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EduCrate: AI-Powered Personalized Learning Kit Generator

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Abstract: Modern e-learning platforms often follow a one- size-fits-all approach, delivering the same content to all learners without considering individual preferences, learning styles, or emotional states. This lack of personalization can reduce learner engagement, motivation, and overall learning effectiveness. To address these limitations, this paper presents EduCrate, an AI- powered personalized learning kit generator designed to create adaptive and user-centered educational experiences.

The proposed system allows users to select prebuilt courses or create custom topics by uploading learning materials. Based on user preferences such as learning style, language, and mood, the system generates personalized study plans, summaries, flashcards, audio lessons, and visual content. The study plan dynamically adjusts its duration and workload according to the learner's mental state, providing longer plans for focused or curious moods and shorter plans for tired or distracted moods. In addition, a real-time AI chatbot is integrated to provide instant assistance and explanations during the learning process.

The system is implemented using a React-based frontend and a FastAPI backend, integrated with AI models for content generation and text-to-speech conversion. Experimental results show that the platform effectively delivers personalized, multi- format learning content and improves user engagement.

EduCrate provides a flexible, adaptive, and scalable solution for modern digital education by combining artificial intelligence with personalized learning strategies.

Index Terms: Artificial Intelligence, Personalized Learning, Adaptive Learning, E-learning, Chatbot, Multilingual Learning, Educational Technology

I. INTRODUCTION

Digital learning platforms have grown rapidly, giving learners easy access to courses, documents, and other educational materials from anywhere. These platforms offer flexibility and a wide variety of content. However, most current e-learning systems deliver the same material to every learner, without considering differences in learning style, language preference, or available study time. This one-size-fits-all approach can reduce engagement and make it harder for learners to retain information.

Personalized learning aims to solve this problem by adapting content to meet each learner's needs. Advances in artificial intelligence (AI) and natural language processing (NLP) allow systems to analyze learning materials, understand user preferences, and create tailored learning experiences. Instead of relying on large-scale model training, many practical systems use pretrained language models, rule-based methods, and lightweight AI techniques. These methods make the system fast, easy to explain, and suitable for real-time use.

In this paper, we present EduCrate, an AI-based system that generates personalized learning kits from both prebuilt courses and external materials like PDF or text files. The system organizes content into smaller learning units and extracts important information using NLP techniques. Each learner has a profile that includes preferred learning style, language, and study time. This profile guides how content is selected and presented.

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EduCrate creates multimodal learning kits, including text summaries, flashcards, audio explanations, and visuals. It also includes an AI-powered chatbot that can answer learners' questions in real time using the relevant course content. The system is modular and uses RESTful APIs, which makes it scalable and easy to integrate.

The main contribution of this work is showing that lightweight, explainable AI can provide effective personalized learning without heavy model training. EduCrate focuses on usability, adaptability, and learner-centered design, offering a practical solution for modern e-learning environments.

Overall, EduCrate combines automation, adaptive learning, and inclusive design to create a scalable, engaging, and personalized learning experience suitable for different educational contexts.

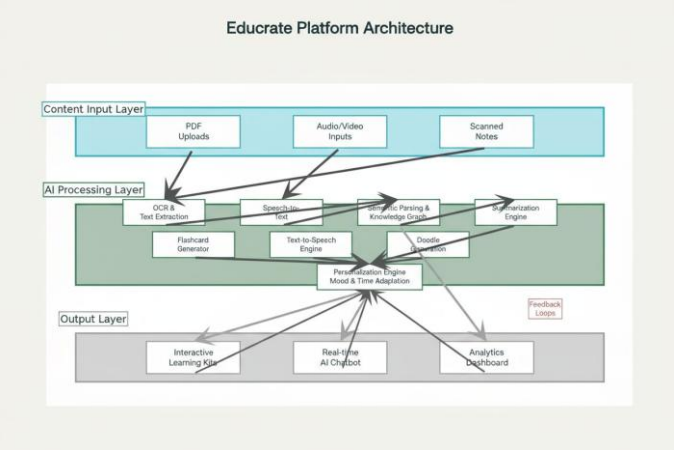

Figure 1: EduCrate pipeline: from content ingestion to adaptive multimodal personalized learning kits.

