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ICT-based Learner-Centric Evolutionary Learning Model: An effective solution to Teaching-Learning process

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Abstract. In India around in the second week of March 2020, in order to avoid spread of COVID-19 virus, the Central Governments have declared LOCKDOWN in the country. It results in temporary shutdown of schools and colleges. By looking around, at severity of situation due to spread of the novel corona virus, there is no certainty when schools and colleges will reopen. This is a crucial time for the education field, including board tests, kindergarten admissions, entry tests of various universities and competitive exams. It has greater impact on Education field. It has affected continuous teaching-learning process, student counselling operation, assessment methods of teachers, students' interest towards higher studies in abroad got lower. Information Communication Technology (ICT) may play important role in the lockdown period by providing online learning platforms. Its need in education is discussed in this paper. With the help of power supply, basic digital skills to teachers and students and internet connectivity digital learning can be made possible. Similarly, students those are from low-income groups or presence of disability, etc. for them distance learning program can be included. To mitigate such hazardous situations, ICT-based learning model is essential. In this paper, ICT-based Learner-Centric Blended Education Model is proposed which blends traditional classroom teaching with e-learning where students and teachers both are active, students can interact with teachers; also, teachers can monitor progress of students, etc. After surveying different research papers on Education Models, it has been observed that in learning based on ICT, the Learner-centric environment need to be implemented. In online platform instructors provide course material to students but personalization of these materials is missing. The proposed work presented an ICT-based Learner-Centric Evolutionary Learning Model which suggests appropriate course material to learner, according to learner's profile built by our profile builder module which includes details like learning style, demographic details, recommendations, expectations, likes and dislikes. Our proposed work presented is seamless integration of traditional teaching-learning methods with online teaching-learning methods. The equal importance to teachers is given here to design and recommend study material to different types of learners, their preference is



at highest priority in proposed recommendation model. Active engagement of students in learning process increases education graph using technologies and finally it will be helpful in development of our country.

1. Introduction

In India, COVID-19 outbreak affected the structure of education and learning, including teaching and evaluation methods. Only a few private schools and some universities were able to use methods of teaching online. On the other hand, their low-income private and public-school counterparts have shut down completely because their e-learning solutions do not exist. Similarly, there are many students from India who do higher studies abroad. The countries which are affected with such situations are not allowing students to leave these countries. Where the situation persists, the demand for international higher education is expected to decrease over the long term. To manage such crisis, immediate action to ensure continuity of education in schools and universities is vital. Open-source digital learning solutions and software for learning management should be adopted to enable teachers to teach online. Some private schools and colleges started using ICT tools to continue teaching learning process. Still there are issues in Government schools and colleges which are in rural area which could not use these technology-driven tools due to lack of knowledge about technologies, infrastructure and funds. But, with rapid increase in mobile internet users, it will be easy to access and personalize education even in the most remote parts of the country. This can alter the education system and make teaching-learning more effective and give students and teachers a wide range of options. It indicates there is need of Innovative mobile learning models for efficient education delivery. It is also important, through the seamless integration of classroom learning in e-learning modes, to reconsider current delivery and pedagogic methods for higher education and schools to build a unified education system. Different Quality assurance mechanisms and quality standards for online learning need to be established. In this time of crisis, the capacity-building of young minds needs a well-rounded and effective educational practice. It will increase its skilled workforce, productivity, health and well-being in the coming decades and will ensure the progress in India as a whole.

We can't ignore the fact that technology plays a key role in the education system and only this is the demand for the current situation. Study of importance of Information Communication Technology in education shown that there are various E-learning platforms available in which learner's are active, but current situation demands both students and teachers must be active, which will give feel of traditional learning in online mode. After analysing various challenges faced in education field by our country an ICT-based Blended Education Model is proposed, in which with basic training of computers students and faculties can be active in teaching-learning process even with mobile internet. Through this model a teacher can monitor student progress, can interact with them through discussion

forums, chats, conduct interactive lectures through video streaming, etc. There are number of models present to deliver online education but, in these models,, teacher share same study material to all students without understanding learning style of students. It leads to delivery of content but not quality education which can build quality learners. In order to overcome such issues, in this paper an ICT-based Learner-Centric Evolutionary Learning Model is proposed. Using AI technologies, this model suggests most suitable course materials to Learner by considering Learner's profile which includes learner's learning style, demand, recommendation, reviews; instructor's suggestions, feedback; peer learners reviews and social media users related to domain. Its advantageous feature is increase in active engagement of students in learning process, motivations towards learning new things, also with encourages them to gain and share knowledge across the world. With proposed work it is possible to accomplish Quality Education. It results in development of students, development in Education field ultimately development of India with the help of technology-driven education.

