Educational Administration: Theory and Practice
2024, 30(5), 11073 - 11078
ISSN: 2148-2403
https://kuey.net/

Research Article

Study Notion Empowering Learners Through Personalized AI Driven Learning

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Citation: Vijay Kumar Sharma[1] et al. (2024 Study Notion Empowering Learners Through Personalized AI Driven Learning *Educational Administration: Theory and Practice*, *30*(5), 11073 - 11078
Doi: 10.53555/kuey.v30i5.4891

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ABSTRACT

The unionized nature of a significant portion of the education system has sparked concerns about EdTech being perceived as an attempt to phase out certain in-class duties in a bid to reduce costs. However, proponents of EdTech stress its potential to enhance education by freeing up teachers to take on more facilitative roles. Given the time constraints teachers face, juggling curriculum adherence, supporting lower-level learners, and engaging high-achieving students is a formidable task. EdTech addresses this challenge by automating the assessment of ability and adjusting difficulty levels, potentially leading to improved outcomes for both individual students and the class as a whole. EdTech revolutionizes education by seamlessly connecting educators and learners through its interactive online platform. Instructors benefit from streamlined course creation tools, while students gain access to a diverse course catalog. The platform's integration of AI and ML offers personalized learning experiences, analyzing user patterns for tailored course recommendations. EdTech goes beyond traditional coursework, fostering interactive learning and providing progress tracking. In tandem, Educational Technology (EdTech) is evolving, aiming to enhance classroom learning through hardware and software. While concerns exist, EdTech holds promise for customized curricula, potentially transforming the role of teachers and improving student outcomes. Both EdTech and EdTech represent transformative forces shaping the future of education.

Keywords—Educational Technology, AI-driven Learning, Personalized Education, Machine Learning Algorithms ,Progress Tracking.

I. INTRODUCTION

In the swiftly evolving landscape of education, the need for accessible, personalized learning experiences is more critical than ever [9]. Enter "EdTech," an innovative educational platform designed to address this pressing need, offering personalized, AI-driven learning experiences that are paramount for professional advancement [13]. In today's competitive world, continuous learning is synonymous with career growth [14]. EdTech recognizes this need, serving as a catalyst for individuals striving to excel in their careers. The platform's emphasis on personalized learning becomes the cornerstone for career advancement, enabling learners to tailor their educational experiences to align with their career aspirations and individual learning preferences [18]. The integration of AI in EdTech amplifies this personalized learning experience. By leveraging sophisticated AI algorithms, EdTech analyses each learner's unique patterns, interests, and career objectives [11]. This analysis forms the foundation for providing tailored course recommendations, fostering skill development, and nurturing competencies directly aligned with career trajectories. Personalized learning within EdTech isn't just about acquiring knowledge; it's about cultivating skills that resonate within professional spheres. The platform's AI-driven approach ensures that learning experiences are not only engaging but also directly contribute to career growth by pinpointing and addressing skill gaps [15]. This introduction embarks on an exploration of EdTech's pivotal role in addressing the necessity for personalized learning in career development. It delves into the symbiotic relationship between personalized learning and professional advancement, showcasing how EdTech's AI-powered approach enriches learning experiences, propelling individuals toward their career objectives. As we delve deeper, it becomes evident that EdTech isn't

merely a learning platform; it's a catalyst for career growth. Its fusion of personalized learning and AI-driven insights serves as a beacon, guiding individuals toward a future enriched with continuous growth and professional success.

II. BACKGROUND AND RELATED WORK

The advent of the digital age has transformed education, shifting from traditional classrooms to online platforms, providing unparalleled accessibility and flexibility [7]. Personalized learning has gained prominence, focusing on tailored educational experiences aligned with individual learning preferences and goals. Technology, especially AI and ML, plays a crucial role in personalized learning, leveraging data analysis to offer customized learning paths [10]. Several platforms have pioneered AI-driven personalized learning, refining adaptive learning and recommendation systems [12]. Educational technology (ed-tech) encompasses diverse innovations shaping the landscape of education. Learning Management Systems (LMS) like Moodle and Canvas centralize course materials, streamlining communication. Adaptive learning platforms employ algorithms to personalize content, ensuring tailored learning experiences. Virtual and augmented reality bring immersive learning, allowing students to explore subjects experientially. Gamification integrates game elements, fostering engagement and motivation in educational contexts. EdTech incorporates AI-driven algorithms, particularly in personalized learning. The algorithm is designed to process user data, analyze learning preferences, and recommend suitable courses, enhancing the user experience[12].

