# MACHINE LEARNING: ASSISTING MODERN EDUCATION

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## ABSTRACT

Machine learning has impacted nearly every field in today's world and the educational environment hasn't been untouched. Machine learning is the future of education and training environments. When the new brains will be trained by the teacher-machine duo, only then they'll be able to create impactful innovations for a greater cause. This paper explores the ways Online Learning Platforms can be customized for individual students and also support teachers in creating innovative methods for imparting wisdom. These artificial learning models would help educators to make our teaching and learning environment more exciting and challenging and once implemented, would enhance the overall learning of the society. With the help of machine learning, we can fully refine the education system. This customization will consider aptitude, learning speed, background, and response of the student and even help overcome procrastination which is indeed the biggest catalyst to failure of humans in life. The educators will be able to understand and improvise the whole learning environment with the support of AI. The machine learning algorithms would perform analytics over the whole student behavior from understanding concepts, completing lessons, attempting tests, and analysis of their scores. Also to analyze their learning speed, the application would also analyze the students', thinking and interpretation by analyzing typing and explaining speed and accuracy that would also consider voice analysis algorithms. Reducing human intervention in such analytics would help create more time for the students and well the teachers to create and implement new strategies for better results.

Online education technology has a huge cost of development of resources. Deep Learning uses AI to offers customized learning. This paper aims to survey various applications of Deep Learning approaches for the development of resources for an E-Learning platform which include predictions and algorithms for building. Also, the analytics supports the overall development of the application. The deep learning model for developing the contents and the framework for development, future scope, and the important tools that use this technology are reviewed.

**Keywords**: E-Learning, Deep Learning (DL), Learning Management System (LMS), Machine Learning.

## I. INTRODUCTION

Machine Learning is having a tremendous impact on our lives and the way we work. From enabling computers to understand speech to driving our cars, the applications of machine learning are almost endless. But one of the most exciting applications of machine learning is in the field of education. Machine learning is being used to personalize learning, predict student engagement, and assess teacher effectiveness with the help of Artificial Intelligence. Individual student concepts and goals can easily be tracked with the help of machine learning by taking real-time feedback. Based on that feedback, curriculum, topics, and methodology can be improved further. In simple terms, machine learning makes the process automatic for decision- making process and analyzed the individual student data. Overall, the assessment process is made more streamlined, accurate, and unbiased with the help of machine learning. Machine learning is having a tremendous impact on the teaching industry. The teaching industry is adopting new technologies to predict the future of the education system. It is Machine learning which predicts the future nature of the education environment by adapting new advanced intelligent technologies. Machine learning plays an important role in the education industry. Machine learning plays an important role in the education industry.

Machine learning is already transforming a variety of industries, and the impact is beginning to be felt in education. The teaching industry is no exception. Machine learning is revolutionizing the teaching industry by enabling teachers to adapt their teaching to the needs of individual students. This enables teachers to provide better feedback to students, which in turn allows them to learn at their own pace. Customized teaching is an approach to education that focuses on the individual needs and aptitudes of a particular student. It is an

approach to education that takes student background, aptitude, learning style, and past performance into consideration when developing a curriculum. In essence, customized teaching means that the student is the focus of education, not the teacher. The focus on the student is the key to making customized teaching work. Customized learning also considers the individual student background, individual student aptitude, learning speed, and response of each student. This individualized approach to learning provides immediate feedback to the teacher after real-time processing of the data. This way, a teacher can easily recognize when a student is not paying attention and take corrective measures. This will improve student participation and, as a result, the overall results. This technology would surely assist an individual student to understand the concepts as well as set goals. On the contrary, educators or the teachers will be able to track and monitor whether the students are able to digest the concepts. From the feedback of the software, modifications can be made to methodology, curriculum, or topics accordingly by the educators. This would result in more accuracy for individuals. In simple words, machine learning analysis can be performed based on individual student data, making the decision-making process automatic and uniform.

Assessment plays important role in the teaching and learning process. Machine learning applications do assessments and provide scores. The process is analyzed automatically and the feedback provided is unbiased. The feedback is provided to the teacher in real-time, making it easy for them to act upon it. The process is streamlined, producing better results. These assessments are done by machine learning algorithms that are based on the data feed. However, some kind of human intervention might be required and sometimes necessary.

