ADAPTIVE E-LEARNING COURSE WITH AI-BASED EVALUATION FOR PERSONALIZED STUDENT ASSESSMENT

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Abstract: This paper explores the development and application of an adaptive e-learning system integrated with Artificial Intelligence (AI) for personalized student assessment. It presents the limitations of traditional examination systems, which primarily focus on a single final assessment and fail to reflect the continuous learning process and diverse competencies of students. The proposed AI-driven adaptive evaluation system dynamically adjusts to the individual learner's progress, offering personalized feedback and supplementary learning materials based on performance. By leveraging real-time analysis of student responses, the system identifies knowledge gaps and provides targeted resources to enhance learning outcomes. The adaptability of the system promotes non-linear, student-centered learning trajectories, where students' unique strengths and weaknesses are addressed throughout the course. This approach ensures more accurate assessments, reduces dropout rates, and fosters better learning experiences by considering both theoretical and practical aspects of knowledge.

Keywords: Adaptive Learning, Artificial Intelligence, Student Assessment, E-Learning, Personalized Education, Continuous Evaluation, Machine Learning, Educational Technology

Annotatsiya: Ushbu maqolada sun'iy intellekt (AI) bilan integratsiyalashgan moslanuvchan elektron o'qitish tizimini ishlab chiqish va uni shaxsiylashtirilgan talabalarni baholashda qo'llash masalalari ko'rib chiqiladi. Unda an'anaviy imtihon tizimlarining cheklovlari — asosan yakuniy baholashga e'tibor qaratilishi va bu orqali talabalarning uzluksiz o'quv jarayoni hamda turli kompetensiyalarini aks ettirishda sustlik qilinishi tahlil qilinadi. Taklif etilayotgan sun'iy intellektga asoslangan moslanuvchan baholash tizimi har bir o'quvchining o'zlashtirish darajasiga dinamik tarzda moslashadi va unga natijalarga asoslangan individual fikr-mulohaza hamda qo'shimcha o'quv materiallarini taqdim etadi. Talaba javoblarining real vaqt rejimida tahlili orqali tizim bilim bo'shliqlarini aniqlaydi va natijalarni yaxshilash uchun yo'naltirilgan resurslarni taqdim etadi. Tizimning moslanuvchanligi o'quv markazida talaba turgan, chiziqli bo'lmagan o'quv yo'nalishlarini qo'llab-quvvatlaydi va ularning o'ziga xos kuchli hamda zaif tomonlarini kurs davomida hisobga oladi. Bu yondashuv yanada aniq baholashni

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ta’minlaydi, tashlab ketish darajasini kamaytiradi va nazariy hamda amaliy bilimlarni inobatga olgan holda yaxshiroq ta’lim tajribasini yaratadi.

Kalit so‘zlar: Moslanuvchan ta’lim, Sun’iy intellekt, Talabalarni baholash, Elektron o‘qitish, Shaxsiylashtirilgan ta’lim, Uzluksiz baholash, Mashinaviy o‘rganish, Ta’lim texnologiyalari

Аннотация: В данной статье рассматриваются разработка и применение адаптивной системы электронного обучения, интегрированной с искусственным интеллектом (ИИ), для персонализированной оценки студентов. Описываются ограничения традиционных экзаменационных систем, которые в основном ориентированы на одну итоговую оценку и не отражают непрерывный процесс обучения и разнообразные компетенции студентов. Предлагаемая адаптивная система оценки на основе ИИ динамически подстраивается под прогресс каждого обучающегося, предоставляя персонализированную обратную связь и дополнительные учебные материалы в зависимости от результатов. Используя анализ ответов студентов в реальном времени, система выявляет пробелы в знаниях и предлагает целевые ресурсы для повышения качества обучения. Адаптивность системы способствует нелинейным, ориентированным на студента траекториям обучения, в рамках которых учитываются уникальные сильные и слабые стороны студентов на протяжении всего курса. Такой подход обеспечивает более точную оценку, снижает уровень отсева и способствует лучшему образовательному опыту, учитывая как теоретические, так и практические аспекты знаний.

Ключевые слова: адаптивное обучение, искусственный интеллект, оценка студентов, электронное обучение, персонализированное образование, непрерывная оценка, машинное обучение, образовательные технологии.