The organization of paper is - section-I discusses ICT, its need in education, various challenges using ICT in education. Section-II discusses existing research work related to ICT in education. Section III elaborates the proposed work. Section IV demonstrates mathematical model of Multi Feature Decision Support System and finally in Section V concluding remarks on proposed work are given.

1.1 Information Communication Technology (ICT)

The Information and Communication Technologies or ICTs is a set of electronic technologies that are versatile, adaptable, enabling and capable of transforming organizations and redefining social relationships when converged into new configurations(Karampa and Paraskeva, 2020). The technological spectrum is increasingly growing and there is a fusion of emerging innovations and traditional media. There is no definitive evidence to prove that learner's performance is superior by using ICTs in the education space, either in developed countries or in developing ones. There is, however, a general opinion among professionals and scholars that introduction of ICTs into education has overall a significant effect on the learning environment. ICTs have the capacity to develop, improve, enrich and expand talents, inspire and educate pupils, help connect school knowledge to job activities, build economic prosperity for tomorrow's staff and enhance teaching learning process(Rico-Bautista, Medina-Cárdenas and Guerrero, 2019).

ICT as a teaching and learning medium refers to the resource itself for training and learning purposes. More than three decades ago, educators were exposed to computers and associated information technology for the purpose of direct teaching and learning. It began with CAL / CBT / CAI, then switched to Digital courseware and finally to Web based technologies and Computer Mediated Communication (CMC) framework(Bhatt, 2008). Using CAI for basic skills drilling and practicing can be highly successful, based on a broad data collection and a long history of use. In

classes that use computer-assisted teaching, students typically learn more, and learn faster. This has been shown to be the case in all subject fields, from pre-school to higher education, as well as in normal and special education schools. Efficient teaching includes knowledge delivery, instructor feedback, preparation and student learning assessment. Computer-assisted guidance may be called the use of a computer to have some mixture of these variables. It should be remembered that there is no necessity for all those elements to be supported by the machine. Instead, any variation of these in the learning phase could be sufficient machine interference. The cornerstone of these systems is interactivity, accessibility and learner power. The application of instructional technology to teaching has progressed beyond the use of simple drill and practice applications, and now involves the use of interactive digital devices and sophisticated networking. Students now use technology to interactively study and collaborate on class assignments. They use the Internet for analysis, for project participation, and for correspondence. The new innovations make it possible for students to have more influence of their own learning, to think analytically and objectively and to work together. An growing body of research shows that ICT incorporation of teaching and learning has beneficial results (Twinomurinzi, 2012) (Chukwunonso and Oguike, 2013).

1.2 What is need of ICT in Education?

Information and communication technology are defined as all applications, platforms, content, data, networks and services, digital and those that can be translated into or distributed by digital forms that can be implemented to achieve learning goals, improve access to resources, create capacity, and manage the education system. This will also include systems for digitizing, delivering and maintaining content, designing and implementing capacity building technologies and systems, and providing connectivity. ICT has become an integral part of daily life and all industries, from banking to tourism, now depend heavily on ICT for their transactions. In the year 2005 (On and Practice, 2014) National Curriculum Framework has underscored the value of ICT in education. Many issues were raised that time such as why ICT is needed in education, without computers also learning process was possible then is implementation of ICT in education actually needed? The answer to such questions is the change is important because this is the age of knowledge and technology, an age that requires teachers to promote this knowledge collection and not just teaching ('ICT needs and trends in engineering education', 2015).

In India, initially when ICT was introduced in education, it had introduced only use of computers and internet in India. How to use ICT in education was not properly discussed. But only use of computers is not sufficient to improve quality of education unless teachers understand the need for ICT and explain to students. Many teachers refuse to the ICT plunge, they have traditional concept

that students can't learn anything without the teacher demonstrating or intervening. But there is need to make realization that students often have their own ideas and experiences this they have learned from daily life; teachers don't acknowledge or use this experience and ideas. This can be done in a major way through ICT. Teachers need to be prepared to promote the learning process, make the experience real, realistic, demanding, and enjoyable and not intimidating. It's incredibly necessary to raising teacher talk and promotes student conversation. There is no need to write anything on the blackboard to be regarded as teachable. The teachers need to realize that knowledge is not difficult to obtain in the 21st century, but it is important skills to coordinate, communicate, and collaborate. So ICT is not just about representing knowledge, it is about communicating, exchanging, and thus learning. ICT offers significant, consuming media that increase the efficiency of teaching-learning. ICTs are a potentially effective resource for expanding educational opportunity, both formal and non-formal, to scattered and remote communities, culturally or socially disadvantaged groups such as ethnic minorities, girls and mothers, people with disabilities and the elderly.

