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STRATEGIC DEVELOPMENT OF EDUCATION PROGRAM UNDER THE INFLUENCE OF AI

The subject of this research is the strategic development of education programs under the influence of Artificial Intelligence (AI). It focuses on exploring how AI technologies can be effectively integrated into educational systems to enhance learning outcomes, improve administrative efficiency, and address contemporary challenges such as accessibility, inclusivity, and ethical concerns. The object of research is the education programs themselves, specifically their structure, delivery, and outcomes, as influenced by the integration of Artificial Intelligence (AI). The rapid evolution of Artificial Intelligence (AI) has profoundly impacted various sectors, including education. This paper examines the strategic development of education programs influenced by AI, exploring how advanced technologies can transform traditional pedagogies, curriculum design, and educational delivery. It identifies key areas where AI contributes to personalized learning, adaptive assessment, and administrative efficiency, offering solutions to challenges such as accessibility and scalability. The study highlights case examples of AI integration into educational systems and provides a framework for policymakers and educators to strategically implement AI-driven tools. Furthermore, ethical considerations, such as data privacy, algorithmic bias, and the role of educators in an AI-enhanced environment, are critically discussed. The findings suggest that leveraging AI in education requires a balanced approach to ensure innovation aligns with equity, inclusivity, and sustainability. This paper aims to guide stakeholders in harnessing AI to create forward-thinking, effective, and ethical educational programs for the 21st century. The research confirms that AI can profoundly transform education programs by enhancing personalization, efficiency, and scalability. However, addressing ethical and infrastructural challenges is essential for equitable and sustainable adoption. The results provide actionable insights for policymakers, educators, and administrators to strategically implement AI-driven solutions in education.

Keywords: Strategic development, Artificial Intelligence, Education, Personalized Learning, Adaptive Learning.

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СТРАТЕГІЧНИЙ РОЗВИТОК ОСВІТНІХ ПРОГРАМ ПІД ВПЛИВОМ ШІ

Предметом дослідження є стратегічний розвиток освітніх програм під впливом штучного інтелекту (ШІ). Він зосереджений на вивченні того, як технології штучного інтелекту можна ефективно інтегрувати в освітні системи для покращення результатів навчання, підвищення адміністративної ефективності та вирішення сучасних проблем, таких як доступність, інклюзивність та етичні проблеми. Об'єктом дослідження є самі освітні програми, зокрема їх структура, надання та результати під впливом інтеграції штучного інтелекту (ШІ). Швидка еволюція штучного інтелекту (ШІ) глибоко вплинула на різні сектори, включаючи освіту. У цій статті розглядається стратегічний розвиток освітніх програм під впливом штучного інтелекту, досліджується, як передові технології можуть змінити традиційну педагогіку, розробку навчальних програм і надання освіти. Він визначає ключові сфери, де штучний інтелект сприяє персоналізованому навчанню, адаптивному оцінюванню та адміністративній ефективності, пропонуючи рішення таких проблем, як доступність і масштабованість. Дослідження висвітлює приклади інтеграції штучного інтелекту в освітні системи та забезпечує структуру для політиків і освітян для стратегічного впровадження інструментів, керованих штучним інтелектом. Крім того, критично обговорюються етичні міркування, такі як конфіденційність даних, упередженість алгоритмів і роль викладачів у середовищі, розширеному ШІ. Отримані результати свідчать про те, що використання штучного інтелекту в освіті потребує збалансованого підходу, щоб забезпечити відповідність інновацій справедливості, інклюзивності та сталості. Цей документ спрямований на те, щоб допомогти зацікавленим сторонам використовувати ШІ для створення перспективних, ефективних і етичних освітніх програм для 21-го століття. Дослідження підтверджує, що штучний інтелект може кардинально трансформувати освітні програми шляхом підвищення персоналізації, ефективності та масштабованості. Однак вирішення етичних та інфраструктурних проблем є важливим для справедливого та стабільного усвоєння. Результати надають практичну інформацію для розробників політики, викладачів і адміністраторів для стратегічного впровадження рішень на основі ШІ в освіті.

Ключові слова: стратегічний розвиток, штучний інтелект, освіта, персоналізоване навчання, адаптивне навчання.