We all know that different students have different learning abilities so the traditional way of dating lessons and the same plan may not be ideal for all students as some students are quick learners while some are not and might struggle and result in failure. To a survey, the students are more interested in learning through visual representations, figures, diagrams rather than text-based study materials. This was not possible with the traditional ways of teaching and learning. As a result, AI and Machine learning came as a boon and found ways to cope with problems and reach a possible solution. Now, the students would not be under pressure and take lessons and assessments at their own pace, which is now the new normal in the covid times. Now the students are not struggling to get passed rather they study and enjoy this method of learning.

Artificial Intelligence applications proved to be a great solution to this situation. Customized and self-paced learning resulted in better learning as the technology assesses the data of students and provides better methods to learn. These applications also determine a better mapping of subjects based on student interest.

Any learning system relies heavily on feedback. One of the most crucial components of teaching is feedback. When we say "feedback," we're referring to 360-degree feedback. It is used to describe both the student and the teacher in this context. Machine learning analyses and offers feedback on student data (grading, interest, score, behavior, and so on). Machine learning also evaluates and provides feedback for teachers based on their data (subject taught, teaching manner, acceptability, and so on). This feedback is beneficial to both parties. Students can receive constructive criticism and act on it to improve their grades. Teachers, on the other hand, can modify their teaching styles to produce a better learning environment. While the teacher now provides feedback to students, machine learning will go far further. It will examine student behavior, replies, and previous data before drawing data-driven conclusions and providing objective feedback. In terms of assessments, it will eliminate the possibility of human prejudice in the feedback process.

Career Prediction is one area where students might become perplexed and make decisions that may not be the best for them. A student's career route is critical to their future success. Frustration and disappointment can ensue if the path is not carefully chosen. In general, a student's career choice is impacted by a variety of factors, including family profession, parents, and neighbors – and, of course, the most profitable employment alternatives. However, the most vital factor is missing: the particular student's interest. AI and machine learning have the potential to play a significant role in this. Student interests, aptitudes, and dislikes can all be tracked using machine learning applications for career path prediction. It examines the behaviors and emotions of students. It can fairly anticipate interest areas in which the learner can excel based on the analysis.

Artificial intelligence and machine learning are transforming the teaching profession. A generic, one-size-fits-all strategy was typical prior to the emergence of AI/machine learning. As a result, students were obliged to try to

adapt their learning style to the class plan rather than vice versa. Educators, on the other hand, were having a difficult time understanding students' needs and feasible answers. As a result, the teaching experience and success rate fell short of expectations. It is getting more focused, accurate, and successful with the introduction of machine learning and AI. Machine learning, if properly utilized, has the potential to transform teaching by relying solely on data. Machine learning will become more efficient and offer better results in the near future.

## Scheduling, Grading, and Organisation

Various Machine Learning for Education ICML (international machine learning conference) workshops have discussed new ML Applications that will be beneficial for the education community:

### 1. Adaptive Learning

It analyzes the student's real-time performance and keeps developing the methods and the curriculum for teaching using that data. The customized approach tries to support the individual's better development.

It suggests new paths the student should take, be it career recommendation systems or learning management systems for students, the suggestions come in handy for a better overall decision.

### 2. Increasing Efficiency

Machine Learning can help in better organization and management of the course contents and curriculum. It helps to divide the tasks according to the student's potential and also helps to analyze the best techniques for training.

It also makes the whole education system streamlined and also enhances the participation of students.

Also reduces the efforts of the task such as by autocompleting the classroom management, time tables and letting the educators be free to make the necessary human contribution which AI can't.

### 3. Learning Analytics

When the teacher can't perform a deep analysis of data to provide proper content to the student for better understanding, Machine learning algorithms may provide millions of pieces of content properly organized for immediate consumption by students for better, easier and quicker understanding.

The learning paths suggested via the analytics provide the benefit of the overall analysis of the world's education and support provide necessary concepts to the students.

### 4. Predictive Analytics

The knowledge of the mindset and the requirements of the students are called Predictive analytics. It provides predictions for the events that might take place in the future. With the analysis of the class tests and other sessional assessments, the student's performance in future exams can be predicted, and also necessary changes in their syllabus and schedule can be made.

Using this approach for Career Path suggestion would prove to be a boon for all students.

As we have seen, many students just on the basis of their class 10th marks tend to choose Sciences as a stream for future and in turn, suffer later in intermediate and graduation.