One trait of ICTs is their potential to overcome time and space. Its available anytime anywhere. Online course materials are available to learners 24X7. It removes the requirement for both learners and teachers to be in one physical location. In addition, with Web-based tools like video conferencing the knowledge can be shared with learners that are geo-geographically distributed across the world. ICTs also promote exposure around the globe to qualified users-advisors, consultants, scholars, educators, industry executives, and peers(Jain *et al.*, 2018).

Currently, we are in the era of technology. Thus, one of the most beneficial reasons for using ICTs in the classroom was to better prepare the new generation of students for a workforce where ICTs, particularly computers, the Internet and similar technology, are becoming increasingly omnipresent. Therefore, technical literacy is seen as a strategic advantage in a rapidly globalizing job market. ICT not only develops technical literacy but supports creative thought, higher-order thought and clear reasoning, successful communication(Sinclair and Kalvala, 2015). ICTs' ability to facilitate the learning of these skills is tied to its use as a resource to improve the quality of education, particularly facilitating the move to a learner-centred environment. ICTs can improve the quality of education in a variety of ways: by increasing learner enthusiasm and commitment, by promoting the learning of basic skills, and by improving teacher training (Barrera, Hernández and Luna, 2018). ICTs include audio, videos, multimedia contents which can be used to engage the learner in learning. Rather so than any other form of ICT, networked computers with Internet access will improve learner enthusiasm as it blends the social exposure and interactivity of other ICTs with the ability to communicate with real people and engage in activities in the real ICTs can turn the learning environment into one that is learner-centric.

1.3 Challenges of using ICT in EDUCATION

ICT as a digital tool simplifies and promotes human interaction is not only helpful in many ways but still has many drawbacks. Limitations may be classified as being related to instructors, related to students, and related to technology.

- The mindset of the teacher towards the use of such technologies is important, certain experiences show that some teachers may not have insight as to how helpful technology may be in promoting and optimizing learning due to lack of expertise to deal, while other teachers may have optimistic attitudes to the technology.
- A further weakness could also be teacher reluctance and lack of motivation to use ICT in education.
- Lack of infrastructure and facilities is another problem for Indian education sector backwarding.
- If teachers learn some practical skills and ability to play with the pupils, there is a downside of using ICT of education.
- Related learning style would not be the same for all students, so suitable research materials need to be recommended for a range of students

2. Related Work

Various research papers are surveyed related to role of ICT in education and its extensive use till date in same.

In (Bhatt, 2008)(Fung and Yuen, 2012), it is mentioned that due to ICT, education is available anywhere anytime. Authors mentioned that ideal models are required to identify what kind of learner is and accordingly customization of learning materials needs to be done. Many organizations started using Learning Management System. But most of the LMSs don't provide complete learning solutions. In comparison, most LMS don't provide full learning solutions. LMS framework is not sufficient to ensure rational content delivery or personalized the course material to student needs. In (Chukwunonso and Oguike, 2013) authors mentioned that a person got connected to his/her relatives, friends and people across the globe through social networks. This platform can be used in education to develop, discover, evaluate, and manage the information of various domains provided in educational material.

Ease of sharing knowledge across the world is one of the benefits of ICT. But only sharing knowledge is not important but proper data representation and sufficient information management are essential(Satapathy *et al.*, 2015). An ability of identification and representation of relationships between various contents is required for the development of context-aware apps. This knowledge

makes it possible to classify important details more accurately. All together creating some sort of system that deals with a person needs capacity to work with imprecision and uncertainty. In order to understand what are expectations of learner, some semantic analysis and fuzzy logic is required. Apparently this dimension is absent in the works under study.

Recently, the use of mobile devices that are having internet connectivity, makes learning possible even outside the school timing. Ubiquitous Learning is closely linked to this, because the learning process can take place almost anywhere and this can be blended into the everyday lives of individuals (Sinclair and Kalvala, 2015). In addition, in recent years, the probability of developing understanding needs of learner's has increased (Tang, Ronghuai and Price, 2016). Specific background data can be explored in mobile learning settings. It is no longer new to provide handheld tools used to promote teaching and learning. The fact that wireless technology is broadly deployed and the proliferation of portable computing devices is rapid has made mobile learning experience possible.

In addition, context-awareness, a term which is useful in enhancing the usability of the learning systems is proposed in this study. The student context may thus include the surroundings of students, location detail, the learning purpose, historical awareness and expectations according to the works in (Ng, Luk and Lam, 2018). Accordingly, in a bid to fulfil this purpose, material adaptation may personalize the learning object. Opinion Mining as Semantic Web definition is also proposed as an idea of machine-processed knowledge in one of the classical works (Szewczyk and Barak, 2019). Its introduction to e-learning provided incentives for developing structures capable of understanding the needs and habits of the students, and choosing learning resources more appropriately. But there is no such system present to provide personalization of course contents to learners who are ultimately at centre point of this ICT-based education.