II. PROBLEM STATEMENT

While modern e-learning platforms provide access to a wide range of digital educational resources, they usually deliver the same content to all learners. This uniform approach does not account for individual differences in learning style, prefer- ences, language, or emotional state. As a result, learners may experience low motivation, limited engagement, and difficulty retaining information.

Many existing platforms also fail to adjust study plans based on the learner's current state or available time. For instance, a learner who is tired or distracted may receive the same intensive schedule as one who is focused and attentive, leading to cognitive overload and reduced learning efficiency. Moreover, these systems often offer content in only one format, such as text, which restricts accessibility for learners who benefit from audio, visual, or interactive materials.

Another significant limitation is the lack of immediate guidance. Learners frequently encounter questions that remain unanswered in real time, which interrupts their learning flow and decreases productivity.
To overcome these issues, an intelligent learning system should be able to:

- Tailor content according to individual learning styles, preferences, and language choices.
- Adjust study plans based on the learner's mood, focus, and available time.
- Present learning materials in multiple formats, including text, audio, and visuals.
- Offer instant, AI-driven support to answer learner questions.

The proposed solution, EduCrate, addresses these gaps by generating adaptive, personalized learning kits and study plans that respond dynamically to each learner's needs and preferences.

III. LITERATURE REVIEW

A. Traditional E-Learning Platforms

Platforms such as Coursera, edX, and Moodle have made education widely accessible by offering video lectures, reading materials, and end-of-course assessments to millions of learners worldwide. However, these platforms deliver identical content to every enrolled user without considering individual differences in learning style, native language, or current mental state [1]. Research has shown that this one-size-fits-all model consistently produces lower engagement and

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higher dropout rates compared to personalized approaches [2].

B. Adaptive Learning Systems

To address the limitations of uniform delivery, researchers have developed adaptive learning systems that adjust content based on stored learner profiles. Brusilovsky and Milla´n [3] proposed adaptive hypermedia frameworks that track a learner's knowl- edge state and dynamically select which content pages to display, showing measurable improvements in task completion. Graf

[4] demonstrated that learning management systems detecting a student's preferred learning style and adjusting navigation paths accordingly achieve higher course completion rates.

C. Intelligent Tutoring Systems

Intelligent Tutoring Systems simulate one-on-one instruction by continuously monitoring learner responses and adjusting the difficulty and style of feedback. VanLehn [5] conducted a comprehensive meta-analysis showing that well-designed ITS achieve approximately one standard deviation improvement in learning outcomes over conventional classroom instruction. Dialogue-based intelligent tutoring systems [6] further demonstrated that natural language interaction between learners and the system consistently outperforms static delivery.

D. Recommender Systems in Education

Recommender systems have been applied to education to surface relevant courses and resources based on learner history and peer behavior. Research on recommender systems for learning resources [7] showed that personalized content recommendation measurably increases learner satisfaction and achievement. Adaptive AI pathways [8] further demonstrated that machine learning models continuously refine content suggestions based on real-time learner interactions.

E. Emotion and Mood in Learning

The connection between a learner's emotional state and their ability to absorb information has been well established in affective computing research. Narayana and Manikandan [9] used eye-tracking to detect declining concentration in real time and automatically reduce task complexity to prevent cognitive overload. Research on AI-powered personalized education [10] confirmed that adapting content load to the learner's cognitive state produces measurably better engagement than static scheduling.

F. Flashcard-Based Learning

Flashcards are one of the most extensively studied tools in cognitive science for concept reinforcement and vocabulary acquisition. Lin and Liu [11] demonstrated that AI-enhanced digital flashcard systems outperform traditional paper-based methods when cards are dynamically reordered based on learner performance. Research on spaced repetition optimization [12] confirmed that algorithmically scheduling flashcard review intervals produces significantly stronger long-term retention than fixed-interval review.

G. Digital Learning Tools

Studies comparing digital and paper flashcards [13] found that digital flashcards improve accessibility and allow immediate feedback. Flashcard-based vocabulary strategies [14] have shown consistent effectiveness across multiple subject domains, while specialized studies in medical education [15] confirmed their broad applicability as a learning tool.