1 Introduction.

The advent of Artificial Intelligence (AI) has ushered in a new era of possibilities, reshaping industries and influencing every aspect of society. In education, AI presents unprecedented opportunities to enhance learning experiences, improve administrative efficiency, and bridge educational gaps. However, the strategic incorporation of AI into education programs requires a comprehensive understanding of its potential benefits, limitations, and ethical implications. Traditional educational models often struggle to meet the demands of a rapidly changing world, characterized by diverse learning needs, global interconnectivity, and the necessity for lifelong learning. AI-driven technologies, such as intelligent tutoring systems, personalized learning platforms, and automated assessment tools, have emerged as transformative solutions to these challenges. These technologies promise to revolutionize curriculum delivery, learner engagement, and teacher-student dynamics.

This paper explores the strategic development of education programs under the influence of AI, aiming to provide a roadmap for educators, policymakers, and stakeholders to harness AI effectively. It addresses critical questions: How can AI personalize education while maintaining equity and inclusivity? What role should educators play in an AI-augmented system? How can ethical concerns, such as data privacy and algorithmic bias, be mitigated?

By examining the integration of AI in education, this study seeks to identify best practices, highlight successful implementations, and propose a strategic framework for developing innovative and sustainable education programs. The ultimate goal is to create educational systems that not only adapt to the demands of the 21st century but also empower learners and educators to thrive in an AI-driven world.

Key aspects of the research subject are presented on Fig. 1.

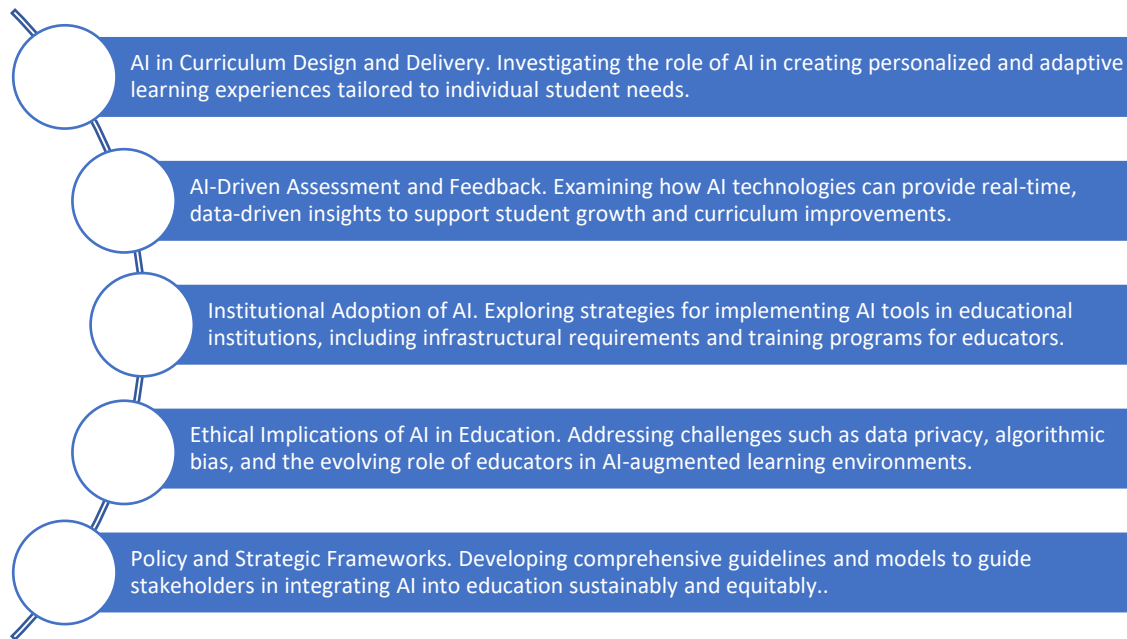


Fig. 1. Key aspects of the research

The research aims to provide actionable insights and frameworks for stakeholders-educators, policymakers, technologists, and learners-to leverage AI in building forward-thinking, inclusive, and impactful education programs.

The research on the strategic development of education programs under the influence of AI yielded the following results.

1. Enhanced Personalization and Learning Outcomes

AI-driven tools, such as adaptive learning systems and intelligent tutoring platforms, significantly improve learning outcomes by tailoring content to individual learner needs. Students using personalized AI-based systems exhibit higher engagement, better retention rates, and faster skill acquisition compared to traditional methods.

2. Increased Efficiency in Educational Processes

Automation of administrative tasks, such as grading, enrollment, and scheduling, reduces the workload on educators and administrators, allowing them to focus on strategic and teaching activities. Predictive analytics enables early identification of at-risk students, facilitating timely interventions.

