

FLAME University



AI in Business (BUAN501)

Domain: Education - Course Registration & Elective Recommendation

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1. Industry Domain and Process Context

1.1. Domain: Higher Education Administration

The core business domain for this research is Higher Education Administration, which is rapidly converging with the Education Technology (EdTech) sector.

- **Scale and Complexity:** Higher education institutions (HEIs) are large, complex organisations characterised by:
 - Vast and diverse student bodies with unique academic profiles, aspirations, and learning paces.
 - Complex degree requirements (majors, minors, concentrations, prerequisites) that must be meticulously tracked to ensure compliance and timely graduation.
 - High administrative overhead across departments, from student admissions and the Registrar's Office to academic advising and financial aid.
- **Administrative Strain:** The traditional operational model is frequently stressed by:
 - Reliance on legacy systems and manual processes, particularly in high-volume areas such as course enrollment, can lead to staff burnout and potential data errors.
 - The continuous pressure to manage resources efficiently, including allocating classroom space and faculty time, requires accurate, real-time data that is often unavailable in complex, siloed systems.
- **Context for AI Integration:** This environment of scale, complexity, and administrative strain makes higher education administration an optimal domain for AI intervention, particularly in processes involving large-scale data analysis and personalised student interactions.

1.2. Traditional Process and Its Challenges

The process area that we have chosen is ‘Course Registration and Elective Recommendation’, one of the most critical student-facing administrative functions, yet it is plagued by inefficiencies and barriers that directly impact student success.

1.2.1. Defining the Core Process

The core process involves moving a student from the academic planning stage, where they choose and plan what courses they want to take, to the enrollment stage, where they have been officially registered for the class of their choice. The key stakeholders in this process are students, academic advisors, faculty, senior/former students, and program administrators (called the program office at FLAME University).

1.2.2. Inefficiencies

Many institutions rely on legacy Learning Management Systems (LMS) that are non-user-friendly, involve multiple cumbersome steps, and suffer from outdated technology. Crucially, the system automatically validates pre-requisites and eligibility using pre-imported data and flags issues before the final registration attempt. However, the student's upfront planning remains complex and manual, requiring them to independently manage:

- **Multi-Semester Dependencies:** Planning current courses with respect to what they want to study two or three semesters in the future.
- **Logistical Conflict Resolution:** Manually checking for course clashes and optimal section selection.
- **Non-Goal Alignment:** The system only confirms *eligibility*; it does not provide *recommendations* based on career aspirations or learning styles.

This lack of integrated, goal-oriented planning tools means the system serves as a rule enforcer, not a partner, adding friction to the educational process.

1.2.3. Student Facing Barriers to Success

Students often select courses on the basis of the knowledge they have easily available. The course selection process usually takes place during high-stress periods, and the extra barrier of complex long-term planning is often skipped.

- **Sub-optimal Choices:** This behavioural pattern results in students selecting courses based on the course title or recommendations by their peers and seniors, rather than courses that strategically align with their career goals or learning styles.
- **Reactive Bottlenecks:** While the prerequisite system is proactive in informing the student, it is often reactive in correcting complex planning errors. For example, if a student misses a non-obvious core sequence course, they realise the long-term impact too late, potentially causing a delay in degree completion.
- **Conflict Resolution Failure:** Conflict of timings between multiple desired or required courses forces difficult decisions upon students. The system flags the conflict but offers no optimised, personalised alternatives.
- **"Cold Start" Problem:** Newly admitted students have no historical data, rendering the automated eligibility checks less useful for elective guidance and forcing reliance on generalised information or basic peer recommendations.
- **Exception Management:** For transfer or exchange students, the discrepancy in exact course equivalence still requires manual intervention and complex planning, despite the system's core automation.

1.3. AI-Driven Trends Transforming the Process

Artificial Intelligence (AI) directly addresses the structural deficiencies of the traditional process by injecting **personalization, efficiency, and predictive power** into academic planning. The overarching goal is to convert the enrollment process from a bureaucratic, rule-enforcing checkpoint into a dynamic, proactive, and individualized advisory experience. This transformation is driven by four key AI trends.