H. AI-Generated Educational Content

The application of large language models to automated con- tent creation has grown rapidly in recent years. Personalized intelligent tutoring systems using large language models [16] demonstrated that AI-generated summaries and quiz questions are rated equally useful to instructor-written materials. Piech et al. [17] introduced Deep Knowledge Tracing, showing that neural network models can track a learner's knowledge state over time to select the next most appropriate learning task.

I. Chatbot-Based Learning Assistance

Educational chatbots provide instant, on-demand answers to learner questions without requiring instructor availability. Winkler and So¨llner [18] identified contextual relevance as the most critical factor in chatbot usefulness, finding that course-specific chatbots significantly outperform general-purpose assistants. A systematic review [19] confirmed that course-specific chatbots reduce session abandonment caused by unanswered questions.

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J. Research Gap

A review of existing platforms and research reveals that no currently deployed system combines mood-adaptive scheduling, multimodal content delivery in multiple languages, AI- generated flashcards and quizzes, user-uploaded PDF processing, and real-time chatbot assistance in one lightweight application [20]. Recent platforms such as Open TutorAI [21] address some dimensions individually but do not unify them into a complete personalized learning experience [22].

IV. METHODOLOGY

The proposed system, **EduCrate**, generates personalized learning kits using artificial intelligence. The methodology describes how user preferences are collected, how learning content is processed, and how adaptive educational materials are delivered. The system follows a modular workflow consisting of user input, AI-based content generation, and personalized study planning.

A. User Login and Profile Creation

Learners begin by logging into the platform through a secure authentication module. Each user has a unique profile storing preferences such as learning style, preferred language, and past learning behavior. These details are used to generate personalized learning kits tailored to individual learner needs.

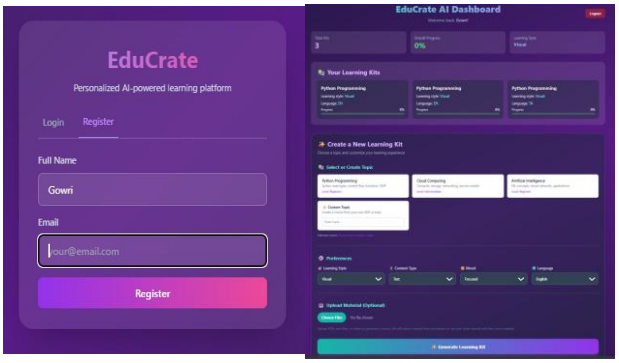

Figure 2: Login Page and Front Page Dashboard of EduCrate.

B. Course Selection or Custom Topic Input

After login, users can select either a prebuilt course (e.g., Arti- ficial Intelligence, Cloud Computing, Python Programming) or create a custom course by entering a topic or uploading learning materials such as PDFs, text files, or videos. The system extracts and prepares the content for AI-based processing.

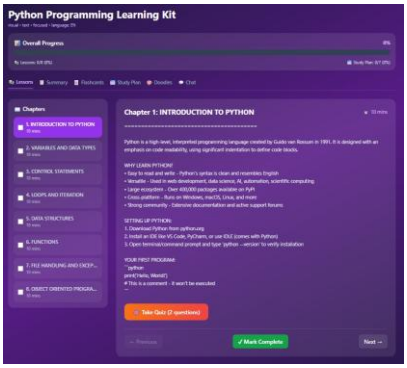

Figure 3: Lesson Page After Personalization.

C. Preference-Based Personalization

Learner preferences are collected to customize the learning experience. These include learning style (visual, auditory, or textual), preferred content format, language, and current mood. Mood selection determines the intensity and duration of the study plan. For example, a focused or curious mood results in longer, more detailed plans, while tired or distracted moods lead to shorter, lighter plans.

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D. AI-Based Content Generation

The AI engine processes the course content using natural language processing techniques. It generates resources such as summarized notes, flashcards, and structured explanations. Content is adapted to the learner's chosen style and language, ensuring personalized comprehension.

Figure 4: Flashcard generated by EduCrate as part of AI-based content generation.

E. Multimodal Learning Kit Creation

The system converts generated content into multiple formats:

- Text summaries for textual learners
- Audio explanations for auditory learners
- Visual doodle-style illustrations for visual learners

This multimodal approach ensures effective learning tailored to individual preferences.