1. INTRODUCTION

The challenge of accurately assessing a student's progress during a university course remains a pressing issue. Current assessment models, such as the one used at Turin Polytechnic University in Tashkent, rely predominantly on a single, final exam to evaluate students' understanding of the course content. This approach fails to capture a comprehensive picture of student performance as it neglects ongoing learning activities such as class participation, assignments, and interactions with study materials throughout the semester. As a result, students' diverse skills and learning processes are often misrepresented, leading to an inaccurate reflection of their true capabilities.

Furthermore, the traditional exam format, typically involving written or multiple-choice tests, may not adequately assess a student's practical knowledge, critical thinking, or problem-solving abilities. This limitation becomes apparent

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when students excel in practical projects or discussions but underperform in the exam, which may not reflect their actual competence. Similarly, students who focus on memorization may score well but lack deeper understanding. These discrepancies emphasize the need for a more holistic assessment method that considers all aspects of a student's learning experience.

In response to these challenges, this paper proposes an adaptive, AI-driven e-learning system designed to offer a more personalized, continuous assessment approach. The system aims to provide an ongoing evaluation of student performance, allowing for real-time adjustments to the learning process. This continuous assessment model not only offers a more accurate representation of a student's progress but also enhances engagement and supports personalized learning paths tailored to each student's needs.

2. LITERATURE REVIEW

Several studies have highlighted the limitations of traditional assessment models in education, particularly the emphasis on summative exams. Researchers have pointed out that these models fail to consider students' diverse learning styles, strengths, and challenges [1]. The integration of AI in education has been suggested as a solution to these issues, with AI-based systems showing promise in providing personalized learning experiences [2]. Additionally, adaptive learning systems powered by AI have been demonstrated to enhance learner outcomes by continuously adjusting course content based on individual progress [4].

These systems can analyze large amounts of student data and provide personalized feedback, supporting a more tailored and effective learning experience. The article by Adel Ihichr et al. (2024) presents a comprehensive **systematic review** of adaptive assessment in the context of adaptive learning systems. The authors examine existing theories, algorithms, and technological techniques used to create personalized learning environments and dynamic evaluation models[5]. Momin Iqbal (2023) explores the **role of Artificial Intelligence (AI)** in education, particularly focusing on personalized learning and adaptive assessment processes. Unlike a systematic review, this paper provides a **conceptual analysis** of how AI transforms learning systems[6].

Research focusing on the development of electronic courses as an element of an adaptive training system provides a theoretical foundation for utilizing ITS, emphasizing the need to tailor educational content to individual student needs. One of the possible schemes of nonlinear model of training is considered in Figure 1. In this scheme the total rating estimation of the student is developed on the base of midterm (intermediate) results and final control[3].

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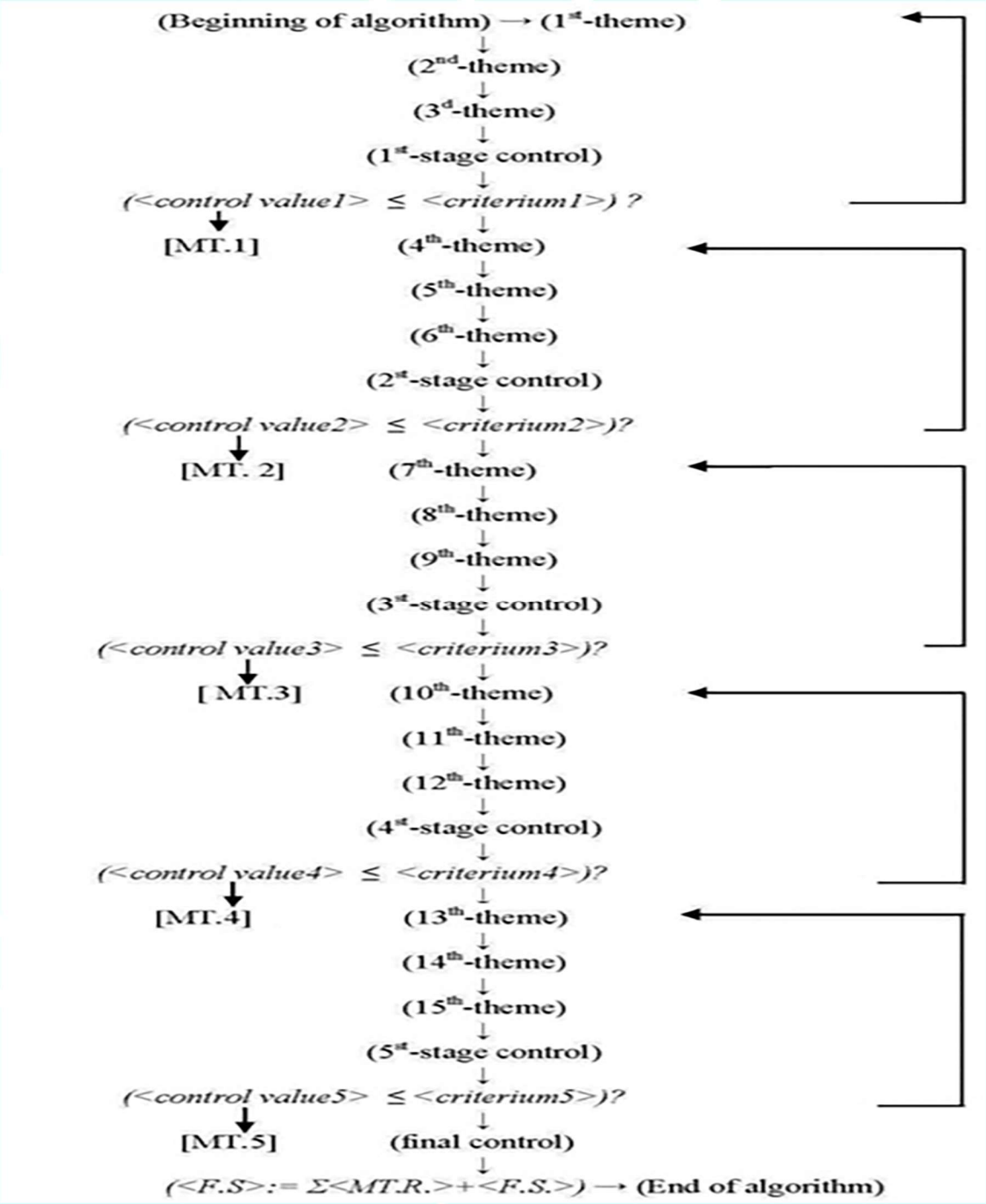


