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Research Article

A Study on Effectiveness of AI-Based Adaptive Learning Systems in Colleges in Thane District

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ABSTRACT

AI-powered adaptive learning platforms are transforming higher education by offering automated assessments, instant feedback, and personalized learning experiences. Tools like ChatGPT, Coursera, and AI-driven learning management systems enhance student engagement by tailoring content to individual needs while also assisting educators with lesson planning and performance tracking. Although these technologies are gaining traction in Thane District, widespread adoption is hindered by challenges such as inadequate faculty training, technological constraints, and ethical concerns.

This study examines the perspectives, challenges, and overall satisfaction of faculty and students regarding the effectiveness of AI-driven adaptive learning systems in colleges across Thane District. Findings indicate that while only 40% of educators integrate AI into their teaching, 80% of students actively utilize AI tools. Despite this gap, 65% of faculty and 70% of students express satisfaction with AI-enhanced learning. Key barriers include technical constraints, ethical concerns, and insufficient faculty training. Additionally, skepticism among educators about AI's reliability and long-term impact remains a concern. The study highlights the need for faculty training programs, institutional support, and structured AI implementation strategies to maximize the effectiveness of AI-driven learning in higher education.

Keywords: AI in Education, Adaptive Learning, Higher Education, Thane District, Faculty Perceptions, Student Learning Outcomes.

1. INTRODUCTION

1.1. Background of the Study

Artificial intelligence (AI) is transforming the education sector by delivering adaptive learning systems that personalize instructional content to student performance, learning pace, and preferences. In order to offer a customized learning experience and guarantee that students receive the assistance they require, these systems make use of machine learning algorithms and data analytics.

The way students engage with educational content has changed dramatically with the emergence of AI-powered platforms like Coursera, Khan Academy, ChatGPT, and Smart Learning Systems. These resources increase the flexibility and accessibility of education by providing immediate feedback, automated tests, and personalized study schedules.

1.2. Research Problem

While AI-based learning tools have the potential to revolutionize education, their adoption in colleges in Thane District remains uncertain. How effectively are AI-based adaptive learning tools being used in colleges in Thane District? What are the key challenges faced by students and faculty? These are the questions this research aims to address.

1.3. Objectives of the Study

1. To assess the effectiveness of AI-based adaptive learning systems in colleges in Thane District.
2. To analyse student and faculty perceptions regarding AI in education.

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3. To identify challenges in AI adoption and suggest improvements.

1.4. Research Questions

- How frequently do students and faculty use AI-based learning tools?
- What are the key benefits of AI-driven education?
- What challenges do faculty and students face in AI adoption?
- How satisfied are users with AI-based learning experiences?

1.5. Scope of the Study

This study focuses on colleges within Thane District affiliated with the University of Mumbai. It includes students and faculty across disciplines to understand the broader impact of AI-based adaptive learning.

2. REVIEW OF LITERATURE

Several studies have looked into how AI-based adaptive learning systems can be used in higher education, with a focus on how they can increase student engagement, automate assessments, and improve individualized learning. According to Luckin et al. (2019), adaptive learning platforms enhance recall rates and overall learning efficiency by modifying content according to student progress. Holmes et al. (2020) discovered that AI-powered tools promote autonomous problem-solving abilities and active learning by providing personalized study schedules and real-time feedback.

Siemens & Baker's (2021) study highlighted how AI-powered learning analytics may be used to monitor student progress, pinpoint areas that need help, and lower dropout rates. According to Baker et al. (2022), students in STEM education who used AI-driven technologies outperformed those in conventional learning environments by 15% to 20%. In their evaluation of AI-assisted learning in Indian colleges, Aggarwal & Sharma (2021) found that while issues like teacher reluctance and the digital divide still exist, AI improves student motivation and self-paced learning.

Despite the advantages, educators have been cautious to integrate AI in the classroom. According to Gupta & Mehta (2023), 55% of faculty members are hesitant to include AI because they lack technical knowledge and are worried about AI taking the place of traditional instruction. Infrastructure constraints, such as inadequate internet access and a lack of finance, were noted by Kumar (2022) as the main obstacles to AI implementation in Indian colleges. Faculty members are concerned about AI's accuracy in evaluating subjective activities like essay writing and critical analysis, according to Sinha (2021). Additionally, ethical issues have been brought to light, such as prejudice in AI and data privacy (Bhatia & Rao, 2020).