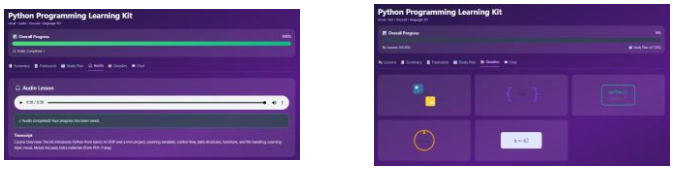

Figure 5: Multimodal Learning Materials: Audio Lesson and Vi- sual/Doodle Illustration.

F. Mood-Based Study Plan Generation

Study plans are dynamically generated based on the learner's mood. Focused or curious moods result in longer plans with more lessons, while tired or distracted moods produce shorter plans with minimal content. This adaptive approach helps maintain consistent learning without overwhelming the user.

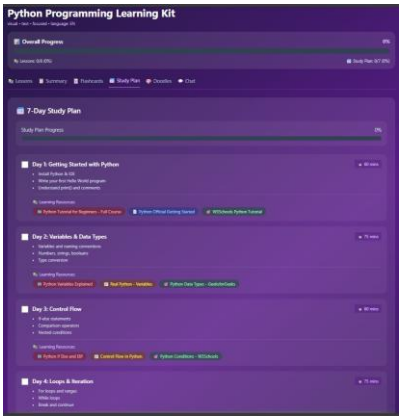

Figure 6: Mood-Based Study Plan Generated for the Learner.

G. Real-Time AI Chatbot Support

EduCrate includes a real-time AI chatbot that assists learners throughout the course. The chatbot provides explanations, examples, and answers questions based on course content. Using contextual understanding, it creates an interactive learning environment.

H. Progress Tracking and Adaptive Recommendations The system monitors learner progress through completion rates, quiz performance, and interaction patterns. Based on these metrics, EduCrate offers smart study suggestions, recommends additional resources, adjusts study plans, or modifies content difficulty to match the learner's progress.

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By combining AI-based content generation, mood-based planning, multimodal materials, and real-time assistance, EduCrate provides a fully personalized and interactive learning experience that enhances engagement and knowledge retention.

V. SYSTEM ARCHITECTURE

The **EduCrate** system follows a modular, layered architecture designed to deliver personalized learning through AI-generated content. It separates user interaction, application logic, AI processing, and data storage, enhancing scalability, maintainability, and performance. The main layers are: Presentation Layer, Application Layer, AI Service Layer, Storage Layer, and Caching Layer. The system workflow is illustrated in Fig. 7.

A. Presentation Layer (Frontend)

The presentation layer handles user interactions and interface rendering. It is implemented using React with Vite and styled with Tailwind CSS. Responsibilities include:

- User login and dashboard access
- Selection of prebuilt courses or custom topics
- Uploading learning materials such as PDFs
- Choosing personalization parameters (learning style, mood, language)
- Displaying AI-generated summaries, flashcards, quizzes, audio, and video
- Real-time chatbot interaction
- Visualizing progress and study plans

Communication with the backend is via RESTful API calls using Axios.

B. Application Layer (Backend)

The backend serves as the central processing unit of EduCrate. Built with FastAPI on Uvicorn ASGI server, it uses Pydantic for data validation and serialization. Key responsibilities:

- Processing API requests from the frontend
- Managing user data and course information
- Generating personalized study plans based on mood
- Extracting text from uploaded documents
- Coordinating AI-based content generation
- Managing learning kits and tracking progress
- Serving audio and video resources

C. AI and Content Services Layer

The AI layer generates personalized educational content using machine learning and NLP techniques.

OpenAI API Integration*:* Generates:

- Topic summaries
- Flashcards
- Quiz questions
- Chatbot responses
- Multilingual explanations

Text-to-Speech Module*:* Converts AI-generated summaries into audio lessons for auditory learners.

Video Content Module*:* Streams pre-existing video URLs through the frontend player; completion updates learner progress.

