

Big Data and AI- Driven Institutional Policy Formulation for Evidence-Based Decision Making in OBE



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Abstract

The rapid advancement of AI and Big Data analytics has revolutionized institutional policy formulation, enabling evidence-based decision-making in OBE. Traditional policy frameworks often struggle to integrate real-time insights, leading to inefficiencies in curriculum design, student performance assessment, and resource allocation. AI-driven learning analytics provide predictive modeling, sentiment analysis, and data visualization, allowing institutions to identify academic risks, optimize teaching strategies, and enhance student engagement. This chapter explores the transformative role of AI in institutional governance, focusing on AI-powered early warning systems, ethical considerations in algorithmic decision-making, and regulatory frameworks for responsible AI deployment. It examines bias mitigation strategies, data privacy challenges, and the role of XAI in ensuring transparency and fairness. By leveraging AI for real-time monitoring, automated policy recommendations, and adaptive learning frameworks, institutions can create more inclusive, responsive, and data-driven educational ecosystems. The insights from this research provide a strategic roadmap for AI adoption in higher education, ensuring that institutions harness the full potential of AI while upholding ethical and academic integrity.

Keywords: AI-driven learning analytics, Outcome-Based Education, institutional policy-making, predictive analytics, ethical AI governance, real-time decision-making.

Introduction

The integration of AI and Big Data analytics in institutional policy-making has reshaped the landscape of higher education governance [1]. Traditional approaches to policy formulation often rely on historical data and static evaluation methods, which limit the ability to make real-time, data-driven decisions [2]. AI-driven learning analytics provide institutions with the capability to analyze vast datasets, uncover hidden patterns, and predict future academic trends, making decision-making more proactive and evidence-based [3]. OBE, which emphasizes measurable learning outcomes, benefits significantly from AI-enhanced analytics that assess student engagement, skill acquisition, and curriculum effectiveness [4]. Institutions that integrate AI into governance structures gain a competitive edge in fostering student success, optimizing resources, and designing adaptable academic policies [5]. The shift toward AI-driven institutional decision-

making presents challenges related to data accuracy, ethical considerations, and the need for regulatory oversight [6].

The application of AI-powered predictive analytics enables institutions to anticipate student performance trajectories and implement targeted interventions before academic issues escalate [7]. Early warning systems (EWS) use machine learning algorithms to analyze multiple data points, including attendance records, online learning behaviors, assessment patterns, and student feedback, to identify those at risk of disengagement or failure [8]. By leveraging AI, institutions can design personalized learning experiences, adaptive curricula, and proactive student support systems, ultimately improving retention rates and overall academic success [9]. AI-driven analytics empower faculty and administrators with real-time dashboards and decision-support tools, enhancing their ability to make informed policy adjustments [10]. Despite these advancements, institutions must ensure that predictive models remain fair, unbiased, and interpretable, avoiding the reinforcement of existing inequalities in educational access and assessment [11].

Predictive analytics, AI-driven sentiment analysis plays a crucial role in understanding student engagement and satisfaction [12]. Sentiment analysis, powered by NLP, examines textual data from student evaluations, discussion forums, feedback surveys, and social media interactions to gauge emotional and cognitive responses to learning environments [13]. This technology allows institutions to identify underlying concerns, assess the effectiveness of teaching methodologies, and make data-driven improvements to pedagogical strategies [14]. By continuously monitoring student sentiment trends, universities can proactively address academic stressors, improve faculty-student interactions, and enhance overall student well-being [15]. Sentiment analysis requires contextual sensitivity and cultural awareness, as language nuances, sarcasm, and diverse communication styles can impact the accuracy of sentiment classification [16]. Developing robust AI models that account for these complexities was essential for ensuring reliable and actionable insights [17].

The integration of AI in institutional policy-making also raises concerns regarding algorithmic bias, data privacy, and ethical governance [18]. AI models, if trained on biased datasets, unintentionally reinforce disparities in academic assessment, admissions, and faculty evaluations [19]. Ensuring fairness in AI-driven decision-making requires institutions to implement bias detection algorithms, fairness audits, and transparent model validation techniques [20]. Data privacy regulations such as GDPR (General Data Protection Regulation) and FERPA (Family Educational Rights and Privacy Act) mandate strict protocols for data collection, storage, and usage [21]. Institutions must establish AI governance frameworks that prioritize ethical considerations, ensuring that AI deployment aligns with institutional values and societal expectations [22]. Transparency in AI decision-making, supported by XAI techniques, was crucial for maintaining stakeholder trust and accountability [23].