India is progressively using AI in education, as evidenced by the National Education Policy (NEP) 2020, which supports projects for AI-driven learning. But research indicates that AI is more often utilized for competitive exam preparation than for traditional classroom instruction (Choudhary et al., 2023). Though university curricula have not yet fully included AI-driven learning, Patel & Joshi (2022) discovered that AI-powered financial modeling and data analytics technologies have gained momentum in commerce education.

Although earlier studies have demonstrated that AI can improve learning results, there are still unanswered questions regarding its adoption in conventional Indian colleges, notably with regard to teacher attitudes and institutional difficulties. Comprehensive research on AI's effects on non-STEM fields like business and the arts, as well as on ethical issues and biases in AI-generated content, is lacking in the literature currently in publication. By examining AI adoption in Thane District institutions, evaluating its efficacy in actual classroom environments, identifying institutional and faculty obstacles, and suggesting solutions for improved AI integration in higher education, this study adds to the body of literature.

3. RESEARCH METHODOLOGY

3.1. Research Design

A quantitative survey-based approach was used to collect data from students and faculty using structured questionnaires via Google Forms.

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3.2. Sampling Method

- Population: Students & faculty from colleges in Thane District
- Sample Size: 150 students, 50 faculty members
- Sampling Technique: Convenience sampling

3.3. Data Collection

A structured Google Forms questionnaire was distributed digitally. Responses were anonymized to ensure unbiased feedback.

3.4. Data Analysis

1. Descriptive Analysis: Frequency & percentage distribution of responses.
2. Thematic Analysis: Common themes from open-ended responses.
3. Simple Graphical Representation: Bar charts, pie charts for insights.

4. DATA ANALYSIS AND INTERPRETATION

4.1. AI Adoption Trends in Colleges in Thane District

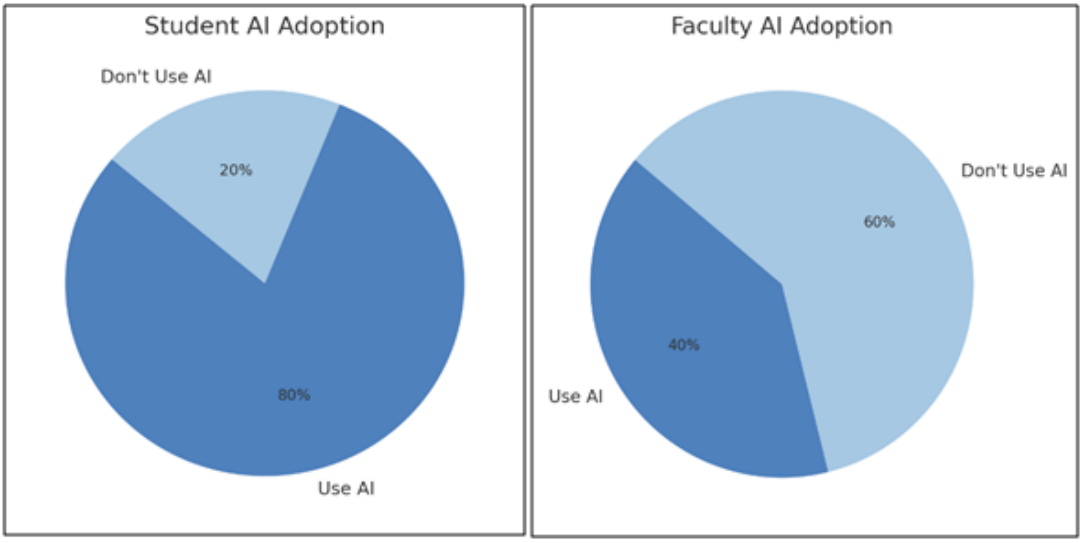
AI adoption among students and faculty shows a clear gap in usage and integration.

Key Findings:

- 80% of students reported using AI-powered learning tools at least once a week.
- However, only 40% of faculty members actively integrate AI into teaching.
- Popular AI tools among students and faculty include ChatGPT, Coursera, AI-powered quizzes, and virtual tutors.

📊 **AI Adoption Rate (Students vs. Faculty)**

🔹 The chart below highlights the difference in AI adoption between students and faculty.



AI Adoption Trends

- **Students:** 80% use AI-based tools, while 20% do not.
- **Faculty:** 40% use AI-based tools, while 60% do not.

📌 **Interpretation:** The data suggests that while AI-based learning is widely accepted among students, faculty adoption is significantly lower, likely due to lack of training and institutional support.

