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Innovative Online Teaching and Learning Methods for a Post-Pandemic Period

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Abstract : Information and communication technology (ICT) tools have been widely used in teaching and learning during the past two decades. ICT tools enhance, support, and optimize the delivery of information. ICT tools improve teaching methods and enhance effective student learning. During the COVID-19 pandemic period, online teaching-learning methods helped teachers and students carry out teaching-learning effectively while following the guidelines prescribed by the health department for preventing the spread of the disease. The recently implemented competency-based medical education system (CMBE) in India uses e-learning as a key tool for self-directed learning. The National Medical Commission (NMC), the leading organisation in charge of medical education in India, has acknowledged the value of online learning. Many online collaboration tools for students, as well as teaching tools for teachers, are described in this paper. Innovative online learning methods are illustrated with schematic graphics showing their inter-relations. Multiple approaches to effective learning are discussed in detail. The challenges experienced by teachers and students during online teaching and learning are presented. It is shown that the innovative use of open educational resources (OER), massive open online courses (MOOC), and YouTube videos by teachers and students produce synergy in the online teaching-learning process. The way forward in the post-pandemic era and case studies from various higher education institutes in India are discussed.

Keywords - Digital Learning, Collaborative Tool, Learning Environment, Learning Resources, Effective Learning, Team-Based Learning, Health Professional

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1. Introduction

This paper aims to recognize the factors that aid in teaching and learning methods to impact learning to excite, sustain, and optimize a student's learning through online platforms. This article, together with the other considerations, outlines diverse learning methods that would draw learners to successful learning. This paper also discusses the set of criteria that make it more enjoyable for students and also engage them qualitatively. Students are willing to take their learning towards meeting the needs of the industry and society, much beyond their classroom and laboratory. Many of the students of this time are committed to pursuing their goals and climbing high in their professional careers. In a time like this, the post-COVID-19 pandemic period, when the university and college campuses are fully open and

traditional learning is back on track. Faculty members and students could still be encouraged to continue online learning for a few of the sessions. The advantages of e-learning, such as flexible schedules, convenience, and open resources, are to be implemented wherever applicable. Nevertheless, the benefits of conventional learning, such as face-to-face teacher-student interaction, student-student interaction, and clinical skills, are to be exploited. Moreover, the faculty member may continue using the online teaching method to enhance communication skills [Nimavat N et al. 2021, Saiyad S et al. 2020]. This is possible as there are geographic boundaries even beyond classroom learning. Teachers may design and implement an online model to align the learning scheme, encourage self-learning, promote higher-order thinking (HOT), and obtain prompt feedback, Figure 1.

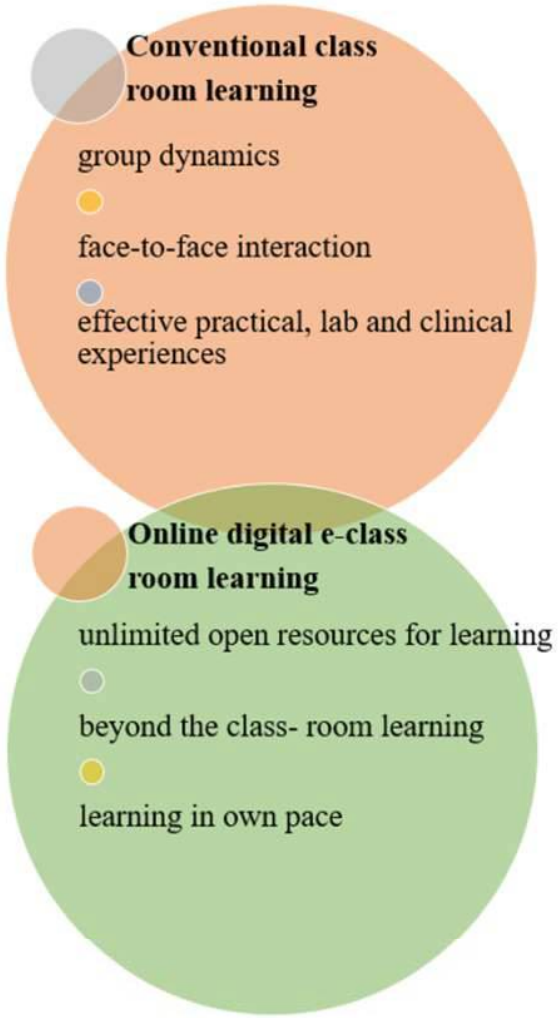

Fig. 1. Balanced view of learning practices

A group of committed academicians will connect better with society and offer a variety of solutions to the challenges it faces. This paper presents the online teaching and learning tools and methods for effective learning. It is shown that teachers use innovative open educational resources (OER), students use OER, massive open online courses (MOOC), YouTube videos, and many more resources available on the internet for improving their skills and knowledge. The challenges faced by both teachers and students during online teaching-learning are presented. When teachers use information and communication technology (ICT) tools, students will acquire HOT skills and space for displaying their understanding. This would enable students to be better prepared to handle technological challenges at their workplace.