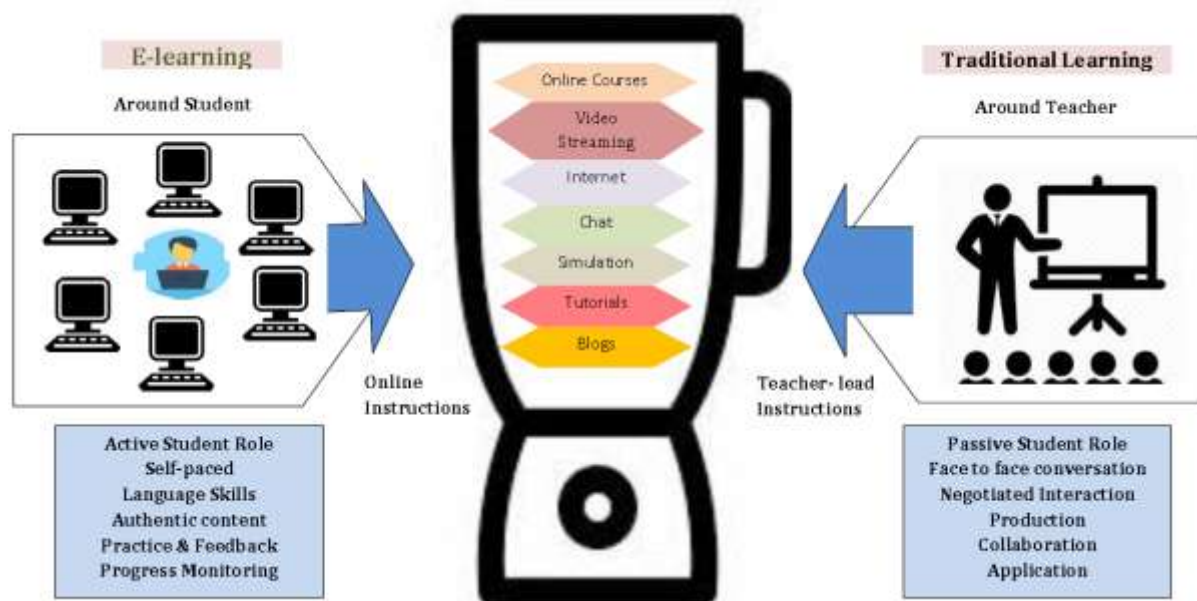
3. Proposed Work

After observing current LOCKDOWN situation due to COVID-19 and such perilous situations there is need for ICT based education. This paper presented ICT-based Learner-centric Blended Education Model which blends traditional teaching-learning methods with ICT-based teaching-learning methods. For personalization of course contents ICT-based Learner-centric Evolutionary learning model is proposed to which an essential input is learner's profile. Building learner's profile as learning advances is again challenging task. It is overcome by using machine learning techniques.

3.1 ICT-based Learner-centric Blended Education Model

An ICT-based Learner-centric Blended Education Model is given in Figure 1.

Figure 1: ICT-based Learner-centric Blended Education Model



The first thing that springs to mind when there is a contrast between online and conventional classroom education is the computer and the classroom. Many apps and online networking tools are available to make learning online simple and to meet tutors and peers in a moment. This model is designed to help aspirants use different resources to make learning more effective, validated and less time consuming.

The learning style will be different for the different types of the learning mediums. The e-learning is tangentially more autonomous. Learners need to take an active role in going into the information and understanding new things. In achieving the educational objectives, it would be like self-directed approaches. Learner will prepare his / her analysis, rather than relying on the tutors (Ng, Luk and Lam, 2018) (Sinclair and Kalvala, 2015). Though that will be different from the conventional preparation, students should have their mentors to direct and help them to prepare future studies. There will be extra support from peer. They can also be inspired by social pressure to accomplish the impossible targets. Users assume e-learning is better too. But in fact e-learning requires equal commitment and dedication in order to achieve the desired results. There are several e-learning courses accessible under the current conditions of an engaging learning atmosphere involving peer to peer contact and engagement with students and tutors. Traditional learning is primarily about the curriculum in the classroom. It is limited to a specified time limit and a venue. Learners need to attend the lectures, enter the group meetings and engage in other school events intended to support your education. It will be tutor-driven, and the instructors will supervise the learning practices of the learner. They won't have to go through this process in e-learning. The learner would have the freedom to pick all of his / her

suitable learning time. The e-learning is easier to use. This is planned to give the users the greatest versatility. But that doesn't mean it would affect the standards of the learning. A learner will get the best education at the convenience of his / her home at any of the suitable times. If learners are involved in online courses in e-learning, then learners may need to develop some basic technology skills. He / she could not be able to obtain an on-line education without any professional expertise. To familiarize with online and e-learning, learners need to grasp search engines, apps, post, text, web page, webinars, chat rooms, video sharing platforms and social networking. In the case of E-learning all these items would be essential. Owing to technological development in recent days, the typical learner would now require certain digital skills for reporting and data collection from the internet. Comprehension of the technology and applications needed to make learning simpler and more efficient. The technological skills would be required in both the conventional and e-learning. Yet the engagement in e-learning should be greater (Morze, Glazunova and Kuzminska, 2018).