3. Cost-Effective Scalability

AI technologies offer scalable solutions that enable education programs to reach more learners without proportional increases in costs, especially in remote or underserved regions. The integration of AI helps reduce the reliance on physical infrastructure, enabling cost-effective online and hybrid learning models.

4. Improved Curriculum Design

AI-assisted data analysis helps in continuously refining curricula based on learner performance and feedback. The incorporation of emerging technologies such as machine learning, cloud computing, and cybersecurity into IT education programs ensures relevance to industry demands.

5. Ethical and Equity Challenges Identified

Concerns around data privacy, algorithmic bias, and unequal access to AI technologies remain significant barriers to equitable education. The need for robust ethical frameworks and transparent policies to govern AI usage in education is critical for its sustainable implementation.

6. Educator Roles and Training

AI adoption requires educators to acquire new skills, including the ability to operate AI-based tools and understand AI's limitations. The educator's role evolves to focus more on mentoring, critical thinking, and interpersonal skills, complementing AI-driven automation.

7. Strategic Framework Validated

The proposed strategic framework and mathematical model provide a viable foundation for planning and evaluating AI integration in education programs. Stakeholder collaboration, continuous feedback, and ethical considerations are essential components for successful implementation.

8. Case Studies and Pilot Programs

Analysis of pilot programs shows that institutions adopting AI see improvements in student satisfaction and learning outcomes, though initial challenges include high implementation costs and technical expertise requirements.

2 Related Works

The strategic development of education programs under the influence of artificial intelligence (AI) is a rapidly evolving field. AI's integration into educational systems offers opportunities for personalized learning, improved accessibility, and enhanced operational efficiency [1]. However, it also presents challenges such as potential job displacement, privacy concerns, and the need for strategic oversight.

AI is being strategically integrated into educational systems to create "smart universities" and adaptive learning environments. These systems aim to personalize learning

experiences, improve accessibility, and enhance economic efficiency. However, the transition to AI-driven education requires careful consideration of potential pitfalls, including educational quality, job displacement, and privacy issues [2, 3].

AI education programs are increasingly being implemented, focusing on developing AI literacy and problem-solving skills among young learners. These programs have shown positive impacts on students' motivation, engagement, and attitudes towards AI. However, there is a need for more research to objectively measure students' knowledge acquisition as learning outcomes [4, 5].

The integration of AI in education presents several challenges, including data confidentiality, potential plagiarism, and socioeconomic disparities due to unequal access to technology. There is also a significant gap in legislation regarding AI usage standards in education. Addressing these challenges requires strategic oversight and collaboration among policymakers, educators, and stakeholders [6, 7].

In higher education, AI is being used to enhance postgraduate teaching by fostering active engagement and meaningful learning interactions. A proposed framework for integrating AI into postgraduate education aims to empower professional learners and enrich their learning experiences. This approach highlights the importance of combining AI technologies with pedagogical strategies to meet the needs of professional learners [8, 9].

Future research and strategic planning should focus on developing comprehensive AI education strategies, creating new academic disciplines centered on AI expertise, and promoting grant funding for AI research. Additionally, there is a need for curriculum development that incorporates AI education, guided by frameworks such as self-determination theory and various curriculum planning approaches [9, 10].

The increasing integration of Artificial Intelligence (AI) in education is revolutionizing assessment practices. This paper explores the multifaceted role of AI in education, encompassing automated grading, instant feedback mechanisms, and personalized adaptive learning. We delve into the potential of AI to mitigate biases and enhance fairness in assessment while acknowledging the critical need to address ethical considerations such as data privacy and the potential for algorithmic bias.

3 Method and Material

3.1. Conceptual model of strategic development of education programs under the influence of Artificial Intelligence

The conceptual model for strategically developing education programs under the influence of AI is centered around four interrelated components: Foundational Pillars, AI-Driven Educational Elements, Implementation Strategies, and Ethical Considerations. This model outlines how AI can be integrated into education systems to enhance effectiveness, equity, and adaptability while maintaining ethical integrity (Fig. 2).