Figure 1. An algorithm of training process trajectory.

3. PROBLEM STATEMENT

The traditional exam-based assessment system at the Turin Polytechnic University fails to reflect continuous student engagement and ongoing learning. The single final exam does not account for the day-to-day performance of students or their ability to apply learned knowledge in practical contexts. This misalignment between assessment and actual learning progress has led to a rise in student dissatisfaction and an increasing dropout rate, as students who may be struggling in exams but excelling in other areas are not adequately supported.

4. METHODOLOGY

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This study introduces a novel approach to student assessment by developing an adaptive, AI-powered evaluation system. The system is structured as follows(Figure 2):

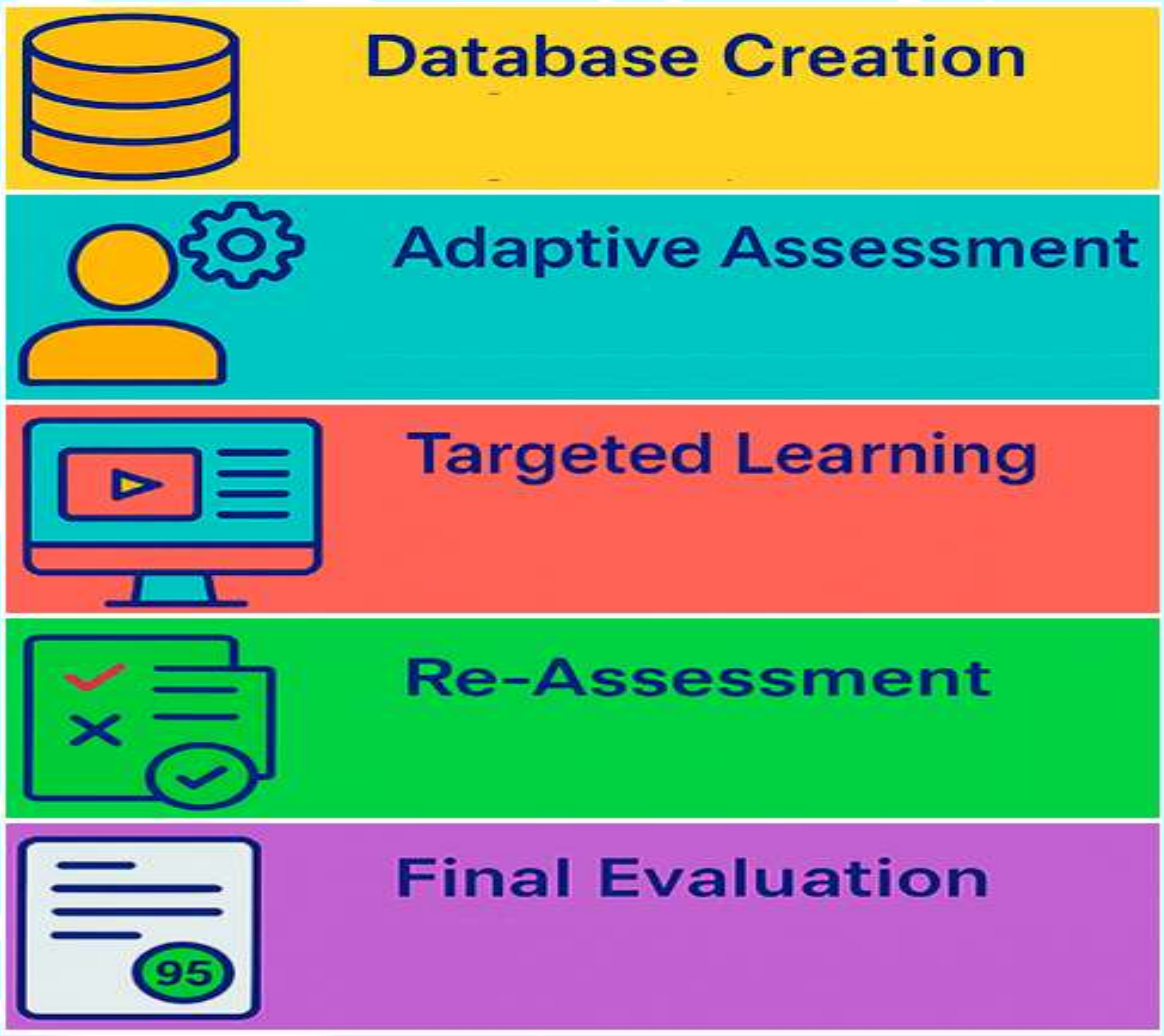


Figure 2. Adaptive AI Assessment Flowchart.

Step 1: Database Creation – A comprehensive database of exam tasks and questions is created, categorized by course themes.

Step 2: Adaptive Assessment – During the exam, the system evaluates student responses in real-time, identifying "ill" themes or topics where the student performs poorly.

Step 3: Targeted Learning – Based on the "ill" themes, the AI system recommends personalized learning materials and tasks to address the knowledge gaps.

Step 4: Re-Assessment – Students who fail to meet the required criteria are provided with additional, tailored exam tasks targeting the identified weaknesses. The process repeats until the student meets the passing score.

Step 5: Final Evaluation – After successful completion of the exam, the student's final score is calculated based on both their exam performance and the supplemental work undertaken.

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This adaptive system ensures that each student receives individualized attention and resources, enabling them to progress at their own pace while continuously improving their understanding of the course material.

5. RESULTS AND DISCUSSION