After understanding pros and cons of traditional and e-learning, instead of using either traditional learning or e-learning separately, an ICT-based Blended Education Model is proposed. In this model, instructor can instruct or teaches learners through video streaming. The students can raise their issues or clear their doubts through discussion forums, chats, blogs, and reference study material provided by tutor which are accessible at any time anywhere. Instructors can motivate students by giving problem solving based quizzes, discussion forums and students can reply to them hence, learners will be active in learning. For an instructor, due to availability of various ICT tools, evaluation of learner's activities will be also easier so that an instructor can continuously monitor progress of learner. In proposed education model, learner not only takes guidance from instructors also can get experience from peer learners or through social media, various forums and blogs. This will improve problem solving ability of learner and for a given topic learner's thinking will change, he/she will look problem from different perspectives and will try to give best solution.

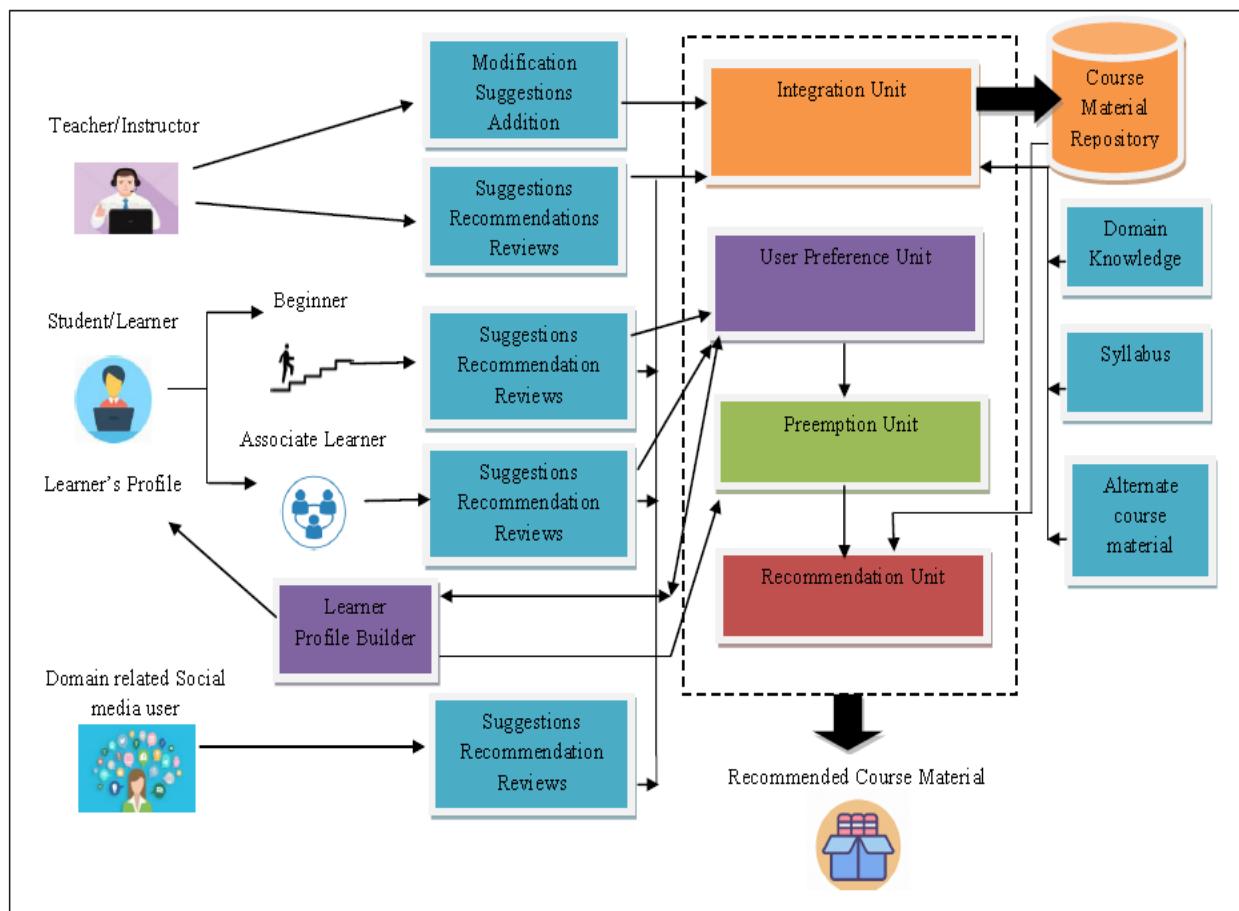
Currently India is undergoing LOCKDOWN period due to COVID-19, its having greater impact on all the sectors including Education sector. The classroom teaching is not possible and to leave students only on E-learning, it will not be efficient. To continue teaching-learning routine in such situations, the proposed model will be useful where students as well as teachers will be active and they can instruct students through video streaming. They can interact through chats, discussion forums and various ICT-based communication media. Instructors can share their course material prepared like notes, videos, e-books, etc. with students which will be helpful for their studies. An instructor not only can share their specialized area knowledge with their students they can globally share it with Internet technologies. It will definitely useful for growth of our nation as education plays vital role in development of a country.