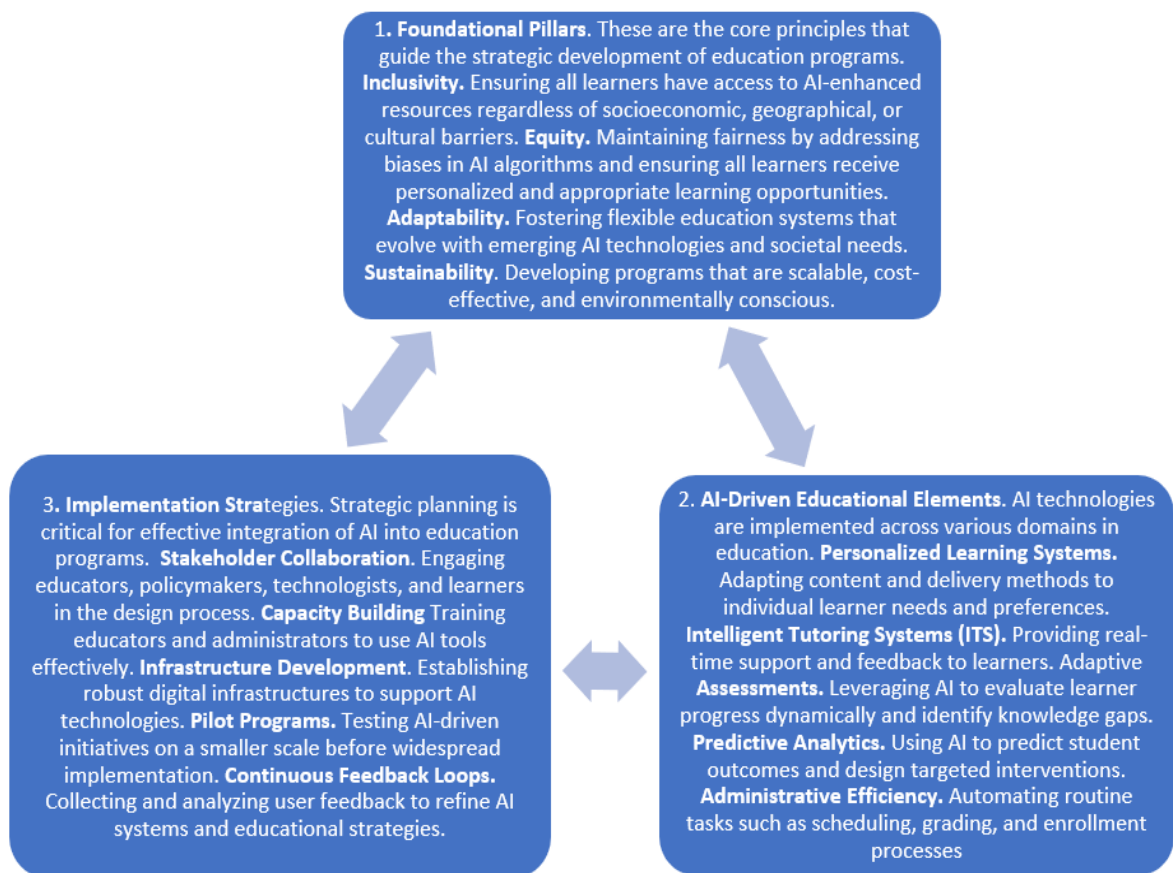


Fig.2. The conceptual model for strategically developing education programs

This conceptual model serves as a blueprint for integrating AI into education, enabling stakeholders to design programs that are innovative, ethical, and aligned with the future needs of learners.

Let's look how changing the scope of an educational program in IT under influence of AI.

Changing the scope of an educational program in IT involves adapting its focus, content, and structure to meet evolving technological, industry, and societal demands. Below are key steps and strategies to effectively redefine the scope of an IT education program (Table 1).

