Assess Learning Parameter of Learner and Classification of Course Content in E-learning System

*Santosh Kumar[1], Baldev Singh[2] and Madan Mohan Agarwal[3]

[1,2]Department of Computer Science and Engineering, Vivekananda Global University, Jaipur, India
[3]Department of Computer Science & Engineering, Birla Institute of Technology, Mesra, Off Campus, Jaipur, India
[1]ska.bitjpr@gmail.com, [2]baldev_singh@vgu.ac.in, [3]mmaagarwal@bitmesra.ac.in

Abstract: The enhancement of advanced web-based technologies in the real world has positively flexible and efficiently used e-learning systems. These technologies reduce time and space limitations and provide a convenient learning system for learners/students with different backgrounds, knowledge levels, and goals. However, most adaptive e-learning systems have been developed to solve flexibility problems by providing the same learning materials to all learners. They did not categorize the learners according to their knowledge level. So, it requires a more adaptive, more efficient, and more flexible system that is able to provide the learning course materials, exercises, and remedial according to the problem of individual learners and also conduct the exam that tests the performance of the learners/students after learning the course material. The present paper assesses the learning parameters of learners in adaptive e-learning to create a more adaptive, more efficient, and flexible system capable of providing different levels of learning material according to the learner/student level of knowledge and improving the performance and knowledge of the learner/student.

Keywords: Adaptive E-learning, Intelligent Learning, Learning Parameters, Assess, Course Content

1 Introduction

To gain knowledge anytime and anywhere, learners utilize an online learning environment. E-learning can reach the maximum number of participants by accommodating a diverse range of teaching styles, preferences, and needs. The primary objective of learning is to create e-learning environments that cater to the requirements of these learners. An effective system will be evaluated using a selection algorithm for learning materials that considers each student's unique needs. Therefore, to deliver educational content tailored to the individual necessities and understanding levels of each student, an adaptive e-learning system is currently being developed. Analyzing the aspects of adaptive e-learning, the student and learner process can be characterized by behavioral personal preferences, knowledge of the subject, objectives, qualifications, age, likes, dislikes, and the administration of quizzes/tests. The student model is illus-

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trated in the form of a profile that encompasses personal preferences for machines, allowing for direct processing. Various research methods differ in how they portray the student profile, how they maintain current information on student models, and their techniques for delivering personalized data.

The level of knowledge possessed by users served as the foundation for many adaptation efforts in this field [1]. Additional learner characteristics considered include their background, experience in hyperspace, preferences, and interests [2]. Nonetheless, there was insufficient focus on learning styles and their impact on academic success. Despite their potential as a valuable resource for enhancing individual learning in relation to user features, learning styles have been overlooked [3]. Statistics indicate that students' learning styles play a significant role in enhancing the effectiveness of online education or e-learning, especially considering their educational background [4]. The influence of learning styles and their impact on the achievement of teaching has not been given as much attention. In spite of realty styles of learning are an important method to enhance individual learning characteristics for users [5]. It is important to take into account that the learning style of the students is an important factor in improving the learning performance or e-learning. The use of genetic programming techniques [6] for improving the performance of a rule set is one way to achieve this. Studies have shown that this method is applied in the design of rule based systems [7]. Another approach for student modeling using Bayesian inference networks generates estimates of learner proficiency in relation to the content [8].

According to Vincent and Shepherd, multimedia involved the use of multiple media, i.e. audiovisuals, pictures and textual descriptions [9]. Through our five basic sensory systems, we can sense any information that comes in front of us. Research study regarding “Cognitive Theory of Multimedia Learning” which shows that one can learn well when multimedia tools like pictorial and textual material are used for explanation instead of verbal alone [10]. The use of multimedia will aid in education as the teaching material designed using it are very effective. Students can understand the topic better in less time compared to conventional teaching methods. The efficiency of students can be improved by means of multimedia based learning [11]. Multimedia could be an efficient and effective mean in education. It improves the students’ drive to learn at the same times teachers’ proficiency to teach [12]. Additionally, a significant concern is evaluating how adapting teaching styles influences student achievement. An Adaptive eLearning System utilizing the Fuzzy Clustering Approach has been created [13]. A student model has been established through an analysis of the Weblog to pinpoint the relevant terms on the pages accessed by students. Here, the prediction of student interest for the purpose of delivering learning content from the Semantic Web is achieved through a Fuzzy Clustering Approach and the Statistical K-means clustering technique. Explored adaptive e-learning hypermedia, emphasizing the adaptation mechanism of learning styles, and found that 6 out of 10 systems did not present any qualitative evaluations [14].