A. Global EdTech Transformation:

The widespread adoption of educational technology (ed tech) has made learning accessible on a global scale. With the prevalence of digital devices and internet connectivity, ed tech caters to individual needs through adaptive technologies like machine learning. These systems analyze user data to personalize learning experiences, breaking away from a one-size-fits-all model. Edtech's adaptability extends beyond traditional education, impacting professional development and lifelong learning. As technology evolves, edtech's dynamic and personalized approach is shaping the future of education, ensuring learners worldwide have tailored and accessible opportunities for continuous growth.

B. Adaptive Algorithms:

Educational technology platforms leverage algorithms, including machine learning for personalized content recommendations and predictive analytics. Natural Language Processing (NLP) enhances interactivity by analyzing sentiment and understanding language queries. Adaptive learning algorithms dynamically adjust content difficulty and optimize learning paths based on individual progress. Data analytics provide insights into learner performance, while collaborative filtering recommends content through user-based and item-based approaches. Gamification algorithms employ reward systems and progress tracking for enhanced engagement. These algorithms collectively facilitate a seamless flow of data, creating adaptive and personalized educational experiences.

III. EXPERIMENTAL RESULT ANALYSIS

A. Description of Dataset Used:

The platform utilizes specific datasets for user interactions, course content, and user preferences [16]. These datasets contribute to the platform's functionalities, such as personalized learning and content recommendation.

B. Evaluation of System Efficiency or Accuracy:

Various metrics, such as user feedback, performance statistics, and engagement rates, are employed to measure the efficiency and accuracy of EdTech[16]. The evaluation highlights the platform's effectiveness in meeting user needs.

Fig. 1.1 (Statistic)

IV. WORKING ENVIRONMENT

The front end is part of the platform that the user interacts with. It's like the "face" of the platform that the user sees and interacts with. The front end of EdTech is designed using a tool called Figma, which is a popular design tool that allows for the creation of clean and minimal user interfaces[16]. The front end of EdTech has all the necessary pages that an ed-tech platform should have. Some of these pages are:
For Students:
Homepage: This page will have a brief introduction to the platform, as well as links to the course list and user details. Course List: This page will have a list of all the courses available on the platform, along with their descriptions and ratings. Wishlist: This page will display all the courses that a student has added to their wishlist. Cart Checkout: This page will allow the user to complete the course purchase. Course Content: This page will have the course content for a particular course, including videos, and other related material.
User Details: This page will have details about the student's account, including their name, email, and other relevant information.
User Edit Details: This page will allow the student to edit their account details.
For Instructors:
Dashboard: This page will have an overview of the instructor's courses, as well as the ratings and feedback for each course. Insights: This page will have detailed insights into the instructor's courses, including the number of views, clicks, and other relevant metrics.
Course Management Pages: These pages will allow the instructor to create, update, and delete courses, as well as manage the course content and pricing. View and Edit Profile Details: These pages will allow the instructor to view and edit their account details.
For Admin (this is for future scope):
Dashboard: This page will have an overview of the platform's courses, instructors, and students.
Insights: This page will have detailed insights into the platform's metrics, including the number of registered users, courses, and revenue. Instructor Management: This page will allow the admin to manage the platform's instructors, including their account details, courses, and ratings. Other Relevant Pages: The admin will also have access to other relevant pages, such as user management and course management pages. To build the front end, we use frameworks and libraries such as ReactJS, which is a popular JavaScript library for building user interfaces. We also use CSS and Tailwind, which are styling frameworks that help make the user interface look good and responsive. Additionally, we use some npm packages to add extra functionality to the front end. To manage the state of the application, we use Redux, which is a popular state management library for React. Finally, we use a development environment called VSCode, which is a popular code editor, to develop the frontend. EdTech uses a monolithic architecture, with the backend built using Node.js and Express.js, and MongoDB as the primary database. Monolithic architecture refers to a design approach where all the modules of the application are combined into a single large program, with a single codebase, to enable better control, security, and performance. Node.js is a popular JavaScript runtime that allows us to run JavaScript code outside of the browser. Express.js is a web application framework that simplifies the process of building web applications in Node.js. MongoDB is a popular NoSQL database that allows for flexible data storage and retrieval, making it a suitable choice for complex applications like functionalities, including:
a
EdTech's backend functionality centers around robust user management, content creation, and secure transactions. Users, differentiated as students or instructors, access the platform through a secure authentication system employing email verification and password protection. Two-factor authentication (2FA) using OTP further enhances security. Instructors are empowered to manage their courses through a comprehensive suite of tools, enabling them to create, modify, delete, and enrich courses with multimedia content. Students can browse, enroll in, and provide feedback on courses[17][18]. To facilitate seamless transactions, EdTech integrates with Razorpay, a payment gateway, ensuring secure payment processing. All media assets, including images, videos, and documents, are efficiently managed and stored using Cloudinary, a cloud-based media management service. For textual course content, EdTech leverages the Markdown format, simplifying content display and rendering on the frontend. The backend architecture, built on Node.js with Express.js framework and MongoDB as the database, prioritizes scalability, reliability, and security. The API, designed according to REST principles, employs JSON for data exchange and utilizes standard HTTP methods (GET, POST, PUT, DELETE) for efficient communication between the frontend and backend In conclusion, the REST API design for the EdTech ed-tech platform is a crucial part of the project. The API endpoints and their functionalities are designed to ensure seamless communication between the front-end and back-end of the application. By following RESTful principles, the API will be scalable, maintainable, and reliable. The sample API requests and responses provided above illustrate how each endpoint will function and what kind of data it will accept or return. With this API design, EdTech will be able to provide a smooth user experience while ensuring security and stability.
EdTech. Features and Functionalities of the Back-end: The back end of EdTech provides a range of features and