This accident can be reduced with the help of Predictive analytics as the overall performance of the child from the very beginning of his / her education as well as their behavior and skills can be analyzed to suggest a better career option.

### 5. Personalized Learning

The best education model is the one that evolves with the child's needs. The students will be able to guide their own learning journey. They can learn on their own page and decision how, when and what to learn. They'll be able to determine their strengths and weaknesses in certain subjects and even the kind of teaching methods they are comfortable with. This is going to prove to be a revolution in the education industry.

### 6. Evaluating Assessments

Online MCQ examinations are yet another boon for the education industry. Nowadays almost every coaching/ school/Ed-tech is providing mock tests and practice tests for competitive exams. The various machine learning algorithms calculate various data such as time taken, accuracy, percentile, comparison with topper, and many more criteria using the statistical and mathematical functions of machine learning to provide important analytics to the teachers and the students

**7. Cognitive psychology**

Since, data mining is emerging as a tool to validate the theories that are developed and are going to be developed in the cognitive sciences to improve learning procedures and knowledge retention

## II.     EXISTING PLATFORMS

A digital education venture capitalist Tom Vander Ark has recently shared 8 leading platforms that are using ML for Education. Some of them are-

**1. Analytics and optimization of content:**

Gooru, IBM Watson Content Analytics

**2. Tracking of student's knowledge and recommendation for future steps:**

• 　　　Adaptive learning systems: DreamBox, ALEKS, Reasoning Mind, Knewton

• 　　　Game-based learning: ST Math, Mangahigh

• 　　　Dynamic scheduling matches students that need help with teachers that have time:

**3. New Classroom**s is a platform that uses learning analytics in order to prepare customized classes for Mathematics and technical subjects.

**4. Grading systems** : For assessment of the student's knowledge via online exams in bulk scales.

• 　　　Pearson's WriteToLearn and Turnitin's Lightside can score essays and detect plagiarism.

**5. Tools to analyze** huge unstructured and structured data and also visualize the workflows to find new opportunities:

• 　　　Bright Bytes Clarity reviews research and best practices, creates evidence-based frameworks, and also provides a strength gap analysis.

• 　　　**Enterprise Resource Planning (ERP) systems** like Jenzabar and IBM SPSS help HigherEd institutions predict enrollment, improve financial aid, boost retention, and enhance campus security.

**6. Matching teachers and schools:**

• 　　　MyEdMatch And Teacher Match are eHarmony for schools.

**7. Predictive analytics and data mining** to learn from expertise to:

• 　　　Map patterns of expert teachers.

• 　　　Improve learning, retention, and application.

**8**. **Lots of back-office** stuff:

• 　　　EDULOG does school bus scheduling.

• 　　　Evolution, Diet Master.

**3 Popular Examples of AI & ML in the EdTech Industry**

**Duolingo**

Duolingo was founded in Pittsburg and is a language learning app that uses AI and ML algorithms in order to enhance its language teaching procedure. It currently has over 300 Million active users all over the world.

It uses AI and deep learning algorithms to develop various statistical models based on the user's learning capacity and capability and retain words of a new language. It also analyzes the user's data and gets a personalized language learning experience using ML.

**Coursera**

(founded in 2012) is an AI application that is connected and collaborates with many educational institutions to provide online certification courses, degrees, and diplomas in numerous fields. It is ideal for blended learning which is also called self-paced learning.

It is flexible for the students' diverse learning needs. It has various features such as mobile notes, reminders, transcripts, on-demand video lectures, etc.

**Brainly**

Brainly was founded in 2009, it offers a peer-to-peer platform for learning which is ideal for doubt solving under numerous subjects and topics. The app had around 350 million users in the month of November 2020.

**Deep Learning**

Deep learning process the data from low to a high level and composes increasing semantic concepts, in order to simulate the hierarchical structure of the human brain.

With the usage of deep learning algorithms, AI has done various huge breakthrough projects such as Face Recognition, Image processing, speech recognition, and many more.

**e-Learning**

is a distance education information delivery method that allows the exchange of various educational resources over the network. It is a system that revolves around teaching and learning which also has communication and collaboration support among trainers and students. Distance learning/ Digital Learning is called e-Learning as it is intended to be totally remote.

**Review**

Nowadays it has become a necessity for an educational institute to own course management software and create digital content for online education.