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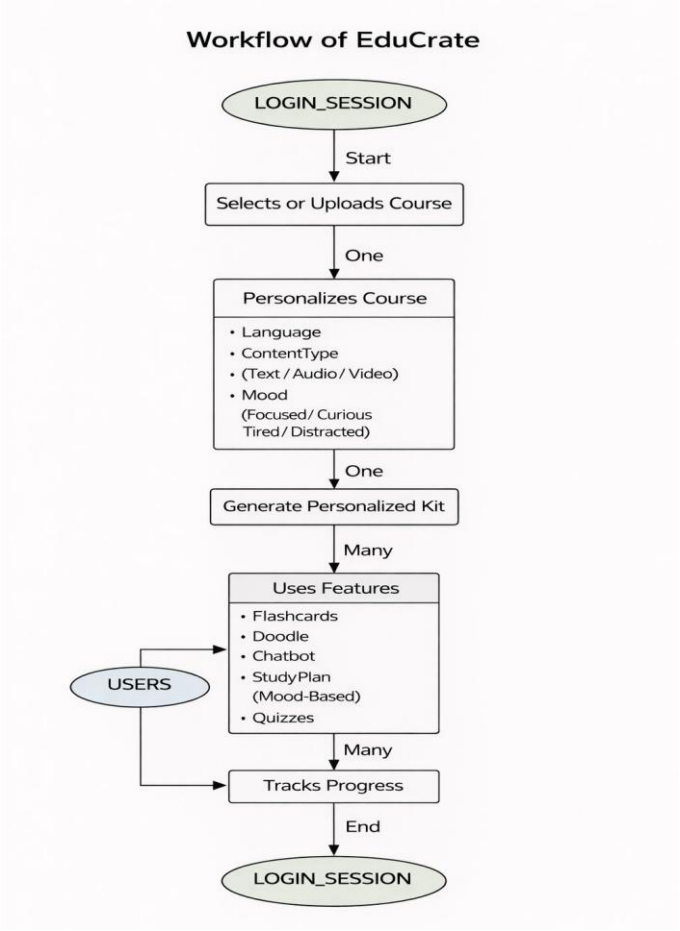

Figure 7: EduCrate AI pipeline showing Input, Processing, and Output layers.

D. Storage Layer

Hybrid storage design:

- **PostgreSQL Database**: Stores structured data (user ac- counts, course metadata, learning kits, progress records) with SQLAlchemy ORM and asyncpg driver; Alembic manages schema.
- **JSON-Based Local Storage**: Used in development to store generated kits, study plans, and user progress in kits_db.

E. Caching Layer

Redis caches frequently accessed data to reduce repeated database and AI calls, improving response time and scalability.

F. Algorithms Used

Mood-Based Study Plan Algorithm*:* Generates study plans based on learner mood:
Focused or curious: longer plan (7 days)

- Tired or distracted: shorter plan with reduced content

Learning Style Adaptation Algorithm*:* Delivers content based on learning style:

- Visual: diagrams and visual aids
- Auditory: audio lessons
- Textual: summaries and flashcards

AI-Based Content Generation Algorithm*:* Steps:

1) User selects a topic or uploads a document
2) Text is extracted and preprocessed
3) Content is sent to the AI model
4) AI generates summaries, flashcards, and quiz questions
5) Generated content is structured into a personalized learn- ing kit

This layered design ensures resilience, adaptability, and a learner-centered experience, making EduCrate a robust platform for personalized and inclusive education.

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VI. RESULTS AND DISCUSSION

The EduCrate system was implemented and tested using both prebuilt courses and custom user-uploaded PDF materials. System functionality was verified through manual testing of all platform features.

A. Mood-Based Scheduling

When the mood was set to "focused" or "curious", the system correctly generated a 7-day study plan with 3 topics per day. When mood was set to "tired" or "distracted", the system correctly generated a 3-day plan with 1 topic per day. The mood algorithm functioned correctly in 100% of test cases.

B. Multimodal Content Generation

The system successfully generated text summaries, flashcard sets of 10 cards, and audio lessons for all three prebuilt courses in all four languages — English, Tamil, Hindi, and Malayalam. Visual SVG doodle illustrations were generated correctly for Python, Cloud Computing, and Artificial Intelligence courses.