1.3.1. Personalized Course Recommendation Systems (CRS)

These systems move beyond checking if a student *can* take a course to predicting if they *should* take it.

Use Case: A student enters their goal ("I want a career in financial analysis"). The system analyzes the academic pathways of successful alumni who achieved that goal and recommends a customized sequence of elective courses and certifications, even suggesting a minor the student hadn't considered. This uses student history to provide highly relevant elective guidance, solving the Sub-optimal Choices problem.

1.3.2. Anytime Conversational Self-Service

AI-powered systems provide instant, always-available answers, automating routine planning support.

Use Case: A student can use a chatbot at 1 AM to ask, "What are the core requirements for the Data Science specialization, and how do my transfer credits count towards it?" The system processes this complex query and provides a clear, conversational answer, eliminating the need to wait for an advisor or manually sift through hundreds of pages of academic policy. This directly addresses the Advising Bottleneck caused by routine queries.

1.3.3. Proactive Risk Management and Intervention

AI uses data to predict and prevent planning failures and resource issues before they occur.

Use Case: When a student is drafting their schedule, the AI flags a high-risk combination (e.g., enrolling in four courses with historically low average grades) and automatically alerts an advisor. Simultaneously, the system helps the Program Office by forecasting student demand for specific sections months in advance, allowing them to proactively increase capacity or adjust the master schedule, thereby mitigating Conflict Resolution Failure and resource issues.

1.3.4. Dynamic Path Optimization

This involves connecting a student's in-class performance directly back into their long-term course plan.

Use Case: A student receives a low score on a midterm in Course A, which is a prerequisite for Course B next semester. The AI system instantly recalculates the student's degree path and provides two optimized options:

- Suggesting an easier, alternative prerequisite course available next term.
- Flagging the student for targeted tutoring in Course A to ensure they stay on track. This provides continuous, adaptive guidance.

2. Process Map - Course Registration & Recommendation

This section explains the hierarchical workflow involved in the AI-enhanced "To-Be" process for Course Registration and Elective Recommendation. AI technologies enhance each level of the process, ensuring faster, more personalized, and more accurate academic planning, moving the system from a rule-enforcer to a proactive advisor. This process is detailed using a three-level drill-down, L0 (High-Level), L1 (Sub-Processes), and L2 (Detailed Activities), consistent with best practice in process mapping.

The visual representation of this process, typically a vertical swimlane diagram, shows the reduction in manual handoffs and the primary role of the Conversational AI / CRS (Course Recommendation System) in handling core planning and validation.

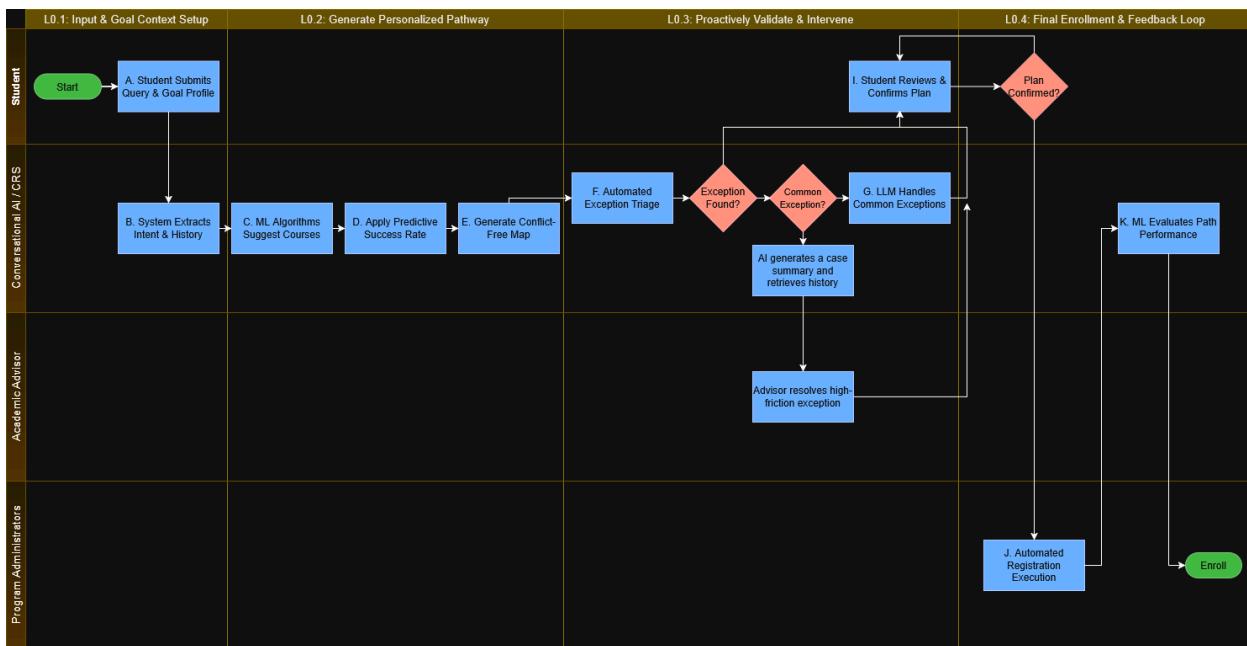
2.1. Cohesive Process Map (L0, L1, L2)