3.2 ICT-based Learner-Centric Evolutionary learning model

As shown in ICT-based Blended Education Model, the environment should be Learner-centric. An interest needs to be generated in learner, necessary skills to be developed within him/her which will ultimately help to achieve learning objective. But still presenting contents, its delivery, distribution and personalization are still a challenge. Furthermore, vagueness of students while for selection of their preferred courses has not been yet covered. In this paper, an ICT-based Learner-centric Evolutionary Learning Model is proposed, which is architecture of adapting learning materials taking into account learner profiles and their context information. Application of AI technologies helps in effective customization and taking decision for selection of adequate course material for the learner that leads to building truly personalized and evolutionary systems. The proposed learning model is presented taking a full advantage of semantic web, social media reviews, and users' feedback. Ultimately, our research aims to build a comprehensive framework for ICT-based learner-centric models of Evolutionary learning where the use of Multi-Feature Decision Support System is required to understand learner-centric aspects. In addition, the implementation of such a model will serve as a framework for drawing conclusions of immediate practical significance for the design of such applications. It has given equal importance to instructor's efforts in content delivery suitable for learner's personal profile. For example, in fundamental courses the suggestions and constraints imposed by instructors on the content will have a higher priority, influence and precision than the student's preferences, feedback from associate students and associate social media users. With implementation of these strategies, the design of course materials is versatile.

The architecture of the ICT-based Learner-centric Evolutionary Learning Model is presented in Figure 2.

Figure 2: Proposed Architecture of ICT-based Learner-centric Evolutionary Learning Model



The proposed system understands what the learner wants, his interests, desires. It involves what teachers propose and endorse (suggestions, changes, feedback), and knows what associate learners think about usable content, it also needs domain –related users feedback on social media which can be helpful in recommending alternate course material. Also domain knowledge and syllabus are having equal importance in this system. In this model learner can share his/her review, suggestions, his likes related to topic. Around the same time teachers have the right to track the student and make changes and additions to the content already being used by the student.

The proposed system is divided into 5 major components-

a) Interpretation unit

There is course material repository which keeps on updating. An interpretation unit performs extraction of important options that considers learner's review, recommendations, suggestions; instructors' reviews, suggestions, modifications, addition to material. It is also used to interpret existing material in course repository.

b) User Preference unit

It stores learner's preferences, needs, likes or dislikes which are useful for updating of learner's profile,

c) Preemption unit

It preempts most appropriate course material by analyzing learner's profile.

d) Recommendation unit

It takes input from preemption unit and integrates associated learner's opinions, and instructors' inputs and performs decision making process to suggest most suitable material keeping the learner's profile into account.

e) User Profile Builder

It creates learner's profile and updates it iteratively. A learner profile contains various details such as demographic information, learner's preferences, needs, likes or dislikes

3.3 Methodologies Used

A) Opinion Mining and Semantic Web

Opinion mining in combination with Multi-criteria Decision Support system has shown benefits in dealing of imprecise and ambiguous human judgment decision conditions and models through the use of estimated information(Zhang, Lu and Wu, 2017)(Smita and Bhoir, 2019) . Incorporating opinion mining into the decision-making methods of learners will resolve the issue of unreliability at the point of making decision due to insufficiency in the amount of knowledge students provide. It applies data classification with boundaries that aren't well defined. It is possible to use machine learning approach for analysis and inference, to figure out new essentials and their classification and accuracy to check the class from which they are belonging. These techniques are used to design and build Evolutionary e-Learning models' elements and functions.