Table 1 – Changing the scope of an educational program in IT

	Key Actions	Examples
1. Identify Emerging Trends and Industry Needs	- Analyze Market Demands. Monitor job market trends, technological advancements, and industry needs, focusing on AI, cybersecurity, cloud computing, blockchain, IoT, and data science.	Regularly analyze job market reports (e.g., LinkedIn, Glassdoor) to identify high-demand skills such as AI and data science.
	- Consult Industry Experts. Collaborate with IT professionals and organizations to understand required skills and knowledge.	Host workshops or roundtables with tech industry leaders to inform curriculum updates.
2. Redefine Program Objectives	- Update the mission and vision to align with the emerging technological landscape.	Add lifelong learning objectives, emphasizing adaptation to evolving IT trends.
	- Focus on competencies in emerging technologies while retaining core IT principles.	Highlight skills like AI programming, data analysis, and cybersecurity within the program's core goals.
3. Revise Curriculum Design	- Incorporate Cutting-Edge Topics. Introduce courses on AI, machine learning, quantum computing, and DevOps.	Add a course on Quantum Computing Fundamentals alongside foundational programming courses.
	- Emphasize Practical Skills. Include labs, coding bootcamps, and industry certifications.	Partner with platforms like AWS Academy to offer cloud computing certifications.
	- Expand Interdisciplinary Areas. Integrate IT with fields such as business, healthcare, and sustainability.	Offer modules on "AI in Healthcare" or "Sustainability through IoT."
	- Promote Research and Innovation. Encourage hackathons and innovation projects.	Organize an annual "Tech for Social Good" hackathon to inspire innovative IT solutions.
4. Leverage Advanced Teaching Methods	- Use AI-driven personalized learning platforms for adaptive instruction.	Implement tools like Coursera Labs for adaptive, hands-on learning experiences.
	- Implement blended learning models combining online and in-person sessions.	Create hybrid courses with flexibility for students to attend remotely or on-site.
	- Introduce simulation-based learning for areas like cybersecurity and network management.	Use cybersecurity labs like Cybrary for virtual network defense training.
	- Encourage peer learning through collaborative projects and coding sprints.	Assign capstone projects requiring group efforts to design IT systems.
5. Strengthen Partnerships with Industry and Academia	- Establish internship programs with leading IT companies to provide real-world exposure.	Collaborate with Microsoft, Google, or startups for internships and mentoring opportunities.
	- Collaborate with tech giants for guest lectures, mentorship, and co-designed courses.	Partner with Amazon to offer guest lectures on cloud services and product lifecycle management.
	- Partner with research institutions to explore emerging technologies and their applications.	Develop joint research programs with universities focusing on AI and IoT.
6. Integrate Ethical and Societal Perspectives	- Include topics on AI ethics, data privacy, and cybersecurity laws.	Create a dedicated course on "Ethics and Legal Aspects of AI."
	- Focus on IT solutions that prioritize sustainability and inclusivity.	Assign projects like "Designing AI Systems for Sustainable Development Goals (SDGs)."
7. Foster Skills Beyond IT	- Incorporate soft skills training such as communication, teamwork, and problem-solving.	Add a module on "Leadership and Collaboration in IT Projects."
	- Develop entrepreneurial skills to enable students to innovate and create startups.	Offer courses like "IT Entrepreneurship and Startup Ecosystems."
8. Monitor and Evaluate Program Outcomes	- Establish feedback mechanisms for continuous improvement.	Use surveys for students, alumni, and employers to refine course offerings.
	- Use metrics like job placement rates, satisfaction, and industry recognition to assess program success.	Track graduate employment in emerging IT fields (e.g., AI and blockchain roles) and adjust curricula based on employer needs.

This table organizes the strategic framework into actionable steps, providing a clear pathway for transforming traditional IT programs into future-ready, AI-driven education models

Changing the scope of an IT program requires aligning educational goals with technological trends and fostering a culture of adaptability and innovation.

3.2. A competence model for AI-driven education projects

A competence model for AI-driven education projects identifies the critical skills, knowledge, and abilities required by key stakeholders to effectively design, implement, and manage education projects influenced by AI. It ensures that all participants are prepared to leverage AI technologies while addressing associated challenges (Table 1).

Table 1 – Competence Model for AI-Driven Education Projects

Domain	Competence Area	Description	Competence Level
Technical Competencies	AI Fundamentals	Understanding AI concepts (e.g., machine learning, NLP, computer vision) and their applications in education.	Foundational, Operational, Strategic
	Data Management	Skills in data collection, cleaning, analysis, and understanding privacy regulations.	Operational, Strategic
	AI Tool Proficiency	Expertise in using AI tools like adaptive platforms, predictive analytics, and tutoring systems.	Operational
	Programming and Automation	Proficiency in programming languages (e.g., Python, R) and developing automated educational solutions.	Operational, Strategic
Pedagogical Competencies	AI-Enhanced Teaching	Integrating AI in teaching strategies and curriculum design for personalized learning.	Operational
	Assessment and Feedback	Designing adaptive assessments and utilizing AI-driven insights for improvement.	Operational
	Learning Analytics	Analyzing and interpreting AI-generated data to support learner progress and interventions.	Operational, Strategic
Ethical and Societal Competencies	Ethical AI Use	Recognizing and mitigating biases in AI systems and ensuring ethical compliance.	Foundational, Strategic
	Inclusivity and Accessibility	Designing AI systems that are equitable and accessible to all learners.	Operational, Strategic
	Critical AI Evaluation	Assessing limitations and risks of AI and balancing automation with human oversight.	Strategic
Strategic and Project Management Competencies	Stakeholder Collaboration	Engaging educators, technologists, policymakers, and learners for successful project planning.	Strategic
	Change Management	Managing resistance to AI adoption through training and cultural shifts.	Strategic
	Policy Development	Creating and enforcing AI policies aligned with ethical and educational standards.	Strategic

This table organizes the competence areas into their respective domains and specifies the required level of expertise (foundational, operational, or strategic) for each area.