To explore the factors that influence the effectiveness of e-learning regarding content, a methodology should be established that tailors it to each student's learning style, allowing for a personalized educational experience. By customizing course materials to align with students' learning styles, adaptive knowledge-based technology has been employed to enhance the learning experience.

2 Design of adaptive intelligent learning and evaluation system

The idea of an adaptive system was first highlighted in 2003. They propose enhancing web-based education systems through the implementation of an Adaptive and Intelligent Web-Based Educational System (AIWBES) as a substitute for conventional systems [15]. The primary goal of the Adaptive Intelligent Learning and Evaluation System (AILES) is to tailor the learning material to the student's knowledge level, preferences, age, educational background, behavior, objectives, plans, likes, and dislikes. Achieving these aims relies heavily on the upkeep of a suitable, efficient, and dependable adaptive Learning Management System (LMS) that accurately represents and updates the characteristics, preferences, and plans of the student/learner. This data is utilized by various components of the system to facilitate adaptability.

The student assessment structures in AILES represent the Domain engine that provides facility of the student to learn the course material according knowledge level. Student first gives the information like name, age, qualification, and subject knowledge which has to be learnt etc. (x1, x2,....,xn). The AILES shown in Fig.1 provides three different levels of course material (basic, moderate, and advanced course) according to learner behavior parameters performance.

This system automatically determines the appropriate course materials for students or learners based on their performance and knowledge levels. The performance and knowledge levels are assessed using a fuzzy-based course material selector (FBCMS). FBCMS relies on three criteria: age (A), qualification (Q), and subject knowledge (S). Age and qualification details are provided directly by the learner during registration, and the system evaluates these parameters to produce a result (R1). Subject knowledge is assessed through an online test comprising multiple-choice questions for specific subjects. The assessment consists of 20 questions, with a total of 60 marks available, where each question is worth three marks. Due to negative marking in the test, one mark is subtracted for each incorrect answer. The score from this test (R2), which reflects subject knowledge (S), is out of a total of 60 marks. Then the performance of behavior parameters (Yk) result of both R1 and R2, the system select the level of course material according to the performance of the student $Yk = R1 + R2$.

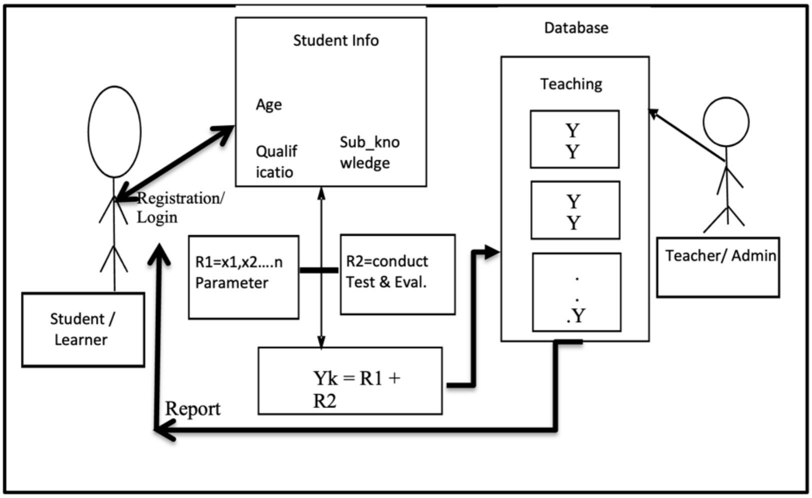

Fig. 1. Adaptive intelligent learning and evaluation system

3 Process of assessing learning parameters of the individual learner

There are several drawbacks to relying solely on behavioral parameters or questionnaires in an adaptive system. The AILES process must be modified to integrate both types of learning parameters while modeling the student or learner system. This process evaluates learning parameters automatically through two stages: (i) examining the learner's preferences regarding behavioral parameters, as well as their subject knowledge, goals, qualifications, age, likes, and dislikes, and (ii) based on the findings from the behavioral parameters, administering quizzes/tests composed of 10 alternate objective questions, each worth 1 mark as illustrated in Fig. 2.