B) Creating Learner's Profile

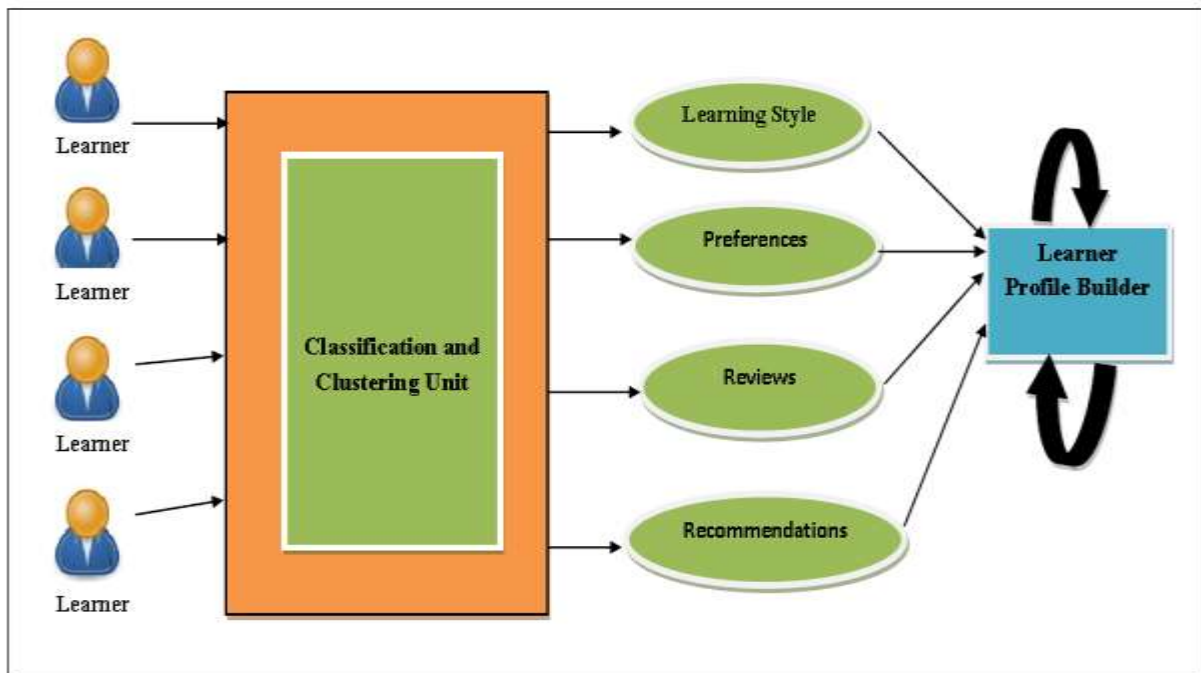
A learner's profile plays a vital role in the proposed system. Figure 3 illustrates the method of building Learner's profile. Initially, demographic data of learners are gathered and their success data are tracked and documented. In web-based platform, web- logs created helps to get learner's progress on given task. Initially while building learner's profile, methods like questionnaires, quizzes should be adopted to know the learner's preliminary information, liking about the course

and his/her learning style. The learner's data is collected from above sources acts as input to the next stage is used as a dataset for further analysis. The data set that has been extracted from the previous stage should be pre-processed using AI-based pre-processing techniques. Now we use Clustering algorithm to identify the learners based on their learning style, behaviors, interests, feedback and comments. (Auddy and Mukhopadhyay, 2015) describes the cluster as a method used to position data items in similar groups without previous knowledge of the meanings of groups. While classification, learning style is important feature of learner which helps for selection of appropriate study material.

Table-I Learning styles and Preferences

Type of Learners	Learning Preferences
Practical Learners	tangible, Practical, Driven by evidence and procedures
Spontaneous Learners	theoretical, inventive, Oriented towards interpretations and hypotheses
Visual Learners	Prefer visual representations contents
Vocal Learners	Prefer written and spoken descriptions
Dynamic Learners	Prefer learning by trying new things, working with others
Deep Learners	Prefer learning through thinking, and working alone
Chronological Learners	Linear, systematic, learn in small incremental steps
Universal Learners	Holistic system thinkers, learn to make great strides

Figure 3: Building Learner's Profile



An instructor should produce variety of course materials for different types of learning modes. The suggested system thus includes a variety of ways in which an instructor will track the actions of the students and behave accordingly. Also, the Instructors are able to ask the program for topics pertaining to the content available and learners completing their classes, as well as read reviews received given by students as related to the information they learned. The system also helps instructors to submit answers to student questions, recommend and appropriate alternate materials for classes.

C) Recommendation of Course Materials

The most important aspect of any Learning Model-based system is the method of choosing the most appropriate course materials, i.e. option between several models, various parts, different media etc. For recommendation of appropriate course material various features need to be considered such as- learner's profile, goals, preferences, feedback and review on specific course material. Similarly guidelines, preferences, recommendations, ideas that include reports and experience from the instructors, reviews and recommendations from peer users and social media users related to domain. Overall, the suggested selection processes conduct decision-making by considering instructor's important thinking related to topic, essentials to learner and reviews of associate learner including domain related social media user.

