWUFE, Miangyang, Sichuan, China
***Corresponding author, E-mail: liujie@tfswufe.edu.cn**

Abstract:
Course scheduling is a fundamental and core task in academic affairs management of private colleges. The uncertainty and lag in student data restrict the efficiency of course scheduling and the quality of teaching operation. Based on the actual school-running conditions of private colleges, this paper systematically sorts out four typical problems, including fluctuations in freshman data, lag in student status change information, delay in course selection data for students upgrading from junior college to undergraduate programs, and complicated student information of innovative classes. It deeply analyzes their cumulative impacts on the progress of course scheduling, teacher allocation and classroom resources. Relying on artificial intelligence, big data and intelligent algorithm technologies, this paper constructs a data-driven course scheduling system featuring "data integration - intelligent prediction - algorithm-based course scheduling - dynamic adjustment". It proposes specific application strategies from five dimensions: platform construction, predictive modeling, system development, process enhancement and quality evaluation, so as to promote the transformation of the course scheduling mode of private colleges from experience-driven to data-driven, and further improve the digital and intelligent level of academic administration.

Keywords:
Artificial Intelligence; Private colleges; Data-driven; Course scheduling

Against the background of mass higher education and digital transformation, the scale of private colleges continues to expand, their program offerings become increasingly diverse, and the complexity of teaching management increases significantly. As a key link connecting teaching plans, teaching staff, classroom resources and student learning, the reasonableness and timeliness of course scheduling are directly related to the stability of teaching order and the quality of talent cultivation. Compared with public universities, private colleges have greater flexibility in enrollment structure, student status management and resource allocation, while facing more prominent dilemmas of unstable student data: large fluctuations in freshman registration numbers, lag in the update of data on resumption of schooling and major transfer, late confirmation of course selection results, and frequent adjustment of personnel in innovative classes. The superposition of multiple data problems leads to repeated adjustments in course scheduling, a sharp increase in workload, and frequent curriculum schedule conflicts, which seriously restrict the efficiency of academic administration.

The rapid development of artificial intelligence and big data technologies offers a new path to solve these

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difficulties. The data-driven decision-making model, centered on accurate data collection, in-depth analysis, and intelligent prediction, can effectively reduce reliance on manual adjustments and improve the foresight and stability of scheduling. Based on the scheduling practice of private colleges, this paper focuses on the core pain points of uncertainty and lag in student data, combines the advantages of AI technology application, constructs a systematic and implementable data-driven optimization solution for course scheduling, and provides theoretical reference and practical pathways for private colleges to improve the refinement level of academic affairs management.

1 Main Problems of Student Data in Course Scheduling in Private Colleges

1.1 Multiple adjustments of freshman data dramatically increase scheduling workload

Course scheduling for the fall semester requires class prediction for freshmen and freshmen students upgrading from junior college to undergraduate programs based on enrollment plans, and teacher allocation must be completed in advance. However, the actual number of admitted students and registered students often deviate from the planned number, requiring class structure adjustments twice: mid-enrollment and post-registration. Private colleges have many program categories and a large total number of classes; adjustments involve reallocation of teachers and classrooms across all grades and programs, which not only greatly increases manual workload but also seriously slows down the overall scheduling progress.

1.2 Lag in student status change data makes adjustment extremely difficult

Most students resuming their studies complete relevant procedures after the semester starts, and the processing time is not uniform, so their timetables must be arranged separately. In some majors, a concentrated influx of students resuming studies causes the original class size to exceed classroom capacity, especially in fixed-capacity venues such as computer rooms and training labs, where the room for adjustment is minimal, leading easily to timetable conflicts.

Results of major changes are usually finalized at the end of the fall semester, but the attribution to administrative classes and the updating of student status information lag, making it impossible to obtain accurate data in the early stage of scheduling. When the number of students transferring in or out reaches the class adjustment threshold, later modifications will trigger a chain of changes in teacher tasks, class settings, and course arrangements, significantly increasing the complexity and difficulty of scheduling.

1.3 Late finalization of course selection data for freshmen students upgrading from junior college to undergraduate programs leaves scheduling passive

Course selection for specialized direction courses for top-up undergraduate freshmen usually takes place after registration, but scheduling must be completed before the semester starts. The academic affairs department can only preset classes based on the total number of students in each program, which often differs significantly from the actual number of students selecting courses, leading to either insufficient class capacity or idle teaching resources. Matching course selection data, reorganizing classes, and adjusting timetables in a

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very short time before the semester begins not only imposes enormous operational pressure but also greatly increases the risk of timetable conflicts.

1.4 Complexity of innovative class data disrupts established scheduling plans

The list of freshman innovative classes can only be finalized after registration and before the timetable is released; personnel adjustments for innovative classes in other grades are usually determined after the final grades are announced and close to the start of the semester. By this time, the overall scheduling work has been largely completed. Personnel entry and exit directly change class sizes and course arrangement, forcing academic staff to partially restructure the already determined teachers, classrooms, and timetables, affecting scheduling stability.

1.5 Combined impact of overlapping data problems

The four types of problems mentioned above do not exist in isolation; they break out intensively in the fall semester, forming continuous scheduling pressure: frequent adjustments lengthen the scheduling cycle and reduce work efficiency; data lag degrades timetable rationality and leads to frequent conflicts; repeated changes in class size affect teacher staffing calculation and classroom resource planning, further exacerbating the tension of teaching resources in private colleges.

2 Impacts of Artificial Intelligence Technology on Data-driven Course scheduling

2.1 Achieving multi-source data integration to improve data accuracy

Artificial intelligence technology can break down data barriers among multiple departments such as enrollment, student status management, course selection and the departments in the college, build a unified student data management platform, realize automatic data collection, cleaning, deduplication and intelligent verification, reduce data errors and lag at the source, and provide a stable and reliable data foundation for course scheduling work.