3.3. The mathematical model for the Strategic Development of Education Programs Under the Influence of AI

Model Variables

1. Learner-Centric Variables:

- L_p – Personalized learning effectiveness.
- Ac – Adaptive curriculum flexibility.
- Ss – Student satisfaction.

2. Technology Variables:

- Ta – AI adoption rate in education.
- Te – Technological effectiveness of AI tools.
- Ci – Cost of implementation.

3. Institutional Variables:

- Rf – Resource availability (infrastructure, funding).
- Et – Educator training effectiveness.
- Pe – Program efficiency (measured by outcomes such as completion rates, skill acquisition).

4. Ethical Variables:

- Dp – Data privacy compliance.
- Ba – Algorithmic bias reduction.
- Ef – Ethical fairness.

Model Construction

The model represents the **Outcome of Strategic Development (O_s)** as a function of these variables, incorporating their interdependencies:

$$O_s = f(L_p, Ac, Ss, Ta, Te, Ci, Rf, Et, Pe, Dp, Ba, Ef)$$

Each variable can be expressed as a function of its influencing factors. For simplicity, we define key relationships:

1. Learner-Centric Model

$$Lp = a_1 \cdot Te + a_2 \cdot Ac + a_3 \cdot Ss$$

Where a_1 , a_2 , a_3 are weights for technological effectiveness, curriculum adaptability, and student satisfaction, respectively.

$Ss = \beta_1 \cdot Pe - \beta_2 \cdot Ci$ are weights showing how program efficiency and cost influence satisfaction.

2. Technology Adoption Model

$$Ta = \gamma_1 \cdot Rf - \gamma_2 \cdot Ci$$

Where γ_1 and γ_2 are coefficients indicating how resources and costs impact AI adoption.

$$Te = \delta_1 \cdot Ta - \delta_2 \cdot Et$$

Where δ_1 and δ_2 measure the contributions of AI adoption and educator training to technology effectiveness.

3. Ethical Compliance Model

$$Ef = \epsilon_1 \cdot Dp - \epsilon_2 \cdot Ba$$

Where ϵ_1 and ϵ_2 indicate the importance of data privacy and bias reduction for fairness.

$$Ba = \varsigma_1 / (Ta + 1)$$

Where ς_1 is a constant showing bias reduction difficulty as AI adoption increases.

Overall Strategic Outcome

Combining these relationships, the strategic development outcome Os can be expressed as:

$$Os = \eta_1 \cdot Lp + \eta_2 \cdot Ta + \eta_3 \cdot Pe + \eta_4 \cdot Ef$$

Where η_1 , η_2 , η_3 , η_4 are weights that balance learner outcomes, technology adoption, program efficiency, and ethical compliance.

Optimization Objective

The goal is to $\max Os$ while minimizing costs (Ci) and ensuring ethical fairness ($Ef \geq \text{threshold}$).

$$\text{Max } Os \text{ while } Ci \leq C_{\max}, Ef \geq E_{\min}, Ta, Rf, Lp \geq 0$$

This optimization problem can be solved using techniques like linear programming or multi-objective optimization to balance various factors influencing education program development.

4 Conclusions and Future Work

The integration of Artificial Intelligence (AI) in education offers transformative opportunities to enhance learning experiences, streamline administrative processes, and address global challenges in accessibility and inclusivity. This paper developed a strategic framework and a mathematical model for the development of education programs under the influence of AI, emphasizing key components such as personalized learning, adaptive curricula, and ethical considerations.

Let's look on the key findings.

AI's Potential. AI-driven tools, such as intelligent tutoring systems and predictive analytics, can significantly improve educational outcomes by enabling personalization and real-time feedback.

Mathematical Modeling. The proposed model provides a quantitative basis to evaluate and optimize the factors influencing program success, offering actionable insights for decision-makers.

Strategic Approach. A balanced strategy that combines technological advancement with ethical safeguards and stakeholder collaboration is essential for sustainable implementation.

Challenges. Effective integration requires addressing issues like algorithmic bias, data privacy, and the digital divide.

Despite the promising results, the study recognizes that the application of AI in education is still in its nascent stages. Continued efforts are required to refine the framework and ensure equitable access for all learners.

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