For recommendation of appropriate course material Multi Criteria Decision Support System (MCDSS) is proposed here which uses Hybrid model of Analytical Hierarchy Process and Voting method (which considers user ratings and recommendations). After investigating advantages and

limitations of Analytic Hierarchy Process, Hybrid MCDSS model is proposed which is a Hybrid Model of AHP method and voting system. In the proposed model, after application of AHP, voting from decision makers are involved to finalize decision.

Algorithm for Proposed Hybrid MCDSS-

Step 1: Start

Step 2: Collect reviews, recommendations from various learner's and reviews, recommendations, modifications from instructor

Step 3: Evaluate performance using AHP.

Step 4: Is Consistency Ratio is less than equals to 0.1?, No then Revise comparison judgement and goto step 3 otherwise goto step 5.

Step 5: Create valuation set for available options with respect to criteria

Step 6: Create wide-ranging evaluation matrix

Step 7: Perform evaluation and get priority ranking

Step 8: Apply any social voting method on aggregated results.

Step 9: Display resultant ranking of results

4. Mathematical Induction

The working of proposed Hybrid MCDSS model is justified with the help of mathematical model.

1. Describe problem and collect related data. These details are useful for identification of problem, available solutions to problem and other specific parameters related to problem.

2: Apply AHP for quality evaluation. Let Course Content M, for example, be the target of the decision taking, M1, M2, M3, M4 and M5 are the alternatives, and R1: Learner's Recommendation, R2: Instructor's Recommendation, R3: Instructor's Modification, R4: Associate Learner's Modification, and R5: Social Media Consumer Recommendation are the requirements for evaluating those alternatives.

The next move is to use Saaty's Nine Point Scale to create a matrix of comparison in pairs, as example is on Table. II. The priority weights vector W is prepared by identification of beneficiary and non-beneficiary features and then according summing each matrix column and then dividing each matrix variable with the sum of its column. The Consistency Ratio (CR) is then calculated as

$$CR = \text{Consistency Index (CI)} / \text{Random Index (RI)}$$

If the CR is less than 0.01, then decision is accepted else need to re-adjust the decision matrix till the condition become acceptable. The value of CI is 0.03039 dependent on the matrix of the pairwise relation in Table-II.

Table-II Pairwise Comparison Matrix

	R1	R2	R3	R4	R5
R1	1	1/5	1/4	1/4	2
R2	5	1	2	2	5
R3	4	1/2	1	1	3
R4	4	1/2	1	1	3
R5	1/2	1/5	1/3	1/3	1

Table-III RI values

N	1	2	3	4	5	6	7	..	15
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	..	1.59

4. Apply suitable optimization technique for decision making such as Simple Additive Method, Weighted Product method and get ranking of alternatives.

5. Establish overall priority ranking

After performing AHP ranking of alternatives are obtained then number of voting methods can be applied. Here for explanation plurality voting method is applied(in which alternative with maximum 1 is having highest priority), we got M5 is the winner, and the order of results is: $M5 > M3 > M1 > M2 > M4$.

Table-IV Voting Table

	M1	M2	M3	M4	M5
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R1	3	4	1	5	1
R2	2	1	4	3	5
R3	1	2	1	5	1
R4	1	3	5	2	1
R5	5	2	1	4	1

6. Get final rankings of results

In this step the alternatives are ranked from highest preference to lowest and decision is finalized.

5. Conclusion

The LOCKDOWN declared in India as preventive measure against spread of COVID-19 virus resulted in temporary shutdown of schools and universities. After analyzing severity of such hazardous conditions there is need to blend digital technology with traditional teaching. The proposed ICT-based Learner-Centric Blended Education Model helps to face such situations and maintain continuity in teaching–learning process. The work proposed has given importance of ICT in education, challenges to use ICT in education and solutions to overcome same. An ICT-based Learner-Centric Blended Education Model ensures active engagement of students and teachers, helps in maintaining Quality Education. Also, an ICT-based Learner-Centric Evolutionary Learning Model proposed here applied AI technologies for suggestion of appropriate course material to learner. A profile builder module is heart of ICT-based Learner-Centric Evolutionary Learning Model, which builds learner’s profile that includes learning style, demographic details, recommendations, expectations, likes and dislikes. For recommendation of appropriate course material, hybrid model of Multi Feature Decision Support System is given here, which is integration of AHP and voting method. One of the main challenges of educators worldwide, and especially in India, is to make the present generation of learners ready for the future. In 2020, the average age of youth is expected to be 29 years. However, if basic education is not accomplished across India, India's large youth population would not be of benefit to the economy. A country's development relies largely on the education system. Another important measure of economic growth is literacy. In the case of India, it is still developing nation because its educational system is missing behind many other developed nations, it is crucial that we

recognize the need for education and its position in Indian youth carving future. The work proposed here is beneficial in satisfying such requirements.

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