The AI-powered adaptive evaluation system offers significant advantages over traditional exam-based models. By continuously analyzing student performance and adjusting course content accordingly, the system provides real-time feedback and ensures that students receive the support they need when they struggle with specific topics. This personalized approach increases student engagement and improves retention, as students feel more confident in their ability to succeed.

Additionally, the non-linear learning trajectory facilitated by the system allows students to focus on their weaker areas without the pressure of a final, one-time exam. By offering tailored learning materials, the system helps build a stronger foundation in difficult topics, ultimately leading to better learning outcomes. The continuous feedback loop also enables instructors to monitor student progress more effectively and adjust the course content when necessary.

One of the key findings of the implementation of this system is a significant reduction in the number of students who fail to complete the course. Students who previously struggled with the traditional exam format now have access to additional resources, enabling them to improve their knowledge and pass the exam. As a result, the system not only fosters a more inclusive learning environment but also contributes to higher retention rates and better overall academic performance.

6. CONCLUSION

The integration of AI in adaptive e-learning systems presents a transformative solution to the limitations of traditional assessment models. By providing continuous, personalized evaluation, the AI-based system enhances student engagement and learning outcomes. It empowers students to take control of their educational journey, offering them the tools and resources to overcome challenges and succeed. Furthermore, this system addresses the growing concern of high dropout rates by supporting students through personalized feedback and supplementary learning tasks. The results from the pilot implementation indicate that such adaptive systems can significantly improve academic performance, offering a more holistic and effective approach to education.

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