The goal of the competency-based medical education system (CBME) is to make Indian medical graduates competitive on a global scale to satisfy the expanding medical necessities. It aspires to develop medical professionals into those who offer excellent and compassionate preventative, promotional, curative, palliative, and holistic care. Knowledge, skill, communication, attitude, responsiveness, and value are among CBME's key values. The new CBME curriculum offers both traditional teaching techniques for clinical exposure and online learning for the most recent advancements in medicine and research skills.

In this paper, teachers and students are encouraged to exploit the benefits of online learning during post COVID-19 pandemic period. This paper gives a balanced approach to online learning while highlighting face-to-face classroom learning. The appropriate online learning and teaching tools listed in this paper could make the learning environment more dynamic. The appreciation and applicability of them are domain-specific. Implementation challenges are discussed in this paper and the impact of adopting online learning in the traditional curriculum is

2. Online Teaching Tools And Student Collaboration Tools

Many online tools are available for teaching and also for student collaborative learning. Depending on the size of the class, the features required, and the ease with which one can operate, the online tools or student collaboration tools are selected. The following sections give information about the tools available for online teaching as well as for promoting student collaboration.

2.1 Online teaching tools

Nowadays, the internet is a tremendous instrument in medical education both in India and throughout the world, allowing students to study from the greatest instructors and acquire new technical skills. These materials fill the gap between the educational standards provided by various universities.

OER are made publicly available with an open license. In India, the government has taken several initiatives such as the National Mission on Education through Information and Communication Technology (NMECIT) and the National Program on Technology Enhanced Learning (NPTEL) by collaborating with elite institutions in India. These tools are widely adopted by various higher educational institutions in India and translated into different regional languages thus breaking the language barrier [Dutta, I. 2016]. In a study conducted at the University of Kelaniya, Sri Lanka, at the Faculty of Medicine on the most popular forms of OER, Wiki Sites were the most popular (84.4%), with SlideShare coming in second (34.2%) [Hettige, S. et al. 2022].

MOOCs provide structured courses to users and are highly scalable and designed to support participation on a large scale. For a continuous learning mechanism, medical practitioners are required to be present in a traditional classroom environment. As there is a shortage, an online classroom facility is enabled using MOOC for practitioners to attend these sessions. Some policy level changes pose a challenge in the adoption of MOOCs for medical education in India, but there is a need to recognize and incorporate such courses for better quality medical education [Gupta, S. et al. 2014]. MOOCs are essential for self-regulated learning and various interventions such as graded quizzes and deadlines aid in successful course completion [Jansen, R. S. et al 2020].

The choice of online teaching tools depends on the content and data analytics tool coupled with the learning tool aid in refining and using the right tools for the content to be delivered. Online teaching enables customized learning approaches for an individual student, and constant feedback and data gathered from the students' understanding of the subject is crucial in adapting the content to suit better the individual student [Shelle, G. et al. 2018]. The quality of tools enabling instructor-to-student content delivery as well as student collaboration tools greatly benefit from continuous assessment of its ease of usage, and effectiveness and is instrumental in providing tailor-made solutions for individual students and instructors. A tool was developed that analyzes a course and the learning styles of students and has proved effective in redesigning the course and offering certain features that support the individual learning style of the student [El-Bishouty et al 2018]. This tool uses a visual feature to highlight the degree of learning style support offered by the course design and which style is not supported at all. Piazza data is available for researchers to analyze and infer student learning behaviours and patterns [Lynch, C. F. 2019].