Some examples of these course management software are

1.      Blackboard
2.      LMS
3.      WebCT
4.      Moodle

And many more, are used to complement the more missed traditional modes of teaching. The incorporation of the technology Web 2.0 and further Web3.0 in the learning process is complex but at the same time, it is also going to shift learning and training. eLearning has now become eLearning 2.0 as it now has various training materials like podcasts, weblogs, wikis, and other web sharing technologies

We have seen a difference between the traditional model of machine learning and the deep learning algorithms in the engineering of the features which requires and expertise and is also a time-consuming process.( Fig.1)

In the traditional model of machine learning the features had to be e-manual created whereas in deep learning the features are automatically evolving. the neural networks are combined in many layers which is is a very powerful form of computing as it learns from very complicated data patterns which is of large amount. to handle Complex data deep learning uses an extended version of the classical neural networks (Fig.2.) therefore it uses more hidden layers which support the algorithms to handle various different it and complex types of data.
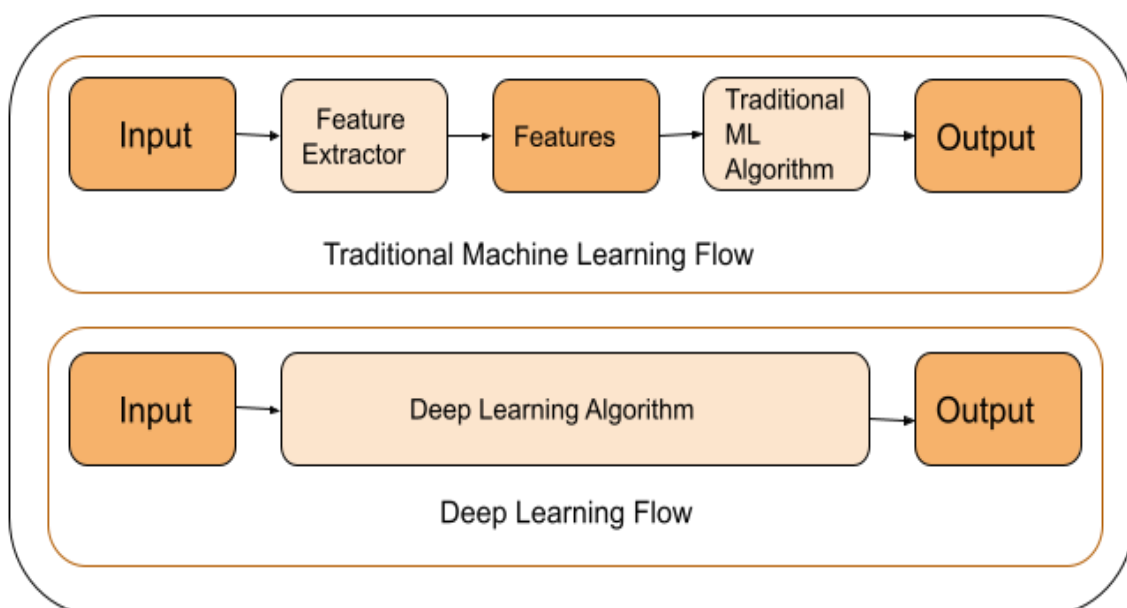


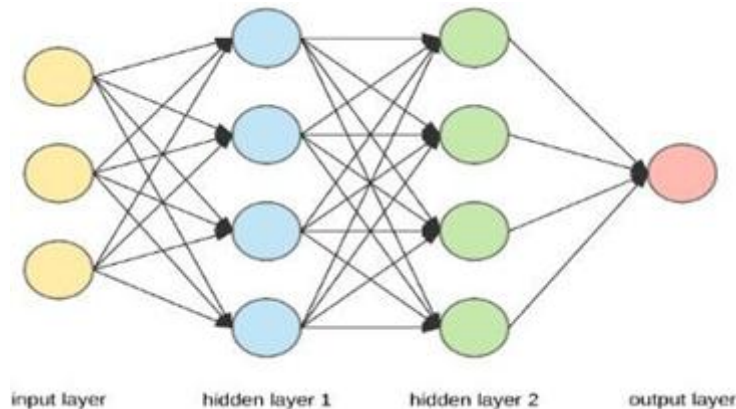**Fig 1:** Machine learning vs. Deep Learning

**Fig 2:** Deep learning with two hidden layers.

There are four algorithms in deep learning that help the system to predict future outcomes and also detect the patterns based on the user data

**1. Supervised learning algorithm:**

In supervised learning algorithms new data sets and past examples are used for the prediction of future outcomes. the system starts working on provided inputs to train the software to give outputs and afterward the system starts to generate outcomes on a similar pattern.

