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Submission date: 13-Oct-2025 09:32PM (UTC+0700)
Submission ID: 2779888673
File name: Artificial_Intelligence_research_proposal_-_Rahat_Nabi.pdf (394.79K)
Word count: 2412
Character count: 14327

Applying Artificial Intelligence for Personalized Learning: A Case Study in Higher Education in Dhaka Using a Mixed-Methods Approach

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Date of Submission: 30/09/2025

Research Aim

The aim of this study is to explore the application of artificial intelligence (AI) in facilitating personalized learning in higher education institutions in Dhaka, using a mixed-methods approach to understand both the effectiveness of AI-driven tools and the perceptions of students and educators regarding their impact on learning outcomes.

Research Question

How does the implementation of AI-enabled personalized learning tools affect student engagement, academic performance, and learning satisfaction in higher education institutions in Dhaka, and what contextual factors moderate these effects?

Introduction

Artificial Intelligence (AI) is changing the way many industries work, and education is no exception. One of the most exciting uses of AI in education is personalized learning—where lessons, materials, and teaching methods are adapted to fit each student's individual needs, abilities, and learning style. This kind of learning can help students stay more engaged, understand subjects better, and improve their academic performance.

In higher education, especially in a busy and growing city like Dhaka, Bangladesh, using AI for personalized learning could be a big step forward. However, while some universities are starting to explore these technologies, there is still a lot we don't know about how well they work in real-life classrooms, especially in developing countries. There are also challenges—like limited access to technology, lack of training for teachers, and unequal opportunities for students—that can make it hard to use AI effectively.

This research aims to explore how AI is being used to support personalized learning in universities in Dhaka. It will use a mix of methods, including surveys, interviews, and data analysis, to understand both the results of using AI tools and how students and teachers feel about them. By combining these different sources of information, the study hopes to provide a full picture of what's working, what isn't, and what can be improved.

The goal of this study is not just to look at technology, but to understand how it can truly support better learning for all students—no matter their background or situation. The findings could help educators, policymakers, and developers make better decisions about using AI in education in Bangladesh and similar settings.

Literature Review

Global Perspective on AI in Personalized Learning

Artificial intelligence (AI) is increasingly recognized for its potential to transform higher education through personalized learning. Worldwide, AI-powered educational tools have shown positive effects on student engagement, adaptive feedback, and academic outcomes. Studies such as Baker and Inventado (2014) and Holmes et al. (2021) report that AI can support real-time assessment, personalized content delivery, and improved learner autonomy.

However, most of this research comes from high-income, technologically advanced countries. These findings, while promising, may not fully translate to developing nations like Bangladesh, where the digital and educational infrastructure is still developing. This creates a gap in understanding how AI might work in less digitally mature contexts.

Emerging Research in Bangladesh

In Bangladesh, research on AI in education is growing but still limited in both scope and depth. A few studies have explored AI's role in improving learning experiences, particularly during the COVID-19 shift to online education. For example, Talukder and Ahsan (2023) found that AI tools helped increase student engagement in virtual learning environments. However, their study also highlighted concerns about data privacy, ethical misuse of AI, and widening digital inequality.

Another study by Sarker et al. (2022) examined adaptive learning systems based on student learning styles. While their findings suggest potential benefits, the research lacks strong empirical evidence regarding academic outcomes such as performance, retention, or long-term learning gains.

Gaps in Methodology and Data Usage

A major limitation of the current literature in Bangladesh is the heavy reliance on perception-based methods, such as surveys or interviews. While these provide useful insights into attitudes and experiences, they often do not include measurable academic data like grades, attendance, or progression rates. As a result, it's difficult to assess the actual effectiveness of AI tools on learning outcomes.

Additionally, important contextual factors—such as students' digital literacy, socio-economic backgrounds, and institutional readiness—are often mentioned but not deeply analyzed. These elements are crucial for understanding how AI functions in real-world educational settings in a country like Bangladesh.