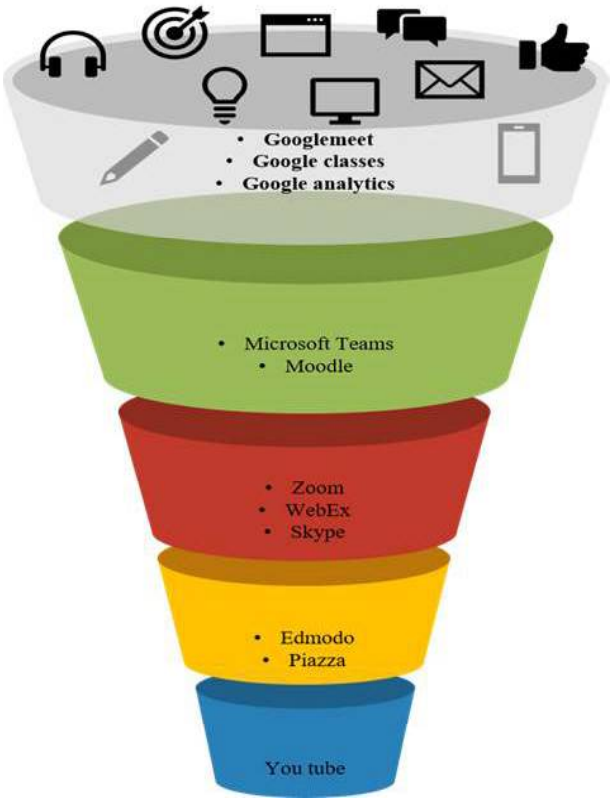

Fig. 2 : Teaching digital tools to communicate

Google Analytics is a free platform that allows researchers to obtain essential inferences and patterns in data with minimal technical knowledge. For the effective use of instructor-to-student online teaching, and collaborative work among learners, it is imperative for institutions to train both the instructors and students for effective use of online teaching tools. Online teaching tools such as YouTube Live, Google Classes, Zoom, WebEx, Skype, Edmodo, Microsoft Teams, Google Meet, and Moodle are handy for teachers who use to share knowledge as shown in Figure 2.

2.2 Student Collaboration Tools

Group work enhances the understanding level of students. These online tools allow any team to collaborate and work on a project and have a central repository that can be accessed and updated by team members. In the survey conducted on students pursuing higher education [D. Sharma et al. 2022] The majority of students, around 58%, preferred to work in small groups to engage them to learn. In a wholly digital environment, a huge obstacle for both instructors and learners is the development of interpersonal relationships. This is required for a student to effectively work in teams. Since social media could distract students from the subject, several tools, such as Yammer, emulate the social app structure in a controlled environment. Facebook for Education enables educators and students to form groups and connect and engage digitally in a familiar platform [Davidovitch, N. et al 2011 and Deb, R., & Bhatt, D. K. 2020]. In a study conducted in medical colleges in Sri Lanka [Hettige, S. et al 2022], they found that 90% use social media for academic purposes. Furthermore, Facebook was used by 80% of the students followed by YouTube and Google+. The interactive features of these platforms encourage students to participate in open discussions and share information.

Students from several medical and nursing institutions in Switzerland and Italy investigated the e-REAL Online virtual cloud platform. The learning process is built on a conversation with the patient, a woman who was hurt while hiking in an alpine landscape. The learners are encouraged to detect a scenario needing immediate response, communication, information sharing, decision-making, and management of an unplanned event—while considering crucial contextual considerations such as a shortage of time, and scarcity of resources and instruments. Peers, the medical simulation teacher, and the injured patient—an avatar designed to engage in dialogue with the participants—can all communicate with each other in real time on this platform [Salvetti, F. et al. 2023].

Microsoft Teams has a class notebook space where instructors and learners both have their private space to take down notes and also a collaboration space where groups can be assigned. Google Classroom has an option to assign work to specific subgroups of students and docs/sheets can be used for collaborative work. Piazza is a tool that fosters HOT and is suitable for colleges and universities. GitHub is a collaborative space that can be used for project-based learning for those in the computer/information technology field. In engineering, tools such as GrabCAD allow for sharing CAD models collaborative design which a group of learners may work on as shown in Figure 3.