The table below provides the full detail of the AI-Enhanced process, outlining the four main steps (L0), the activities within each step (L1), the responsible actor, and the underlying AI technology enabling that activity (L2).

L0 Process Step	L1 Sub-Process / Activity	Responsible Actor	L2 Detailed AI Function/Technology
0.1: Input & Goal Context Setup	A. Student Submits Query & Goal Profile	Student	N/A (User Input)

	B. System Extracts Intent & History	Conversational AI / CRS	NLP Keyword Extraction: Converts unstructured career text (e.g., "job in finance") into structured course attributes and requirements.
0.2: Generate Personalized Pathway	C. ML Algorithms Suggest Courses	Conversational AI / CRS	Collaborative Filtering: ML compares student profile to successful alumni paths to suggest optimal course sequences (solving the "Sub-optimal Choices" issue).
	D. Apply Predictive Success Rate	Conversational AI / CRS	Predictive Grade Modeling: Calculates the probability and likely final grade for the student in each recommended course based on historical data.
	E. Generate Conflict-Free Map	Conversational AI / CRS	Path Optimization Algorithms: Maps a multi-semester degree plan that automatically avoids present and future scheduling conflicts.
0.3: Proactively Validate & Intervene	F. Automated Exception Triage	Conversational AI / CRS	ML Anomaly Detection: Flags unusual enrollment patterns (e.g., highly difficult course load) for immediate advisor review.
	G. LLM Handles Common Exceptions	Conversational AI / CRS	Retrieval Augmented Generation (RAG): Provides conversational, policy-accurate advice on prerequisites or transfer credit equivalence, automating front-line advising.
	H. Advisor Resolves High-Friction Exception	Academic Advisor	Real-time Advisor Assist: AI generates a case summary and retrieves relevant override history for human review, reducing time spent per exception.

0.4: Final Enrollment & Feedback Loop	I. Student Reviews & Confirms Plan	Student	N/A (User Confirmation)
	J. Automated Registration Execution	Program Administrators	API Call to LMS Backend: Executes final enrollment transactions via a secure system interface without manual data entry.
	K. ML Evaluates Path Performance	Conversational AI / CRS	ML Feedback Calibration: The model automatically processes student grades and final outcomes to continuously refine the recommendation algorithm.



3. AI Technologies & Opportunities

This section details the specific AI technologies leveraged in the transformation (as identified in the L2 process level) and outlines the strategic business opportunities created by enhancing the Course Registration and Elective Recommendation process.