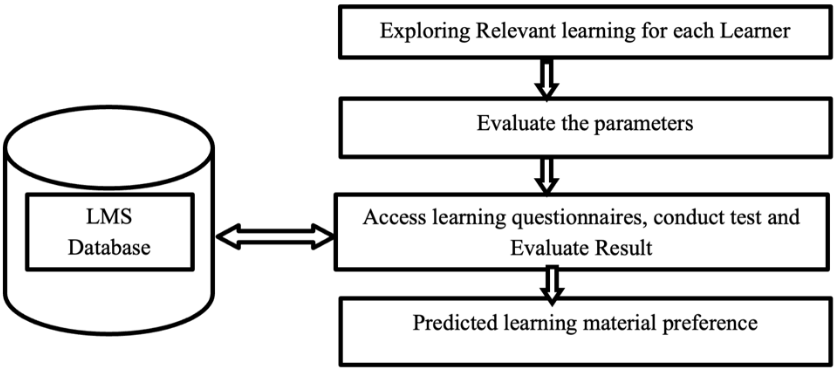

Fig. 2. Automatic Evaluation of learning parameters and learning material preference[[16]

3.1 Explore and evaluate behavior parameters of student

The initial stage of investigating the pertinent behavioral parameters for each learner involves categorizing the alignment of these parameters and specifying the dimension values of the parameters, as illustrated in Fig. 3.

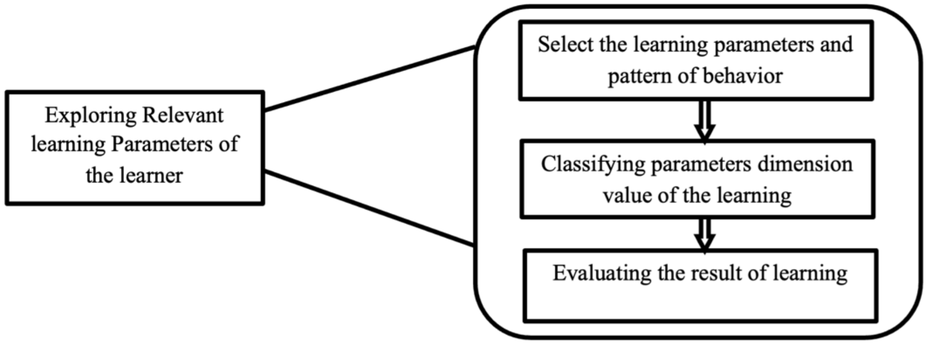

Fig. 3. Exploring and evaluating relevant learning parameters of the learner

Assess Individual Learner Behavior: The student profile comprises factual and behavioral information about a specific learner, such as their name, email-id address, age, academic qualifications, prior knowledge, and course preference. All these factors assess the behavior of each learner**.**

Analyze the Parameters: The LMS database retains this information, subsequently checking and validating these parameters to evaluate the results and determine the next steps.

3.2 Conducting test of the student

The second stage utilizes the outcomes of behavioral parameters. First, it prepares 20 different types of questions, with each question worth 1 mark. The test is then administered and the results are evaluated automatically, with penalties for incorrect answers and unanswered questions. If the score is categorized as below average, average, or above average, appropriate learning materials (including content, examples, and exercises) are provided. These assessments are conducted using a fuzzy system, as illustrated in Fig. 4.