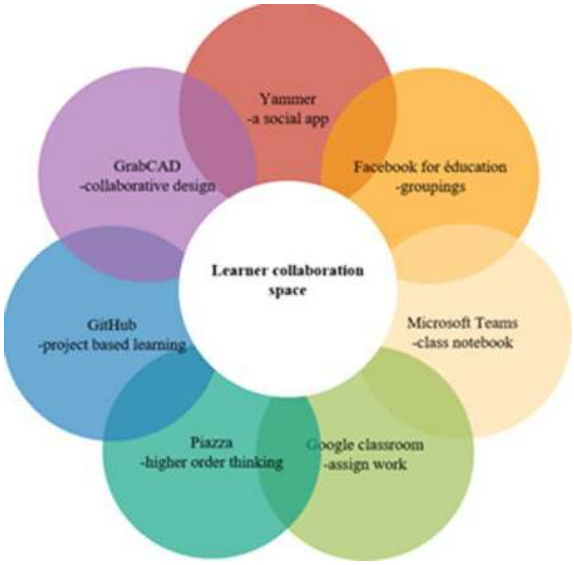

Fig. 3 : Digital collaboration tools for learners

3. Online Learning Methods

Teaching and training the students is like teaching them fishing so that they would get what they want and stand on their feet. Hence, teachers are to provide an environment in which students are helped to 'learn on their own' rather than be taught. Students have to be facilitated in an environment where they learn and empower themselves. Faculty members need to give them the needed space to exhibit their talents and potential. Sometimes, the learners have to be even allowed to fail and stumble, but they should not be offended. The objective of this paper is to bring out innovations in online learning, empower the student community, and unleash their potential.

3.1 Learning environment:

Powerful learning environments were assessed as shown in Figure 4. Learning engagement helps the learner to engage fully and learn [Entwistle, N. J. et al 2004 and Prapulla, S.B. et al 2024]. Variations of study behavior, interrelated ideas, and conceptions of information and perceptions of students are oriented to provide a conducive learning environment. Assorted ideas will affect students' reactions to the educational environment. Methods to increase the

standard of learning by improving interaction, reasoning, and collaboration among academicians and students through digital technology were found. The outcome of this analysis gave positive results for effective learning [Mercer, N. et al. 2019].

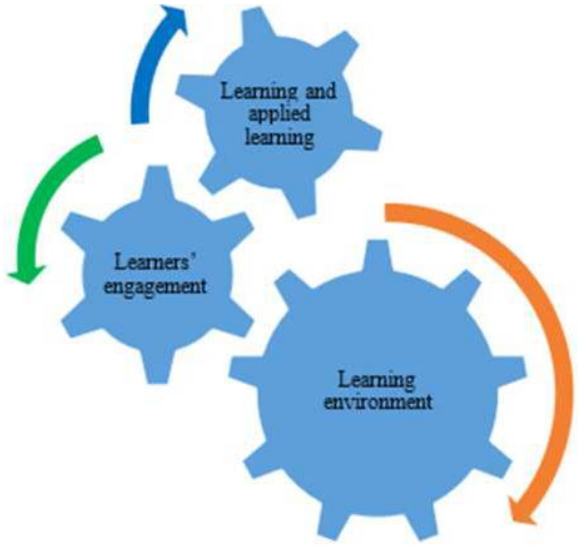

Fig. 4:Influences of an effective learning environment

Researchers across the globe are striving to expand student-centred learning. Few learning styles are extracted from the study of applied learning, which reliably produces measurably superior learning results. Every strategy extends throughout the scope of the program and across the age and skill levels of the students. Specific methods of digital learning and digital technologies are to help and strengthen the learning of students [Twyman, J. S. et al 2015 and Rao, G.V. et al 2022].

1.2 Multiple approaches to effective learning

Online learning allows both the learners and the facilitators to have discipline and time management skills. The material of the course also needs to be well distributed online. Teaching strategies must focus on learning outcomes. Several approaches for effective learning are described in the following sections. Figure 5 shows multiple approaches for effective learning: Team-based learning in groups, discussions in collaborative work using digital platforms, experiential learning, project-based learning (PBL), simulation and animation-based learning, and innovative assessment. The following sections explain all these approaches in detail.

Standardized Online Patient for Health Interaction Education (SOPHIE), a digital application, is created to allow patients to practice and get feedback on their communication skills with doctors. The participant's ability to manage overall communication, aggregate scores, patient empowerment, and empathetic behavior was greatly altered by SOPHIE [K. Haut et al. 2023 and Sheik Abdullah, A. et al 2021].