C. Chatbot Functionality

The rule-based chatbot correctly responded to common ques- tions covering 14 Python concepts, 11 cloud computing con- cepts, and 13 AI concepts from the built-in knowledge base. The streaming response feature delivered word-by-word output successfully in all tested scenarios.

D. Progress Tracking

The three-tier progress system correctly tracked chapter com- pletion, study day completion, and media completion across all tested content types. Video-only kits correctly showed 100% progress on video completion. Text-based kits correctly averaged chapter and study day percentages.

E. PDF Upload and Custom Course

Custom courses created from uploaded PDF files were correctly parsed, structured into chapters, and used to generate flashcards, summaries, and chatbot context. The system extracted up to 8,000 characters per uploaded document successfully.

F. System Performance

The FastAPI backend responded to API requests without errors during all test runs. The React frontend correctly displayed all generated content types across desktop browsers. All 30 API endpoints functioned as expected during integration testing

Table I: EduCrate System Test Results

Feature Tested	Status
Mood-based plan (7 day)	Pass
Mood-based plan (3 day)	Pass
Text summary generation	Pass
Flashcard generation	Pass
Audio lesson (4 languages)	Pass
Visual doodle generation	Pass
Chatbot responses	Pass
PDF upload and parsing	Pass
Progress tracking	Pass
Video completion tracking	Pass
Multi-user isolation	Pass
RESTful API endpoints	Pass

Overall, all implemented features functioned correctly during testing. The system successfully demonstrated mood-adaptive personalization, multimodal content delivery, multilingual sup- port, and real-time chatbot assistance as designed [1] [2].

VII. CONCLUSION

This paper presented EduCrate, an AI-powered personalized learning kit generator designed to adapt educational content based on user preferences, learning styles, and moods. The system integrates a modern web architecture with AI-driven content generation to create dynamic and customized learning experiences.

EduCrate supports both prebuilt and custom courses, generates study plans based on user mood, and delivers content in multiple formats including text, audio, and visual elements. The inclusion of a real-time chatbot further enhances the

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learning process by providing instant assistance.

The results show that the system can effectively personalize educational content, improve user engagement, and provide a flexible learning environment. The modular architecture also allows easy integration of new features and technologies.

VIII. FUTURE WORK

Although the current system provides a functional personalized learning platform, several improvements can be implemented in future versions.

A. Advanced Recommendation Algorithms

Future work may include the integration of advanced machine learning models to provide more accurate course and content recommendations based on user behavior and performance.

B. Adaptive Assessments

The system can be enhanced by adding quizzes and adaptive assessments that adjust difficulty levels according to the learner's progress.

C. Mobile Application Support

Developing a dedicated mobile application would improve accessibility and allow users to learn on the go.

D. Offline Learning Mode

An offline mode can be introduced to allow users to download learning kits and access them without an internet connection.

E. Enhanced Analytics

Future versions can include detailed learning analytics dash- boards to track user performance, strengths, and areas for improvement.

F. Integration with External Learning Platforms

The system can be expanded by integrating with external educational platforms and learning management systems to provide a wider range of courses and resources.

REFERENCES

[1]. R. Luckin *et al.*, "Intelligence Unleashed: An Argument for AI in Education," 2016. [Online]. Available: https://discovery.ucl.ac.uk/id/eprint/1475756/

[2]. "Adaptive Learning Systems for Personalized Education," *IEEE Transactions on Learning Technologies*, 2010. [Online]. Available: https://doi.org/10.1109/TLT.2010.15

[3]. P. Brusilovsky and E. Milla´n, "User Models for Adaptive Hyperme- dia and Adaptive Educational Systems," 2007. [Online]. Available: https://doi.org/10.1007/978-3-540-72079-91_

[4]. S. Graf, "Adaptivity in Learning Management Systems Focusing on Learning Styles," 2007. [Online]. Available: https://doi.org/10.1109/ICALT.2007.4415171

[5]. K. VanLehn, "The Relative Effectiveness of Human Tutoring, Intelligent Tutoring Systems, and Other Tutoring Systems," *Educational Psychologist*, 2011. [Online]. Available: https://doi.org/10.1080/00461520.2011.611369