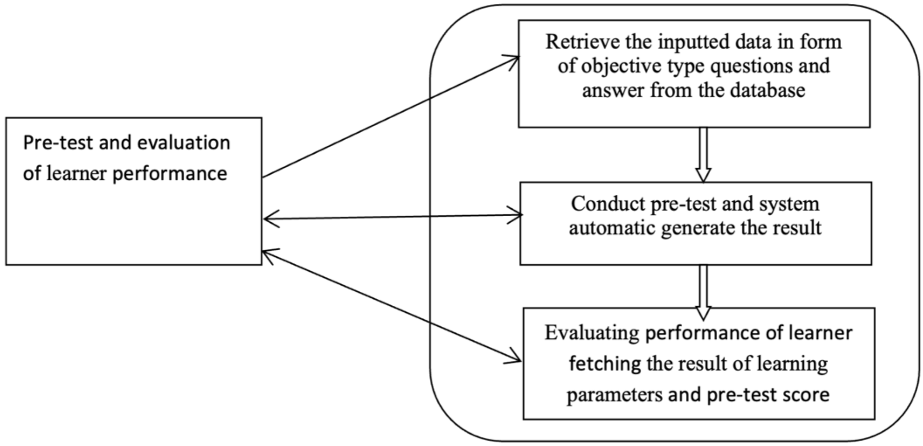

Fig. 4. Conducting Pre Test and evaluate performance of learner

4 Performance Evaluation of the AILES

The AILES system integrates student registration/login, assessment of behavior parameters, a fuzzy-based course material selector (FBCMS), and a tutoring/evaluation module. The AILES process flow is depicted in Fig. 5. Once implemented, this system performs satisfactorily from the registration phase all the way to the completion of courses by the learner. During registration, the learner provides initial details such as name, email address, age, qualifications, and subject knowledge. This information is saved in a database, the design of which is not included here. Following the entry of initial information, the system automatically administers a basic language multiple-choice quiz/test and proceeds with the processes. The system then automatically processes the results.

The learner's behavior performance index (BI) is assessed using fuzzy logic, allowing the system to generate a grade point and predict the types of subject materials that are most appropriate for the learner.

a) if the student performance is below average then system provide basic learning material,

b) If the student performance is average, then the system provides moderate learning material.

c) If the student performance is above average, the system selects advanced learning material.

d) If the individual student result is in the range of 40% points and less than that, then the system will select the basic course material for him/her and will provide basic course material. This will help students learn all basic course contents and then will be able to solve the course exercises. If any query arises, they can provide a remedial and send it to the system. Eg.: The problem z= (a+ b) / (c – d), then submits. This system automatically provides a solution to this problem.

e) After the basic course learning, the conduction of exam will take place and if the student obtains the marks above 40 %, then the next level of course material can be provided by the system; otherwise, they will be instructed to learn the basic course material once again.

f) The same strategy will be used for the students scoring results within the range of greater than 40 % and less than or equal to 70% point. Under this condition, the system will select the moderate course material, and the same will be provided to the student. The students will again attempt to learn all the course content and eventually try to solve the course exercises. If any query arises, they will write the remedial and send it to the system. Eg.: The problem z= (a*b)+(c*d), then submits. This system automatically provides a solution to this problem.

g) After moderate course learning, the exam will be conducted, and if the student obtains marks above 70 %, then the next level of course material can be provided by the system; otherwise, they will be instructed to learn the basic course material once again.

h) After successful completion of these two levels, advanced course material will be given to the students scoring greater than 70% point; then, the system will select the advanced course material for him/her and will provide advanced course material.

i) After the advance course learning, the exam will be conducted, and if the student obtains marks above 75 %, then the subject course is successfully completed. This will help students learn all advanced course contents and then will be able to solve the exercises of the course. If any query arises they can give the remedial and send it to the system.

j) After the completion of that course, students want to again learn the same course on the same subject that time the system repeats the above process, and the system will provide new author course material.

Therefore, effective learning at every level will assist students in easily understanding the learning materials, and the content will also contribute to improving the subject matter as well as preparing for exams that evaluate their knowledge and skills.

For a student named Alisha, a 17-year-old in the 12th grade, the system assessed her subject knowledge through a test. Her results were below average, which led the FBCMS component to choose basic course materials for her selected subject. This illustrates the system's capability to make suitable choices regarding the selection of course materials. Throughout her studies, Alisha asked insightful questions as recorded by the system. She excelled in quizzes, assignments, and final exams, prompting the system to automatically promote her to more challenging course materials. This advancement allowed Alisha to engage with advanced content and successfully complete exercises. When she took the final exam for the advanced course, Alisha received satisfactory results, further confirming the efficacy of the proposed system.

As a result, successful learning at each level aids students in comprehending educational materials. The content was proven useful in enhancing subject knowledge, while exams acted as important tools for assessing students' abilities and understanding.