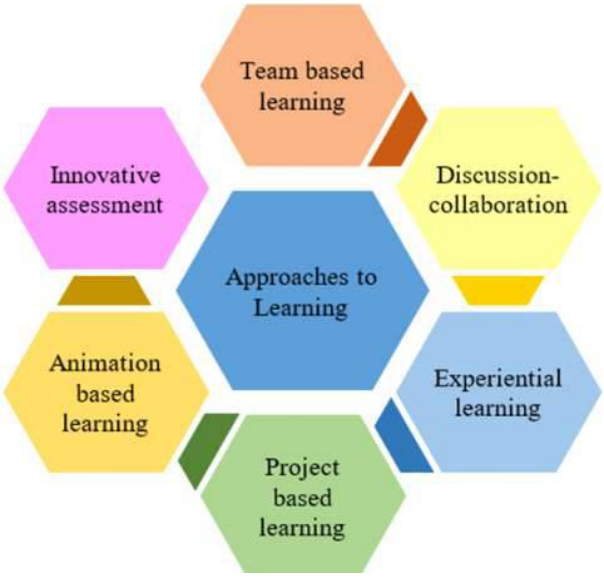

Fig. 5 : Multiple approaches to effective learning

3.2.1 Team-based learning (TBL)

In any learning environment, students are drawn together for several purposes and might be referred to therein context as 'groups'. Often the groups are formed by teachers. If the size of the group is planned strategically and the interaction among members is good, the learning will be effective [Blatchford, P. et al. 2003]. Group learning is a well-known pedagogical exercise that promotes learning in broader curriculum areas, as shown in Figure 6. They encourage socialization among the members of the group. When they work in groups, the members share their ideas with other members, learn to help others and receive help from others, improve their understanding of fundamental concepts and the academic outcomes are good. Compared to working alone, working in a group helps students to attain more knowledge [Gillies, R. M. 2003]. Working in teams allows them to acquire the skills of a team leader or a team member and these skills will be helpful to them in their real-life applications.

TBL is learner-centered and directed by the teacher. After giving a passage for reading, about 20 questions are given to teams of students to find the

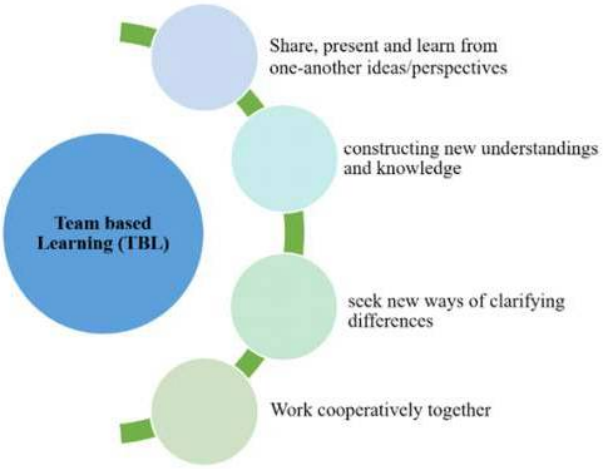

Fig. 6 : Advantages of team-based learning

answers. Team leaders are given Zoom applications and they enroll their members into the break-up rooms. Each team leader collects responses from team members and sends answers through Zoom chat. Afterwards, all rooms are united into one classroom where the teacher gives feedback [Gaber, D. A. et al 2020]. Effective collaborative learning that integrates theoretical knowledge and practical application might be facilitated by a TBL teaching team at a medical school that includes a senior clinician, a junior clinician, and one fundamental scientist. For several areas, this would bring about contact between the clinical and basic sciences. Students may integrate, understand, and apply their newly gained information through this interaction in smaller groups. Benefits of the TBL design include the flipped classroom technique, small groups, testing processes, quick expert feedback, peer observation, and provision of a clinical atmosphere by doctors [Burgess, A. et al 2020].

3.2.2 Collaborative learning through online discussions

Online collaboration is an active learning strategy that encourages communication between students and teachers as well as interest and motivation in learning in a virtual setting. The use of a range of platforms for teaching and learning, including blogs, Facebook, Google Sites, Moodle, Twitter, etc., in collaborative online learning in medical education has produced good educational outcomes. Learning resources that are customised to each student's requirements and learning preferences could well be created through collaborative online learning [Luk, P. et al 2020]. The problems faced by students and how disagreements occur during collaborative learning were studied. Socio-emotional tension was generated by over-ruling and status-centric engagement. The problem found was that students were incapable of maintaining a well-balanced environment leading to regulating emotions. Teachers are required to act as moderators and solve interpersonal issues that arise among students [Näykki, P. et al 2014]. It was found that the higher the percentage of students engaging in online conversation, the greater the chance that the student would have lengthy conversations of thinking and logic [Sedlacek, M. et al 2017]. The worry about privacy problems, the calibre of material available online, access to information online, and students' self-discipline are some further obstacles to collaborative online learning. Nevertheless, several studies have noted that the expense of utilising these learning methodologies is a barrier [Luk, P. et al 2020].