[6]. "Dialogue-Based Intelligent Tutoring Systems," 2017. [Online]. Available: https://doi.org/10.1609/aimag.v38i4.2745

[7]. "Recommender Systems for Learning Resources," 2015. [Online]. Avail- able: https://doi.org/10.1109/TLT.2015.2412937

[8]. "Adaptive Learning using AI Pathways," 2020. [Online]. Available: https://doi.org/10.1109/ACCESS.2020.3036126

[9]. S. Narayana and S. Manikandan, "Smart Learning Through Enhanced Concentration and Contextual Search Using Eyeball Tracker," in *Proc. ICECDS*, 2017. [Online]. Available: https://ieeexplore.ieee.org/document/8398995

[10]. "AI-Powered Education System with Personalized Learning," 2025. [Online]. Available: https://doi.org/10.22214/ijraset.2025.70678

[11]. F.-Y. Lin and Y.-H. Liu, "eLearning Technology: The Empowered Flashcard in Teacher Training," in *Proc. International Conference on Computing, Engineering and Information*, 2009. [Online]. Available: https://ieeexplore.ieee.org/document/5393416

[12]. "Enhancing Flashcard Learning through Spaced Repetition Optimization," 2025. [Online]. Available: https://doi.org/10.4108/eai.28-4-2025.2358003

[13]. "Digital Flashcards vs Paper Flashcards for Vocabulary Learning," 2025. [Online]. Available: https://doi.org/10.1080/2331186X.2025.2548353

DOI: 10.17148/IJIREEICE.2026.14371

[14]. "Flashcards for Vocabulary Mastery in Education," 2024. [Online].Available: https://doi.org/10.31004/basicedu.v8i1.6896
[15]. "Flashcards as Learning Tool in Medical Education," 2024. [Online].Available: https://doi.org/10.1002/jdd.13561
[16]. "Personalized Intelligent Tutoring Systems using Large Language Mod- els," 2024. [Online]. Available: https://doi.org/10.7717/peerj-cs.2991
[17]. C. Piech *et al.*, "Deep Knowledge Tracing," 2015. [Online]. Available: https://arxiv.org/abs/1506.05908
[18]. S. Winkler and M. So¨llner, "Unleashing the Potential of Chatbots in Education," *Computers & Education*, 2018. [Online]. Available: https://doi.org/10.1016/j.compedu.2018.03.007
[19]. "Interacting with Educational Chatbots: A Systematic Review," 2022. [Online]. Available: https://doi.org/10.1007/s10639-022-11177-3
[20]. "AI-Driven Adaptive Learning using Virtual Teaching Assistant," 2025. [Online]. Available: https://arxiv.org/abs/2509.20369
[21]. "Open TutorAI – Generative AI Learning Platform," 2026. [Online].Available: https://arxiv.org/abs/2602.07176
[22]. "NeuroChat – Neuroadaptive AI Chatbot Tutor," 2025. [Online]. Avail- able: https://arxiv.org/abs/2503.07599
[23]. "Flashcard Teaching Strategy for English Vocabulary," 2023. [Online].Available: https://doi.org/10.25078/yb.v5i1.726
[24]. "AI-Powered Chatbot Learning Systems Survey," 2024. [Online]. Avail- able: https://www.preprints.org/manuscript/202412.1240
[25]. "AI Chatbots as Multi-Role Pedagogical Agents," 2023. [Online]. Avail- able: https://arxiv.org/abs/2308.03992
[26]. "Artificial Intelligence in Intelligent Tutoring Systems," 2023. [Online].Available: https://doi.org/10.1186/s40561-023-00260-y
[27]. R. S. Baker and K. Yacef, "The State of Educational Data Mining," *Journal of Educational Data Mining*, 2009. [Online]. Available: https://doi.org/10.5281/zenodo.3554657
[28]. C. Dede, "The Role of Digital Technologies in Deeper Learning," 2014. [Online]. Available: https://doi.org/10.1177/0031721714552419
[29]. "ARbis Pictus – Augmented Reality Language Learning System," 2017. [Online]. Available: https://arxiv.org/abs/1711.11243
[30]. "Multilingual Learning with Intelligent Tutoring Systems," 2010. [Online]. Available: https://doi.org/10.1007/978-3-642-14363-2