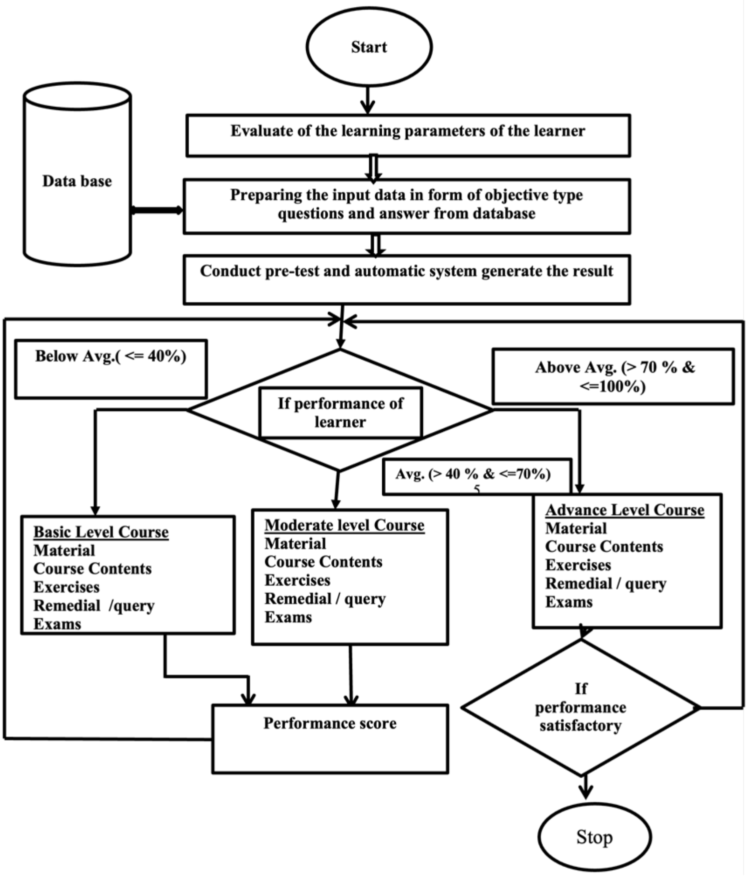

Fig.-5. Course material according to student performance [16]

5 Implementation and result of adaptive intelligent learning and evaluation system

The efficiency of a system is evaluated based on how well it selects learning materials tailored to the specific needs of each learner. The student or learner model is usually depicted through profiles for both the student and the teacher, concentrating primarily on the student, and is designed to capture personal preferences in a format that can be processed by machines. Investigate the learning parameters associated with the student or learner.

The approach to content-driven learning and the retrieval of effective educational experiences personalized to align with students' learning styles can be outlined. The typical process for the Adaptive Intelligent Learning and Evaluation System consists of several essential steps to enable personalized learning experiences and efficient assessment. Below is a structured overview of the process:

5.1 User Registration (Student/Teacher) Home pages

Individuals (students, teacher/ administrators) create an account in the system by supplying essential details such as username, password, email, subject expertise, and type of user. A secure login feature confirms the user's credentials.

5.2 Teacher /expert Login / Registration

Instructors or administrators who are registering for the system for the first time must provide essential details such as their username, password, email address, area of expertise, and type of user. The secure login feature checks the user's credentials for verification. When the user logs in to the system subsequently, they will do so using their login ID and password. In this setup, the administrator is considered a teacher.

5.3 Course and Module Management (Teacher/expert selects the course)

After logging in, teachers (or administrators) develop courses by providing the course name, description, start date, end date, and designating themselves as the instructors, such as for C Programming.
Add/update/Remove Course Content: Teachers then create various levels of modules (Basic, Moderate, and Advanced) within each course, outlining the module name, description, and order in the curriculum. Within these modules, teachers include lessons, detailing the lesson name, content (text, multimedia), and sequence within the module.
Adaptive systems may present varying content levels based on user preferences or learning styles, such as Basic Type, Moderate Level, and Advanced Level course materials. Subsequently, teachers can add new content to the course modules. They also have the ability to update or remove/delete certain lessons or content in the modules.
Assessment Creation and Management (Add/update/remove questions): Teachers can create, modify, or delete questions for assessments (quizzes, exams) using multiple choice questions and answers integrated into the modules. They can define assessment details such as name, type, maximum score, and description. The system adjusts the difficulty level of assessments according to user performance or offers tailored feedback.

5.4 Student/learner registration and leaning parameters evaluation

Learners registering for the first time with the system must provide essential information such as a username, password, email address, background, age, qualifications, knowledge of subjects, and the subjects they wish to study. The secure login feature checks the user's credentials. When they log in again, they use their login ID and password. Students can browse the available courses and enroll in those that align with their educational objectives or curriculum needs. After enrolling in a course, students can investigate the modules, which include reading the titles, descriptions, and objectives of each module.