3.1. AI Technologies Used in Academic Planning

Technology/System	Role in the Process	Mapped L2 Activities
Natural Language Processing (NLP)	Used to parse and understand unstructured student input (career goals, preferences, and complex queries), converting them into structured data for the CRS.	NLP Keyword Extraction (L1: B)
Machine Learning (ML) / CRS	The core intelligence for guidance. ML models use historical enrollment and success data to predict outcomes and suggest personalized, non-obvious course choices.	Collaborative Filtering (L1: C), ML Anomaly Detection (L1: F), ML Feedback Calibration (L1: K)
Large Language Models (LLM)	The conversational front-end that automates complex advisory guidance by processing academic policy documents and answering student questions instantly.	Retrieval Augmented Generation (RAG) (L1: G)
Predictive Analytics	Dedicated algorithms that forecast student success risk and institutional demand, enabling proactive intervention rather than reactive flagging.	Predictive Grade Modeling (L1: D)
Calendar API (Application Programming Interface)	A standard API that allows the CRS to communicate with the university's master scheduling system to instantly verify and resolve potential course clashes or conflicts in real-time.	Path Optimization Algorithms (L1: E)
LMS/Registrar API	An interface that allows the AI system to securely communicate with legacy Learning Management System (LMS) or Registrar backend to execute final enrollment actions.	API Call to LMS Backend (L1: J)

3.2. Opportunities for AI-Driven Transformation

3.2.1. Full Automation of Low-Complexity Guidance

AI can independently resolve common issues like checking enrollment status, finding alternative sections for full courses, and answering routine policy questions, significantly reducing the administrative burden on human staff.

3.2.2. Personalized Academic Pathways

AI analyzes a student's goals, academic history, and behavioral patterns to deliver a dynamic, individualized roadmap that maximizes their likelihood of success and goal attainment, solving the "Cold Start" Problem for new students.

3.2.3. Better Time Efficiency

Automation dramatically reduces the advisor's transactional workload, allowing human staff to focus on high-priority or complex cases, thereby optimizing staff time and lowering administrative overhead.

3.2.4. Improved Student Satisfaction and Retention

Faster response and resolution times for planning issues, coupled with personalized, proactive guidance, significantly improve the student experience and lead to increased student retention and timely degree completion.

3.2.5. Continuous Path Optimization

Through machine learning feedback loops, the CRS continuously learns from the outcomes of its recommendations (e.g., did the student succeed in the recommended course?) and adapts to new enrollment and academic patterns, ensuring the system improves its advisory quality over time.

3.2.6. Proactive Resource Allocation

Predictive forecasting of future course demand allows the Program Office to optimize scheduling and staffing months in advance, minimizing logistical failures such as seat scarcity and scheduling conflicts.

4. Conclusion

The analysis within this document confirms that the traditional Course Registration and Elective Recommendation process within Higher Education Administration is structurally complex, resulting in significant Student-Facing Barriers (Sub-optimal Choices, Reactive Bottlenecks) and creating an unnecessary Advising Bottleneck for human staff. The current system acts merely as

a rule-enforcer, failing to provide the personalized, proactive guidance necessary for timely degree completion and career alignment.

The proposed AI-Enhanced "To-Be" Process represents a fundamental transformation. Leveraging technologies such as Machine Learning (Collaborative Filtering), Large Language Models (RAG), and Predictive Analytics, the process shifts from a reactive system to a dynamic, individualized advisory partner. The detailed L0, L1, and L2 Process Map (Section 2) demonstrates how the Conversational AI / CRS assumes responsibility for the bulk of planning, validation, and conflict resolution, limiting human intervention solely to complex, high-friction exceptions.

The implementation of these AI Technologies unlocks substantial strategic opportunities for the institution, including:

- **Elevated Student Success:** Delivering personalized academic pathways that maximize career alignment and directly address the "Cold Start" problem.
- **Operational Efficiency:** Automating low-complexity guidance to drastically reduce administrative workload and operational costs.
- **Proactive Governance:** Using Predictive Analytics to manage both student risk and institutional resource allocation (e.g., forecasting course demand).

In summary, the transition to the AI-Enhanced Course Registration and Elective Recommendation Process is not merely an automation project; it is a strategic imperative that transforms a major administrative friction point into a sustained source of student value, operational efficiency, and continuous institutional improvement.