**2. Unsupervised learning algorithms:**

Any data classification or labels are not used for unsupervised learning algorithms the inferences for predictions are made by the system by evaluating the data itself

**3. Semi-supervised learning algorithm:**

Human-based training is combined with unlabeled data with the use of the provided online resources for mapping out inputs and outputs with greater accuracy is called semi-supervised learning algorithm

**4. Reinforcement learning algorithm:**

Reinforcement signals are given as feedback to the computer which Learns the desired behaviors required. here a specific task or a goal is assigned to the system and the signals teach the system to complete the task.

**Application of Deep Learning for eLearning**

1. **Personalized learning path:** It is a student-centered approach that monitors the goals and objectives of the student and does match their preferences for mapping the courses. progressive knowledge building is done via A sequence of courses and study material provided by the educator. It provides features on how to dynamically change the contents totally based on the learner's capability, demographic information, knowledge level, progress, and interest in the subject. The backend consists of models to identify and collect variables for the personalization of individuals

2. **Chatbots:** Chatbots are virtual assistants that have a huge knowledge base through which they serve solutions to numerous questions which can be used as an intelligent teaching system for students as students would get very closely personalized assistance on each of their doubts which is quite difficult to achieve in physical systems.

3. **Performance indicator:** a student requires continuous assessment of his learning in order to test his knowledge hence an effective way to analyze this can be done via deep learning. With the help of performance indicators outputs an additional support system can be created for the students who are failing in a particular subject.

4. **Virtual teaching assistants:** These are online classes that will answer the repeated question of the students which are present in their knowledge base in different contexts.

**Deep Learning Framework for eLearning**

There are various kinds of information.

•     Sequences

- Association
- Classifications
- Clusters
- Prediction

Similarly, the deep learning model's overall goal is to deliver powerful answers to problems including relationships, classifications, clustering, and predictions. Deep learning models that are often utilized in eLearning applications include

**• CNN (convolutional neural network):** Conceived and utilized CNN as a method for high-dimensional image processing for the first time. It is made up of convolutional filters that convert 2D to 3D.

**• Recurrent neural network (RNN):** A recurrent neural network (RNN) is a neural net architecture with recurrent connections between hidden states that can learn sequences and simulate time dependencies. The recurrent connections are utilized to detect relationships across time as well as between inputs. As a result, it is well suited to health problems that frequently need modeling changes in clinical data over time [41].

**• Deep belief network (DBN):** This model has two layers on top of layers with a unidirectional connection. Each sub-hidden network's layers serve as a visible layer for the next layer.

**• Deep neural network (DNN):** This type of neural network contains more than two layers, allowing for complex non-linear relationships.

Deep learning models can contribute to the development of eLearning by incorporating:

• Using existing learning materials, creating a tailored learning path, and content classification based on the learner's interests.

• Historical data on learners to anticipate their success and create a course map for each one.

• In the eLearning environment, learners' facial expressions can be used to forecast their moods.

• The mentor's abilities and experience in facilitating peer-to-peer interactions with the students.

• For example, information in the form of a video, an infographic, a text file including the video transcript, and a chat-based quiz with feedback.

Table 1 outlines contemporary deep learning applications in eLearning, as well as the technical benefits and drawbacks of each deep learning model.

**Table 1:** Deep Learning Models Summary in eLearning

| Model | Recent Applications in eLearning | Advantages | Limitations |
|---|---|---|---|
| CNN | Predict the learning resources' hidden variables. Detecting kids' moods via their facial expressions | For 2D data, they deliver excellent results. | It is quick to learn a model. Classification requires a large amount of labeled data. |
| RNN | Prediction of student feedback with Kinect Learning how to model temporal dependencies and gain new knowledge of sequential events. | Deliver high accuracy in speech and character recognition, as well as other NLP-related tasks. Large datasets are required. | Because the gradient diminishing, it has a lot of complications. |
| DBN | Natural language understanding, Large-vocabulary speech recognition | Both the supervised and unsupervised learning models are supported. | The training procedure is computationally intensive because of the initialization process. |
| DNN | In distance learning, visual representational transformations are used. | Widely used and extremely accurate. | Because the error propagates back to the previous layers and gets |

