

# Fuzzy Logic A Soft Computing Approach For E-Learning: A Qualitative Review

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**Abstract:** E-learning model has been developed rapidly because of development in technology, mobile platform such as smart phone and pad etc. But due to low rate of completion of e-learning platform it is necessary to analyze behavior characteristics of online learners which enhance the quality of learning. This can be achieved by recommending suitable e-contents available in learning servers that are based on learning style, learning pattern, time, environment, psychology and mood of learners. All these factors are uncertain. In such case fuzzy logic and neural network approach of soft computing is desirable to use and helps to take decision for prediction of e-learning. The aim of this paper is to study development and work in e-learning, adaptive learning and web-based learning globally. Also study for to develop reliable and efficient solution for e-learners and e-content provider. This paper represent studies of learning style prediction, learning style model, learning system and analysis of related work in e-learning and web environments. This is review of previous research in e-learning prediction.

**Key Words:** E-learning, Fuzzy Logic, FIS, Neural network

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## I. INTRODUCTION:

India's education system is it primary, secondary or high level – is fraught with the quality and quantity challenges. There is shortage of quality teachers, an enabling environment for student and infrastructure. There is sudden increase in number of student at all level and demand for quality education. At the same time demands from industry for skilled human resource. But this demand of quality education and trained personnel will not be easy to quench, because it takes time, fund and quality resource to set up good institutions. In such scenario on-line education could be boon for those.

During 21 st century there is rapid development in e-learning education. The e-learning user scale shows growth of e-learning in developing countries.(show table). MOOC (Massive open online courses) is a representative online education platform [1]. The largest MOOC platform in world is Course-era established by USA top universities, Institutes such as IIT, IIM and even globally to start these courses. Along with traditional books, blogs, tweets, podcasts, webcasts, online chats, discussion boards, virtual study ensures learning becomes multidimensional. Online education helps all those who are new, already in job to re-skill and remain competitive. Woman and less educated and poor also get benefited in low cost. Number of Chinese e-learning users reached beyond 100 million in 2017 with annual growth rate is 56%. E-learning market in India is also growing and estimated around \$3 billion with 1 million users. India ties with China as its biggest source of online learners [25].

According to financial express survey India's online education market size is set to grow \$40 billion in 2017 from \$20 billion in 2014. India has one of the largest education systems in the world with network of more than 1 million schools and 18000 higher education institute. More than half of the population falls in target market and related services.

Even though more people are concerned about e-learning platform, there are only 7% to 9% learners who complete MOOC. Hence it is quite important and very necessary to improve the learning quality and optimize the teaching mechanism to run the course accurately. Many researchers adapted various learning, teaching models, student models, use various methods for prediction of learning, use different parameter and developed new algorithm for the improvement of e-learning. They also studies student profile, behavior of online learners, personalized and individualized learning requirement, psychology and mood of learners.

This complete background history of online learning indicates the need of better solution for e-learning which overcomes the loopholes of previous methods of e-learning for better efficiency of the work, This paper gives the study of different learning models, learning styles of particulars, enormous techniques and instruments such as questionnaires, interviews and disclosure of profile information. All these factors help to predict the learning style of the learners for learning in any kind of environment. Various dimensions provide learning style models and learning theory which are correlated.

Basic e-learning frame work consists of features which are related to user and embedded over e-content. Information from e-content can be exchanged between user and repositories using user interface as shown in fig 1.

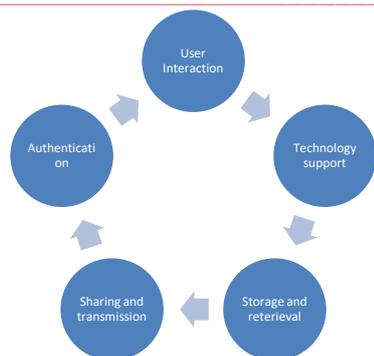


Fig. 1 Basic e-learning framework

#### A. Advantages and Disadvantages of e-learning:

##### Advantages:

E-learning brings unique advantages, the prominent being the ability to provide personalized attention to all students.

People can get access to the best learning resources at very affordable prize.

##### Disadvantages:

The best trainer will sit and talk to student and engage with them to find out what they need to know and how they need to learn it.

Student feedback is highly valuable however that's far less possible with e-learning course.

## II. RELATED WORK:

The learning style is differing for the same individuals based on factors like mood, time, course content and environment. Author Beragasa-Suso et. al. (2005) recommended that objectives of learning style prediction are to assist the learners on the appropriate e-content available at e-learning servers. This system focuses on analyzing performance rather than learning activities. Wilges et.al. (2012) in "Integration of BDI agent with fuzzy logic in virtual Learning Environment" developed a system. They use fuzzy logic for learning system which is able to adapt learning mode to deal with uncertainties and changing conditions to get high accuracy.

Garcia Valverde et.al. (2012) uses fuzzy logic based system to suit e-learning environment for personalized learning. In this system adaptive nature of learner for facility to deliver individual knowledge to learners. Almohmmadi and Hagrus (2013) propose learning architecture which focuses on methodological approach based on fuzzy logic. This approach helps to select the optimum instructional style for designing specific e-learning system.