5.5 Initial Assessment (Conduct preliminary exam of the student)

Students are provided with a preliminary diagnostic assessment to measure their existing knowledge or skill level in relation to the course material. Participants complete a pre-test or initial evaluation to assess their current knowledge or skill level.

Attempt Tracking and Evaluation (Score of the Student Course Awarded
The system independently computes the learner's performance results or scores based on preliminary test evaluations and the learner's behavioral performance. Users take preliminary assessments, with their behavioral performance documented in the system, which records scores, timestamps, and completion status. The assessments are graded automatically, either by educators or the system, and users receive feedback.

5.6 Adaptive Personalization Learning Path Recommendation (Provide Course Material According to Knowledge Level of Student)

According to initial assessment findings and insights into user behaviors (such as background, qualifications, and age), the system proposes a tailored learning pathway, indicating which module level (basic, moderate, or advanced) should be provided by the system.
Learners advance through lessons in the module in either a specified order or according to personalized suggestions. The lessons feature diverse content types, including text, visuals, videos, interactive simulations, or outside resources, accommodating various learning preferences as needed.

5.7 Formative and Summative Assessments and Attempt Tracking and Evaluation (End of Lesion Exam):

Throughout the module, students engage in formative assessments, including quizzes, exercises, mini-tests, discussions, or hands-on activities aimed at enhancing their learning. The system offers immediate feedback on these formative assessments, aiding students in recognizing their strengths as well as areas that require improvement.
Students complete the summative assessment, which measures their overall comprehension and mastery of the module's learning objectives and concepts. Assessment results are logged in the system, with automated grading applied based on the type of assessment. Students receive thorough feedback regarding their performance on the summative assessment, emphasizing their strengths, opportunities for improvement, and recommendations for additional study. Students contemplate their learning experiences, establish personal learning objectives, take feedback into account, and pinpoint strategies for continued development in upcoming modules or courses.

5.8 Progress Monitoring and Reporting (Performance Report)

Learners can track their advancement through courses, modules, and assessments, allowing them to see which lessons they have finished and their assessment results. Educators (and administrators) can view analytics and create reports regarding user performance, the effectiveness of courses, and results from assessments. Learners take assessments, with every attempt logged in the system, detailing scores, timestamps, and completion status. Users get feedback on assessments and their overall progress, helping them pinpoint areas needing improvement. After completing assessments, they are graded automatically or by instructors, and users receive feedback. Depending on user performance and feedback, the system might dynamically modify learning pathways, content delivery, or the difficulty of assessments.

5.9 GO to next level for Continued Learning Path

After finishing the module, students either move on to the next advanced module in the course sequence or investigate other learning module options that align with their academic pathway within the system. The system keeps evolving to meet students' needs and development, taking into account their performance and feedback, which guarantees continuous personalized learning experiences and educational assistance..

5.10 System Maintenance, Updates and User Support services

Consistent upkeep guarantees optimal system performance, ensures security updates, and enhances database efficiency. System updates might introduce new functionalities, adaptive algorithms, or enhancements influenced by user input and advancements in technology. Help desk or support features provide assistance to users facing technical problems or inquiries regarding system operations. Discussion forums, chat platforms, or collaborative tools encourage community involvement among users and educators.

This organized framework details how the Adaptive Intelligent Learning and Evaluation System oversee user interactions, learning materials, assessments, and feedback to maximize educational results and enhance user experience. Modifications and improvements can be implemented based on particular educational objectives, the needs of the target audience, and available technological resources.

6 Conclusions & Future Scope

In summary, creating a framework for adaptive intelligent learning and assessment offers considerable potential for improving the effectiveness and efficiency of online learning platforms. By merging adaptive methodologies with intelligent assessment tools, this framework could tailor learning experiences, enhance educational outcomes, and deliver important feedback to learners, transforming the way people interact with online educational material.

Nevertheless, the process of fully harnessing the advantages of this framework is a work in progress, with several directions for future exploration. Firstly, ongoing research is essential to refine adaptive algorithms to ensure they accurately reflect the subtleties of different learning styles and preferences. Additionally, leveraging new technologies such as machine learning, deep learning, natural language processing, and data analytics, along with incorporating more data sources, could further improve the adaptability and intelligence of e-learning frameworks.

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