3.2.3 Experiential Learning (EL)

It was noted that machine element design was considered a difficult course by mechanical engineering students. This course was revamped using the experiential learning method. Students were made to interact by doing practical work rather than learning the theory. Course outcome analysis showed that experiential learning helped students to have effective learning and active participation [Li, H. et al 2017]. It was indicated that a team is formed to connect with a teacher or a university student in the learning process, collaborating on educational topics through social networks without forming special groups. Learning management systems (LMS) help teachers and students to realize effective teaching-learning. Efforts should be taken to link LMS or Moodle to integrate project-based education. In the teacher's portal, the teacher shares learning materials, and students use cloud data storage (Dropbox, Google Drive, One Computer, etc.) to upload instructional materials as shown in Figure 7 according to their popularity and influence. Interaction between teachers and students on educational issues is carried out through e-mail, WhatsApp, Microsoft Teams chat, and so on. Experiential learning for medical students is the steady, progressive accumulation of information from the first years of medical school until residency. The medical students would be able to take part, reflect, and develop their interpersonal skills. Experiential learning is a crucial component of medical education, where students learn about anything from monitoring blood pressure in

physiology to dissecting a cadaver in anatomy class. During their internship or residency, medical students work in clinical settings where they may interact with patients [Shrivastava SR 2021].

3.2.4 Project-based learning (PBL) using open educational resources (OER)

It was found that the central objective of the project-based approach is to help students learn based on their interests, experience, and skills [Mkrttchian, V. et al 2019 and Deepa, M. et al 2024]. Students with a disability must be allowed to choose the learning approach that suits them well. Teachers and students use OER, MOOC, videos on YouTube, Wikipedia, etc. as shown in Figure 7. The teaching methods with PBL will enhance the learning of students. Unlike problems from textbooks, students will be trained to solve real-world problems through PBL. When groups of engineering students who learned through PBL were compared with a group of students who learned through the conventional teaching method, the PBL group showed much learning and increased participation [Gratchev, I. et al 2018]. Medical students have an opportunity to question actively, think critically, and gain specific knowledge/skills through PBL. Research indicated that the perception of the students has completely changed and there was an improvement in attendance, especially in classes like Biochemistry. The performance of the students improved well in that course and PG students too did well in their PG entrance examination through this method of learning [Shah, Hitesh N. et al 2021].

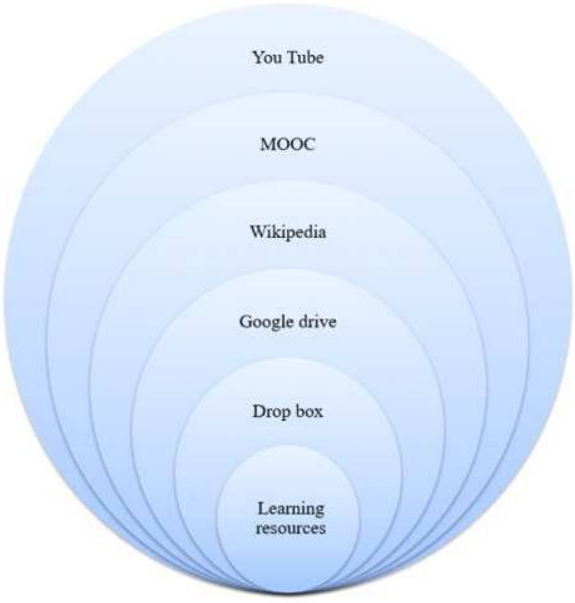

Fig. 7. Learning resources available for learners in online learning

In radiology education, the introduction of visual interaction in e-learning programs is examined. The study examines the research on the impact of radiology e-learning systems, both with and without image interaction capabilities, on medical students' and teachers' learning results and perspectives [Den Harder, A.M. et al 2016].

3.2.5 Computer simulation and animation-based learning

Researchers worked on simulation-based education (SE), which was originally referred to as computer apps, tools, and academic games for enriching effective teaching and learning. It is not a simple job to implement innovative exciting academic games since the fundamental learning principles involved in these games must be understood. The levels of the games should match the skill levels of the particular group of students. Simulation-based laboratories help engineering students to understand the underlying theory easily. Recent advancements in both software and computer hardware make it possible to employ creative methods and techniques that allow the use of SE resources to improve learning. It encourages multidisciplinary research skill development, communication skills, and diverse cultural instructional practices. Simulation education is not only a standard educational tool but also it will continue to be prevalent in the strategic framework [Campos, N. et al 2020]. Computer simulation and animation a useful tools to self-learn having control over the animation's pace for the medical students. This demonstrative method is well adopted in medical schools though its effectiveness is influenced by the learner's prior knowledge and spatial ability [Ruiz, J. et al 2009, Hofer, E. et al 2013].