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Research Article

4.2. Effectiveness of AI-Based Learning Systems

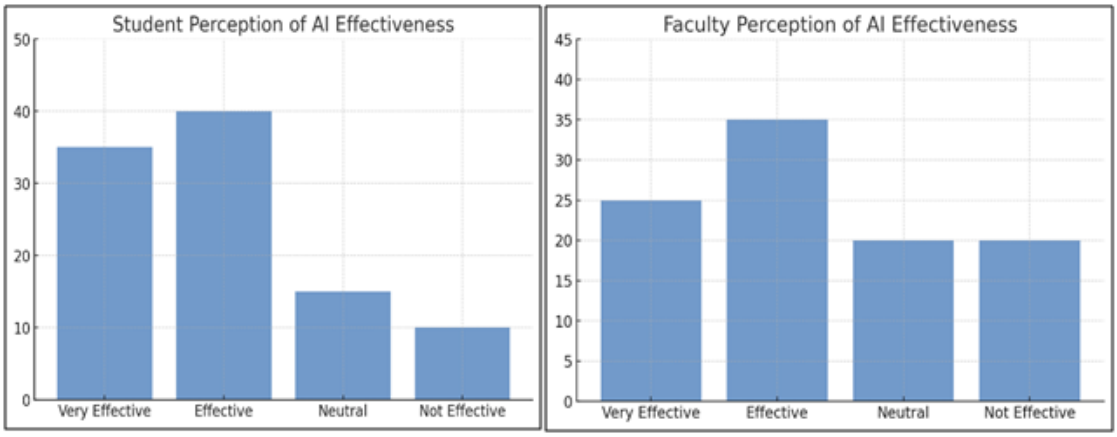
The effectiveness of AI-based learning is highly rated by students and faculty, particularly in helping students grasp complex topics and assisting faculty in assessments.

Key Findings:

- 75% of students agreed that AI-based tools helped them understand complex topics better.
- 60% of faculty found AI useful for automating assessments and research.
- AI-based tools enable self-paced learning and instant feedback mechanisms.

📊 **Perceived Effectiveness of AI in Learning (Students vs. Faculty)**

🔹 The chart below shows how students and faculty rate AI's effectiveness.



AI Effectiveness Ratings

- **Students:** 35% rated AI as *very effective*, 40% as *effective*, while 25% were *neutral or dissatisfied*.
- **Faculty:** 25% rated AI as *very effective*, 35% as *effective*, while 40% were *neutral or dissatisfied*.

📌 **Interpretation:**

- A majority of students find AI helpful in learning complex subjects.
- Faculty adoption is lower, possibly due to lack of experience with AI-based tools.
- Faculty see AI as a supportive tool rather than a replacement for traditional teaching.

4.3. Challenges in AI Adoption

While AI has been beneficial, both **students and faculty face challenges** in adoption.

Key Findings (Challenges Faced by Respondents)

Challenge	Percentage Affected
Lack of faculty training	55%
Internet/technical issues	45%
Resistance to AI use	35%
Ethical concerns (cheating, AI bias)	25%

📊 **Challenges in AI Adoption**

🔹 The chart below shows the major challenges in AI implementation.

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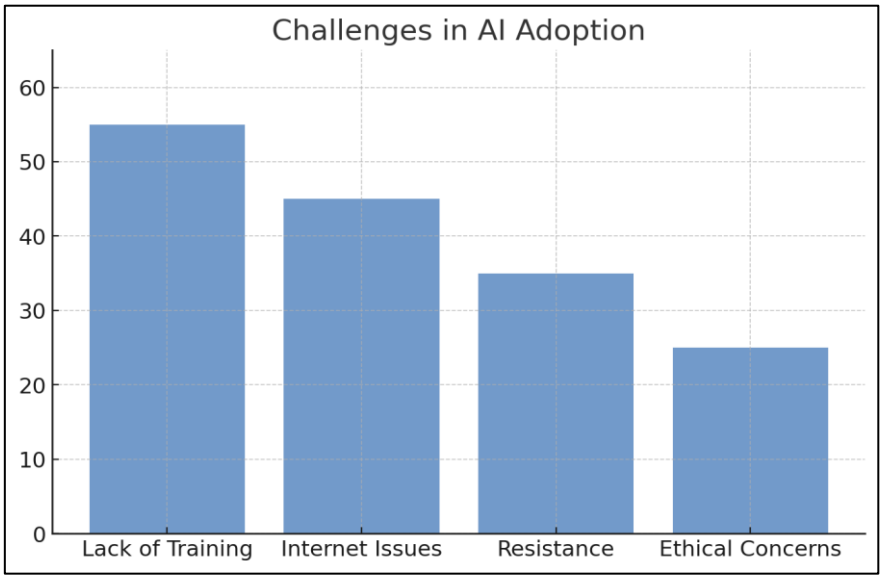


📌 **Interpretation:**

- Lack of faculty training (55%) is the biggest barrier to AI adoption.
- Technical issues (45%) such as internet access slow down AI integration.
- 35% of respondents resist AI adoption, possibly due to fear of job replacement or discomfort with technology.
- Ethical concerns (25%) relate to cheating, AI biases, and misinformation.