Fig.2.1(Data Schema)

V. PERSONALIZED RECOMMENDATION SYSTEM USING MACHINE LEARNING CONCEPTS

A. Data Preparation

To facilitate the implementation of a personalized recommendation system, the project's database was structured to store comprehensive user profiles, completed courses, and detailed course information. Each user profile contains information about the courses they have successfully completed, and each course is enriched with relevant features and tags[16].

B. Choosing a Recommendation Algorithm

Considering the diverse nature of educational platforms, the project explored various recommendation algorithms. The selected approach involves a hybrid model, combining collaborative filtering and content-based filtering, leveraging the strengths of both paradigms for improved accuracy[16].

C. Implementing the Machine Learning Model

To train the recommendation model, Python was employed, utilizing the scikit-learn library. The chosen algorithm, a content-based approach, analyzes the content of courses by transforming tags into a TF-IDF (Term Frequency-Inverse Document Frequency) matrix. This matrix is used to calculate the cosine similarity between courses, forming the basis for personalized recommendations. Creating API Endpoints with Node.js and Express.js To seamlessly integrate the recommendation system into the MERN stack, API endpoints were implemented using Node.js and Express.js. These endpoints receive requests from the frontend, initiate the recommendation logic, and return a curated list of recommended courses for a specific user [19][20].

D. Integration with MongoDB

The implementation ensures seamless integration with MongoDB, retrieving user and course data to facilitate the machine learning model's training and recommendation generation.[21][22]

E. Frontend Integration with React

On the frontend, a React component was created to initiate API requests, fetching and dynamically updating the UI with personalized course recommendations for the user.[23] The recommendation feature underwent rigorous testing with sample users, allowing for iterative refinement of the machine learning model and algorithms. User feedback played a crucial role in enhancing the accuracy and effectiveness of the recommendation system[24][25].

VI. CONCLUSION

EdTech represents a ground breaking shift in education, seamlessly integrating AI and ML for personalized learning [9][V-c]. Boasting an instructor-friendly interface, diverse courses, and robust API design, EdTech stands as a beacon for transformative education. The content-based recommendation system, powered by scikit-learn and MongoDB, tailors suggestions to user patterns.[16] Beyond algorithmic excellence [5], EdTech fosters a global community, blending technology, community, and education seamlessly, setting the standard for the future of personalized learning.

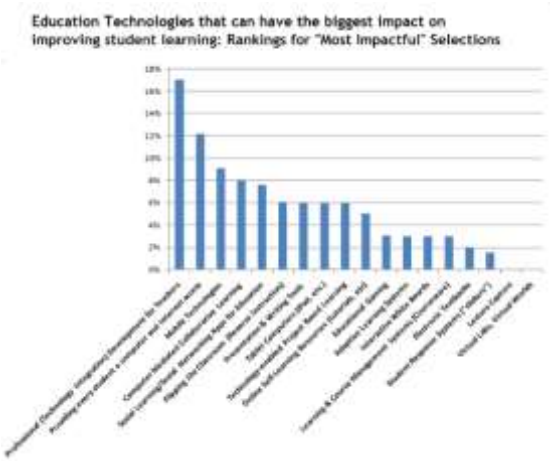

Fig.3.1 (Social Impact on learning)

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