3.2.6 Learning based on online feedback on assignments, quizzes, and other activities

Feedback on assignments, quizzes, and other learning activities should also be up-to-date, and appropriate, and should be completed within the specified time frame [Baghdadi, Z.D. 2011]. Unreasonable delays should be avoided, for example, for more than 3 days, unless this time is spent in elucidating excellently crafted answers that will enhance the teaching and learning environment for all class participants. The teachers may share information

on specific dates in these situations advising the students of the need for extra time outside the stated period. It is important to define the lines and means of communication between teacher and learner. What is crucial is the reasonable value of learning, whether it is provided on university premises or online. The material uploaded to the website should be retrievable and updatable for both learners and teachers. Cataloguing all the documentation produced during the academic year will help both students and teachers gain more knowledge [Pérez-Sánchez, J. C. et al 2016].

3. Challenges In Online Learning

Teachers should be skilled in delivering online lectures, replying to e-mails, and gaining expertise in handling digital equipment. It can be challenging to respond to e-mails from students on the same day. Preparing and teaching an online course consumes a lot of time. Downloading teaching-learning materials is sometimes subjected to issues related to copyright and intellectual property rights. The discipline of a few online students may pose challenges to teachers. There could be a delay in the submission of assignments. Difficulties are identified in online facilities available to students as well as teachers. Teachers should be able to amicably solve unexpected problems to provide a congenial environment to help students learn effectively. Balancing a job from home is a challenge faced by many teachers and a few students [Nimavat N et al 2021, Adebo, P. 2018, Gundabattini, E. et al 2022, Laranjeira, C. et al 2023]. In competency-based medical education, the know-how, show-how, and performance competently are the pillars. The significant challenges identified are lack of skills, time management, lack of infrastructure and resources, poor communication, negative attitude, and student engagement [Nimavat N et al 2021]. In a report based on several colleges in the U.S., the challenges are explained from the instructor and learners' point of view [Adebo, P. 2018]. Ineffective delivery of courses, interaction with students, and getting upskilled with online tools and infrastructure are challenges faced by instructors, and students are mainly plagued with self-directed learning and self-discipline. In our earlier work based on a survey of students from both engineering and medicine students in India [Gundabattini, E. et al 2022], the survey results point to distractions and network connectivity as factors that hinder effective learning during the COVID-19 pandemic. The psychological challenges of depression, anxiety, and stress are also given as challenges in [Laranjeira, C. et al 2023]. The challenges and probable solutions proposed are summarized in Table I.

Table 1 :
Challenges In Online Teaching And Learning

Sr. No	Challenges	affected group Students / Teachers	A solution to overcome the challenges
1	Unequipped skills [1,35]	both	Instructors – to attend sessions on skills upgrading Learners – should be given hands-on training on a rotation basis to acquire necessary practical skills [1]
2	Poor infrastructuer [1,36]	both	Various governments have taken several measures to improve ICT infrastructure [38,39]. Architects to include study rooms while designing homes Parents to provide a calm atmosphere [36]
3	Negative attitude, [137]	students	Change in norms and attitudes to be cultivated at the institutional level and by individuals [1] Build resilient coping mechanisms – positive environment, stress management sessions [37]
4	Time management [1]	both	Use capacity -building programs to train faculty. Share pre-recorded videos Provide a proper timetable for students to follow sessions [1].
5	Communica tion gap [1]	both	Collaborative learning by encouraging teamwork and discussion [1]. Use of social media and other interactive technology [4]
6	Quality of available information [35]	both	Faculty members to ensure the relevance of the content [40] Training may be given to instructors to curate course content for effective online learning [1]

Students from low economic groups are at a disadvantage as they lack access to smartphones, laptops, and tablets. Another challenge is poor internet connectivity for students from rural areas at home. Recorded videos help the students more than live online classes as they can listen to the topic at their own pace and enable self-directed learning. E-lectures, virtual patients, and e-lab simulations can help the students to acquire skills in a better way.