4.4. Satisfaction Levels

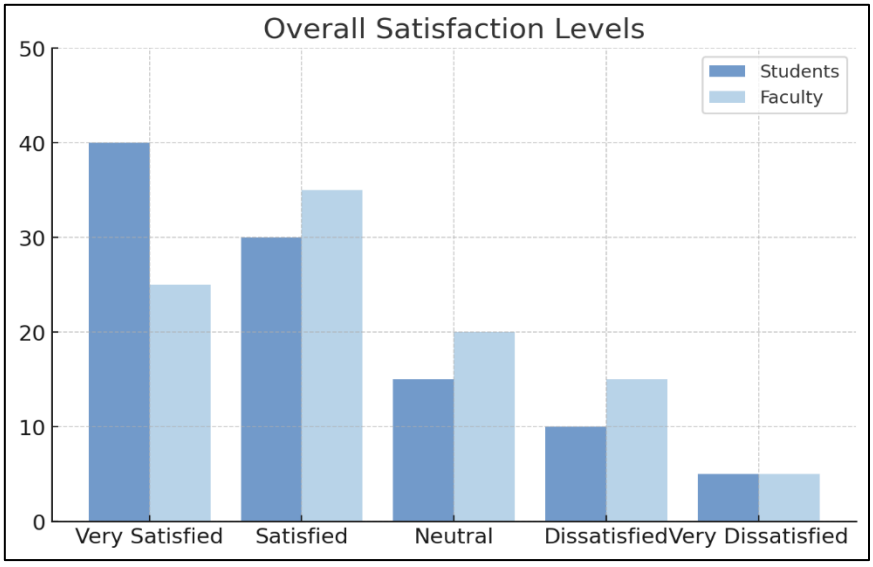
Despite challenges, students and faculty report overall satisfaction with AI-powered learning.

Key Findings:

- 70% of students and 65% of faculty reported being satisfied or highly satisfied with AI in education.
- However, 30% of faculty felt that AI was not reliable enough to replace traditional teaching methods.

📊 **Overall Satisfaction with AI in Education**

🔹 The chart below illustrates student and faculty satisfaction levels.



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📌 **Interpretation:**

- High satisfaction among students and faculty suggests AI is positively impacting education.
- Some faculty members remain skeptical, likely due to concerns about AI accuracy and reliability.

5. CONCLUSION

The survey shows the growing acceptance of AI-based adaptive learning in Thane institutions, with 80% of students actively adopting AI technologies to improve learning and engagement. But at 40%, faculty adoption is still comparatively low, mostly because of a lack of institutional support, training, and ethical and practical concerns regarding AI.

Although AI solutions have been useful in increasing student engagement and automating faculty chores, issues still exist, such as infrastructure constraints, data privacy issues, and AI dependability. Overall satisfaction is high in spite of these difficulties, as indicated by the positive opinions expressed by 70% of students and 65% of faculty. Thirty percent of faculty members are still dubious, which emphasizes the necessity of focused faculty training and organized AI integration techniques.

To close this gap, institutions should prioritize capacity-building activities, clear policy frameworks, and ethical principles for AI application. A well-rounded strategy will guarantee that AI improves education while upholding academic integrity and productive human-AI cooperation.

6. RECOMMENDATIONS

- **Faculty Training & Development** – Conduct AI workshops, hands-on training, and certification programs to improve faculty confidence in AI integration.
- **Infrastructure Support** – Invest in high-speed internet, AI-powered learning management systems, and smart classrooms to enhance accessibility.
- **Ethical AI Use & Policy Frameworks** – Establish clear guidelines on AI-assisted assessments, data privacy, and responsible AI integration in education.
- **AI in Curriculum & Practical Learning** – Incorporate AI-driven projects, simulations, and coursework to enhance real-world applications in various subjects.
- **Cross-Disciplinary AI Adoption** – Promote AI usage beyond STEM fields, integrating AI into Commerce, Arts, and Social Sciences education.
- **Institutional Support & Incentives** – Encourage AI adoption through faculty incentives, research grants, and partnerships with EdTech companies.
- **Student Awareness & Engagement** – Organize AI literacy programs, workshops, and interactive learning sessions to maximize student benefits.

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