Lack of Mixed-Methods and Case Study Research

Very few studies in the Bangladeshi context use mixed-methods approaches, which combine both quantitative and qualitative data. This limits the ability to capture a full picture of how AI impacts learning. A mixed-methods design can help explore not only what is happening (e.g., changes in performance) but also why it is happening (e.g., student or teacher attitudes).

Moreover, there is a lack of localized case studies—especially in Dhaka, which is the central hub for higher education in Bangladesh. Most research focuses on broad, national-level findings or is limited to single-institution surveys.

Underexplored Ethical and Long-Term Concerns

Ethical concerns surrounding AI use in education remain under-discussed in the Bangladeshi literature. As tools like ChatGPT, and other generative AI systems gain popularity among university students, issues such as:

- Algorithmic bias
- Over-reliance on AI tools
- Academic integrity
- Unequal access to AI technologies

deserve more focused study.

There is also limited exploration of AI's long-term effects on critical thinking, independent learning, and deeper cognitive skills. These outcomes are important for assessing whether AI supports meaningful, sustainable educational development.

Research Gap
While there is growing interest in AI for education in Bangladesh, the research remains fragmented and underdeveloped. Key limitations include:

- A lack of empirical, outcome-based studies
- Minimal integration of mixed-methods research
- Limited focus on ethical issues and long-term learning impacts
- Scarcity of localized case studies in Dhaka's higher education sector

Need for the Present Study
Given these gaps, this study proposes a mixed-methods case study approach focused on universities in Dhaka. The aim is to assess how AI-based personalized learning affects student engagement, academic performance, and learning satisfaction. By combining academic performance data with qualitative feedback from students and educators, the study seeks to provide context-specific insights that can support more equitable and effective integration of AI in higher education in Bangladesh.

Methodology

Dataset:
Data will be collected using a structured questionnaire, distributed both online and offline to ensure broad accessibility for students and faculty members across various higher education institutions in Dhaka, Bangladesh. The questionnaire will include sections on demographic information, experience with AI-powered personalized learning tools, perceived effectiveness, frequency of use, and levels of engagement and satisfaction. To gain deeper insights into the lived experiences and perceptions surrounding AI integration, one-on-one interviews will also be conducted with selected students, faculty members, and academic administrators involved in AI-based learning environments.

Sampling:
A purposeful sampling approach will be employed to ensure diversity across different institutional types (public, private, semi-private universities), academic disciplines, and student demographics (e.g., year of study, gender, digital literacy levels). The study aims to collect responses from at least 200 students, ensuring a balanced representation of individuals who have interacted with AI-assisted learning platforms such as adaptive learning systems, AI-integrated LMS, or tools like ChatGPT and Grammarly. Additionally, 20 interviews will be conducted with a combination of students, instructors, and university staff to gain deeper understanding of how AI tools are adopted, perceived, and experienced in higher education in Dhaka.

Data Collection:
Participants will be invited to complete a questionnaire, available via online platforms (such as Google Forms) and offline printed copies distributed at selected universities in Dhaka. These will be disseminated through student groups, academic departments, and university administration channels. To complement the survey findings, semi-structured interviews will be conducted through digital platforms such as Google Meet or Zoom, depending on participant convenience. These interviews will explore personal insights on the benefits, challenges, and overall experiences with AI in personalized learning settings.

Data Analysis:

a) Quantitative Analysis:

The quantitative data from the survey will be analyzed using SPSS or equivalent statistical software. Descriptive statistics (mean, standard deviation, frequency) will be used to summarize trends in AI usage, perceived engagement, and academic satisfaction. Inferential statistical tests, such as t-tests, chi-square tests, and ANOVA, will be applied to examine variations across academic year, gender, digital proficiency, and institutional type.

b) Qualitative Analysis:

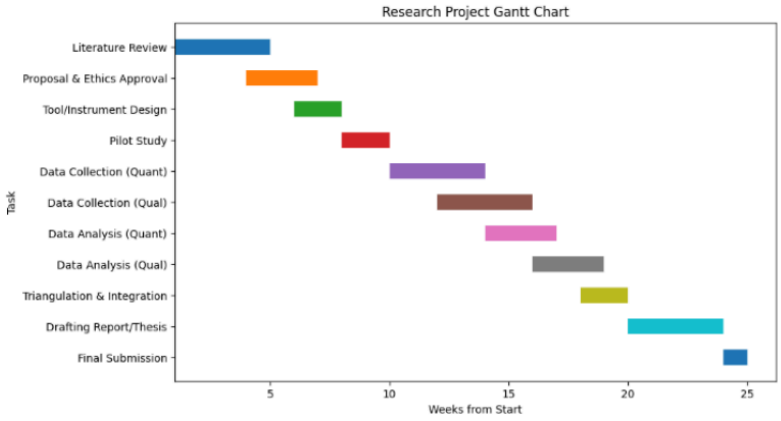
The qualitative data from interviews will be analyzed through thematic analysis to identify recurring patterns, insights, and concerns related to the integration of AI in personalized learning. This analysis will help reveal how different user groups experience, interpret, and evaluate the effectiveness of AI tools in higher education in Dhaka. Key themes will be compared and contrasted across participant types (students vs. faculty) and institutional settings.

Expected Outcomes:

This study aims to identify key trends and variations in the usage and effectiveness of AI-enabled personalized learning tools within Dhaka's higher education sector. The findings are expected to uncover both benefits and challenges, influenced by factors such as institutional infrastructure, digital literacy, and academic discipline. It is anticipated that the results will highlight specific barriers to adoption, as well as facilitators of effective AI use, providing a valuable evidence base for designing inclusive and context-sensitive AI learning systems. Ultimately, the study will contribute to developing more effective and equitable AI integration strategies in the higher education landscape of Bangladesh and other similar developing country contexts.

Practicalities of the Research Proposal

This research is feasible within Dhaka's higher education landscape, as AI tools like ChatGPT, and DeepSeek are already in use among students and teachers. Studies such as those by Talukder and Ahsan (2024) and Chowdhury et al. (2024) show that universities are experimenting with AI in virtual learning and self-directed study, which supports the availability of relevant participants and environments. Required tools like survey platforms and analysis software (e.g., SPSS, NVivo) are affordable and accessible. Since students and teachers are familiar with digital tools, data collection through surveys and interviews is practical. Ethical considerations such as algorithmic fairness and privacy will be addressed by following institutional guidelines, as suggested by Rasel et al. (2025). While infrastructure varies across institutions, selecting digitally-equipped universities in Dhaka will help manage these challenges. Overall, this proposal is realistic in terms of access, tools, participant availability, and ethical compliance.



Category	Description	Estimated Cost (BDT)
Survey Tool Subscription	Subscription to online survey platforms	2,000
Travel and Transport (for field visits)	Local travel costs for visiting universities	5,000
Data Analysis Software (e.g., SPSS/NVivo)	Short-term license for software tools needed	3,000
Printing ang Stationary	Printing of consent forms, questionnaires, etc	1,000
Incentives for Participants	Small tokens of appreciation for students	4,000
Internet and Communication	Internet and mobile communication charges	1,500
Miscellaneous (contingencies)	Unexpected expenses during data collection	2,000

Conclusion

The rapid advancement of artificial intelligence in education presents significant opportunities to enhance personalized learning, particularly in higher education. This research aims to explore how AI-driven tools are being adopted, experienced, and evaluated by students and faculty within Dhaka's university context. By employing a mixed-methods approach, the study will provide both measurable outcomes and in-depth perspectives on the effectiveness and challenges of AI integration.

Through structured surveys and interviews, the research will capture diverse experiences and highlight how contextual factors—such as institutional capacity, digital literacy, and user perception—influence the impact of AI on student engagement, academic performance, and learning satisfaction. The findings are expected to contribute meaningful insights toward building more inclusive, effective, and contextually relevant AI strategies in higher education in Bangladesh.

In doing so, this study not only addresses a critical gap in the existing literature but also supports the broader goal of creating equitable and future-ready learning environments in developing country contexts.

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