2.2 Enhancing prediction and early warning capabilities to improve scheduling foresight

Machine learning algorithms are adopted to conduct in-depth modeling and analysis on historical data on registration rates, resumption rates, major transfer trends and course selection distributions, which can accurately improve the prediction accuracy of key data including freshman scale, student status changes, proportion of students selecting specialized direction courses and innovative classes personnel, thereby reducing the difficulty of passive adjustments during scheduling.

2.3 Automatic scheduling by intelligent algorithms to reduce manual dependence

Relying on intelligent algorithms such as genetic algorithms and constraint optimization algorithms, the existing scheduling system is secondarily developed to upgrade standardized batch scheduling functions into an intelligent scheduling model. The system can automatically generate optimal timetables under multiple

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constraints such as teachers, classrooms, courses, students, and time, and perform real-time class splitting, teacher adjustment, and classroom reallocation when data changes, reducing manual workload and allowing academic scheduling staff to focus on overall coordination and quality supervision of scheduling.

2.4 Dynamically adapting to resource demands to improve resource utilization

Supported by artificial intelligence technology, the data-driven model can accurately match the number of students in classes with classroom capacity, ensure the optimal allocation of classroom resources; reasonably match courses with teaching spaces to improve teaching effectiveness. For special spaces such as computer rooms and training labs, on-demand allocation is achieved, avoiding resource waste and capacity insufficiency, and enhancing the utilization efficiency of the limited teaching resources in private colleges.

3 Specific Applications of Artificial Intelligence Technology in Data-Driven Course Scheduling in Private Colleges

3.1 Building an integrated student data management platform

Artificial intelligence technology is applied to build a unified data platform covering the whole process including enrollment and admission, student status changes, specialized direction course selection and innovative class selection, realizing real-time data synchronization, standardized storage and intelligent verification. Clarify the data submission deadlines and responsibilities of each department, establish a regular data update mechanism, ensure that all types of student data are put into the database timely and accurately, and solve the problems of data lag and inaccuracy at the source.

3.2 Constructing student data prediction models based on AI algorithms

A multi-dimensional prediction system is built based on historical data: accurately predict freshman registration rates and class sizes to scientifically plan the number of classes in advance; predict the number of students resuming schooling and transferring majors as well as major trends to reserve sufficient room for adjustment; predict the number of students selecting direction courses for upgrading from junior college to undergraduate programs and the list of innovative classes to rationally allocate courses and teaching resources in advance. Through accurate prediction, the planning of scheduling is moved forward, reducing later passive adjustments.

3.3 Developing an intelligent course scheduling system to achieve algorithm optimization and dynamic adjustment

Develop an intelligent scheduling system with functions such as automatic scheduling, dynamic adjustment, and conflict detection. The system can automatically generate conflict-free curriculum schedules based on core elements such as student data, teaching staff information and classroom resources; respond quickly when data changes, and automatically complete adjustments of classes, teaching staff and classrooms; identify curriculum conflicts, time conflicts, venue conflicts and other problems in real time to comprehensively improve the accuracy and stability of course scheduling.

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3.4 Strengthening course scheduling process management and improving departmental collaboration mechanisms

The course scheduling work is divided into three stages: prediction and planning, mid-term adjustment and finalization, and the work in each stage is closely matched with the progress of data acquisition. Establish a linkage and collaboration mechanism among the Academic Affairs Office, Enrollment Office, Student Affairs Office and secondary colleges, clarify each department's responsibility for data provision, refine work processes, improve the overall response speed, and ensure the orderly and efficient progress of course scheduling work.

3.5 Establishing a mechanism for quality evaluation and continuous improvement

A course scheduling quality evaluation system containing core indicators such as course scheduling cycle, adjustment times, conflict rate, resource utilization rate and teacher-student satisfaction is constructed. Artificial intelligence technology is used to conduct real-time analysis on course scheduling operation data and form targeted optimization reports. In view of prominent problems in the course scheduling process, iteratively optimize the data platform, course scheduling algorithms and management processes to achieve continuous improvement of course scheduling quality.

4 Conclusion

The uncertainty and lag of student data are the core bottlenecks restricting the progress of course scheduling in private colleges, which are mainly reflected in large fluctuations in freshman enrollment data, slow synchronization of student status change information, delayed feedback on course selection results, and complicated personnel adjustment procedures for characteristic innovative classes. The overlapping of multiple problems significantly reduces scheduling efficiency and teaching operation stability. Artificial intelligence technology and data-driven models can effectively address these difficulties: complete accurate information collection relying on an integrated data platform, realize forward-looking planning of course scheduling with the help of intelligent prediction, complete automatic curriculum optimization by virtue of intelligent algorithms, and enhance the adaptability of course scheduling through dynamic adjustment mechanisms, promoting the transformation from traditional experience-based course scheduling to an intelligent and data-driven model.

The five-in-one optimization strategy proposed in this paper can effectively alleviate the pressure of subsequent adjustments in course scheduling, improve the efficiency of resource allocation such as teaching venues and teaching staff, and provide a feasible path for the digital transformation of academic affairs management in private colleges. In the future, technologies such as the Internet of Things, blockchain and natural language processing can be further integrated to improve functions such as real-time classroom supervision and real-time intelligent response to the needs of teachers and students. Private colleges also need to continuously improve the data governance system, iteratively upgrade the intelligent course scheduling system, strengthen inter-university exchanges and cooperation, explore scheduling models suitable for the development laws of private education, and empower high-quality teaching management through digital reform.

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