Elhag and Ahemad (2013) developed an Expert system based on fuzzy logic and Interference for e-learning environment. The objectives of this proposal are evolution of system rather than the learning system. Kakoty et. al. (2012) reports for achieving those results by exploiting an ontological representation of learning environment. By collecting multi agent which analyze learning preference and generate high quality learning presentation simultaneously.

Several learning style assessment models and techniques studied by Swati Choudhari and Manoj Patil (2014). In their research they consider the learner's online

activity information and some well known learning style prediction through browser based system. Sanders and Bergasa – Susa (2010) developed new intelligent system and which would be developed new intelligent system and which would be evaluated and tested for e-learning environment.

L.Jagatha Deborah et.al. (2015) proposed learning style prediction using fuzzy logic and web interface information. They identifies Felder Silverman learning style model for learning style prediction specially for web environment. They propose to use fuzzy rules to handle uncertainty in learning style prediction. The fuzzy interface engine used rule base for accurately categorization of learners' even incomplete information. The proposed work does not consider all dimension of Felder Silverman learning style model but use only limited dimension with limited participants.

Konstantina Crysafiadi and Maria Virvou (2015) proposed a novel approach to web based education which performs individualized instruction on domain of programming language. The operation is based on fuzzy cognitive map (FCM), which helps to show dependences among the domain concept. The model uses fuzzy set to represent student knowledge level as subset of the domain knowledge. Because of this the system provides individualized adaptive advice. This approach can be used in other application such as e-shop, e-payment etc. to provide adaptively and personalization in addition to educational application. In this proposed work knowledge levels of two related domain concepts is bidirectional and affecting the knowledge level of both prerequisite domain concept. The uncertainty of student knowledge is deal with fuzzy logic.

Jili C et. al. (2009) used a technique of fuzzy clustering to analyze the behavior of students in e-learning and made student models from fuzzy logic. Servarac (2006) proposed a system that enables the classification of students based on their characteristics. Alves et.al. (2008) used fuzzy logic to adapt e-learning content and context according to individual need and learning style of student [12] – [14].

How the knowledge of domain affect the performance of student's learning style is studied by Kavcic (2004). In his proposed work he adapted fuzzy logic mechanism in the overlay user model. This model determines knowledge level of domain concept affected by change in knowledge level of another concept [15]. The knowledge level of domain concept increases as student performance improves and poor performance of student should lead to decrease of knowledge level of domain. This is the reason for generating hybrid student model, fuzzy logic model.

Kunliang et.al. (2017) analyzed the relation indicators of e-learning to build student profile. They design the system model to clean and dig into educational data; student's learning attitude, behavior and duration. This helps learning platform to meet and guide the student behavior deeply and to provide personalized learning and promote optimize e-learning.

Ashwani Kharola, Swarnima Kunwar and Gopa Choudhary (2015) used a stage wise fuzzy reasoning approach for eliminating issues of rule expansion. The advantage of weight age allocation of fuzzy approach is given by comparison between fuzzy and traditional average technique. Fuzzy logic toolbox in Matlab – Simulink helps for modeling and simulation. This proposed model can be further modified and used for performance evaluation of employees, faculty etc [16].

A fuzzy logic based recommender agent framework is used to give further suggestions to learner to increase his/her satisfaction and provide enhanced and personalized learning experience. This approach is proposed by Himanshu Pandye and V.K.Singh (2015). For that they used Mat Lab to simulate recommender agent. The research subject of Birol Ciloglulugil is study of learning styles based on adaptive e-learning system. The findings of his study reveal that there are two main research fields: Automatic classification of learners by learning styles and application of learning style model to provide adaptive learning [17].

R. Sarasu and K.K. Thyagarajan(2015) proposed a work to provide materials to student by assigning teachers model using ANFIS (Adaptive Network based Fuzzy Interface System). In this, work material is provided to teachers according to knowledge level of student. This e-learning material for subject are retrieved and stored in ontology base and which is achieved by ontology construction, fuzzy interface system and ANFIS. The neural network in ANFIS is trained to identify knowledge level of student. Different material is provided based upon learners need again and again to train the student and improves the use of e-learning system [19].

### III. RESULT AND CONCLUSION:

The goal of this paper is to study various learning model and learning style in e-learning developed by many researchers. To promote adaptivity and personalization in e-learning various soft computing tools are used by different researchers. Fuzzy Logic, Neural Network, Fuzzy Cognitive Map, Fuzzy Interface System, Genetic Algorithm and Expert System etc. make e-learning intelligent, effective and efficient in all respect in all direction. The study shows fuzzy logic is the best tool for prediction in learning especially when there is uncertainty in e-content. This e-content is based on input factors such as learning style, learning pattern, learning mood, psychology, time duration, environment etc, which are differ for different student and even same student also. In such circumstance fuzzy logic based e-learning and fuzzy base rules helps to find optimize and efficient solution for learning prediction.

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