| | | | very small, the training procedure is not simple. |
|---|---|---|---|

The learning process is also too slow, as digital learners want knowledge to be available in numerous formats. As a result, many eLearning developments are "repurposing" existing resources and employing a "plus-one" design. A developer should concentrate on the track where the notion is mentioned and defined, then find the content to reuse. A deep learning technology, on the other hand, can swiftly discover and locate appropriate resources, allowing the developer to reuse content more quickly. This method can be automated to improve the consistency of learning resources and facilities across platforms while also saving time in the creation

### 4. Deep Learning Tools for eLearning Platform Development

Table 2 demonstrates the deep learning technologies and platforms used in eLearning applications. Due to the availability of commercial DL tools and components, eLearning creators can now purchase or license algorithms rather than spending the time and money to design their own.

**Table 2:** Deep Learning Tools and Platforms in eLearning Applications

| Tools & Platforms | Features |
|---|---|
| AIaaS (AI as a Service) | For the creation of eLearning, cloud-based AI tools and algorithms |
| Microsoft Azure | Image recognition and bot-based apps are examples of cloud-based AI applications. |
| IBM's Watson | Watson-compatible cloud-based AI services |
| Amazon Web Services | Amazon's AI services are hosted on the cloud. |
| Google's Tensorflow | Data flow graphs are used to build models in this open-source artificial intelligence framework, which allows developers to create large-scale neural networks with many layers. |
| MXNet | An open-source software library that supports DL architectures and uses data flow graphs for numerical computation. CNN and RNN are two types of neural networks. |
| Caffe S | C++, Matlab, and Python programming interfaces are supported across platforms. |
| Apache Singa [6] | Open source library for deep learning |
| Theano | Provides features such as a symbolic API that provides looping control (scan), making RNN implementation simple and efficient. |
| Deeplearning4j [15] | A distributed neural network library in Java and Scala that is open-source and released under the Apache 2.0 license. |
| ConvNet [13] | Convolutional neural network toolbox based on Matlab. |
| Keras | Theano based deep learning library. |

When employing deep learning in eLearning creation, it's important to pick the right platform because each

platform has its own set of strengths and disadvantages. It also depends on the developers' and learners' needs, as well as the developers' technical skills in combining various tools and services to produce deep learning enhanced eLearning products.

## III. CONCLUSION

Students are the future of a country. A child's brain is like clay, moulding it with the right methods can help create wonders for mankind and even the whole universe. The post-pandemic child is built differently and so have to be their educational technologies. The teaching industry is continuously evolving. As all the industries are being backed up by Artificial Intelligence, so is the Teaching industry. Machine learning has impacted nearly every field in today's world and the educational environment hasn't been untouched. Machine learning is the future of education and training environments. When the new brains will be trained by the teacher-machine duo, only then they'll be able to create impactful innovations for a greater cause. This paper explores the ways Online Learning Platforms can be customized for individual students and also support teachers in creating innovative methods for imparting wisdom. Also, give a child guidance on career choices and keep a check on their whole brain function through sentiment analysis techniques and provide also keep procrastination tracking and prevention. These methods would provide real-time data to both the teacher and the student and recognize the areas they both lack. Based on these results, the system would automatically evolve according to requirements. The unbiased and accurate information via the use of machine learning will prove to be a more effective and efficient approach for better education.

Finally, these artificial learning models would help educators to make our teaching and learning environment more exciting and challenging and once implemented, would enhance the overall learning of the society. With the help of machine learning, we can fully refine the education system. We need an environment that fits all and changes itself according to the needs. This customisation will consider aptitude, learning speed, background and response of the student and even help overcome procrastination which is indeed the biggest catalyst to failure of humans in life.

On the contrary, the educators will be able to understand and improvise the whole learning environment with the support of AI. The machine learning algorithms would perform analytics over the whole student behavior from understanding concepts, completing lessons, attempting tests, and analysis of their scores. Also to analyze their learning speed, the application would also analyze the students', thinking and interpretation by analyzing typing and explaining speed and accuracy that would also consider voice analysis algorithms. Reducing human intervention in such analytics would help create more time for the students and well the teachers to create and implement new strategies for better results.

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