5. Assessment Through Online

The teachers encountered many challenges with the online assessment of the students during COVID-19. Online assessment was challenging because there were pedagogical, technical, administrative, and affective barriers. Nevertheless, some of the online assessment tools that were useful during COVID-19 are still proved to be effective even in post-Covid scenarios viz. open-ended questionnaires, Google quizzes through Google forums, multimodal projects, case study questions/analysis, and online discussion with peer assessment, Google Classroom, Quizlet Live, Kahoot, Nearpod and online interviews [Ghanbari, N.et al 2021, D. Sharma, et al 2022]. The "skill evaluation" used to evaluate learners in CBME measures their cognitive and behavioral proficiency. Case-based scenarios containing multiple choice questions (MCQs), short answer questions, and long answer questions are used to evaluate cognitive capacity. Clinical and practical skill evaluations are conducted using direct observation of procedural skills (DOPS) and objective structured clinical/practical examinations (OSCE/PE). Teachers make extensive use of online videos in blended learning or e-learning curricula for medical education. During the COVID-19 epidemic, students used online media to spread information; as a result of social restriction regulations, there has been a shift to online learning modalities. Nevertheless, as part of their speciality learning, postgraduate medical students are required to become proficient in a variety of procedural skills. As a result, research has been done to confirm the legitimacy of the instructional videos that are accessible online. The quality was verified by a thorough evaluation since low-quality online videos might have a ripple effect on postgraduate training in medicine. Researchers desperately require a way to evaluate their quality before implementing them to alter clinical practice [Komal Srinivasa et al 2022]. In online learning, the psychomotor domain assessment is the most difficult. Clinical reasoning testing can be done using virtual objective organised clinical tests and a virtual patient.

6. Adopting Online Learning In The Post-pandemic Era

The post-pandemic era provides a unique ground to cultivate the best online and offline teaching to provide a more effective form of education that would not have been possible before the pandemic. Several factors hindering online education such as the adaptation to the technology and infrastructure are now in place. Instructors and learners are accustomed to the online culture. Several challenges in a traditional classroom environment can be addressed now by incorporating best practices from online learning. Instructors would continue to benefit from training sessions that enable them to plan the course delivery to use both modes of learning. Students also benefit from classroom learning and the self-paced learning that can continue to take place beyond the classroom.

Specific initiatives implemented by certain Universities and institutes in India are highlighted below:

· The recognition of MOOCs as part of the curriculum by Visvesvaraya Technological University public university in the government of Karnataka has implemented several initiatives such as

- o MOOCs with 18 credits for obtaining an Honor's degree
- o MOOCs with 18 credits to obtain a minor degree in another discipline
- o Skill Enhancement Courses for students who cannot obtain offline internships.
- o MOOCs for faculty members for knowledge upgradation.
- o MOOCs for PG courses are directly reflected in the grade card.
- o MOOCs for final year UG students in place of offline classes in the pipeline.

6. Summary

Innovative online teaching and learning methods are presented concisely. Details on online teaching tools and student collaboration tools are described. The importance of the learning environment for effective online learning is highlighted. Multiple approaches to effective learning are discussed such as Team-based learning (TBL), Collaborative learning through online discussions, experiential learning (EL), Project-based learning using open educational resources (OER), Computer simulation & animation-based learning, learning based on online teaching, feedback on assignments, quizzes, and other activities. Challenges in online learning are presented. Online teaching tools such as YouTube Live, Google

Classes, Zoom, WebEx, Skype, Edmodo, Microsoft Teams, Google Meet, and Moodle are available to teachers for sharing knowledge. This paper highlights and motivates online digital e-learning while giving credit to face-to-face conventional classroom learning after the COVID-19 pandemic period. The balance approach model presented in this paper is to strengthen the outcome-based higher-order thinking/teaching/learning/assessing. Challenges in online teaching, online learning, online assessments, and solutions to overcome them, and the way forward in the post-pandemic era are presented.

Conclusion

It is shown that the competency-based medical education system (CMBE) in India uses e-learning as a key tool for self-directed learning. The value of online learning is acknowledged by the National Medical Commission, the organisation in charge of medical education in India. The use of open educational resources, massive open online courses (MOOC), and YouTube videos by teachers and students are shown to produce synergy in the online teaching-learning process. Piazza is a learning tool suitable for colleges and universities. GitHub is a tool for project-based learning. GrabCAD allows the sharing of CAD models and collaborative design with a group of learners. The cognitive capacity of students is assessed using case-based scenarios containing multiple choice questions, short answer questions, and long answer questions. Clinical and practical skills are evaluated using direct observation of procedural skills (DOPS) and objective structured clinical/practical examinations (OSCE/PE). Teachers follow blended learning and make use of online videos or e-learning curricula for medical education. In conclusion, online teaching and learning methods increase the quality and outcomes of the teaching-learning process.

Availability of Data And Materials

All information collected through the literature for writing this paper is available to the authors. The authors have no objection to sharing the collected information.

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Conflicts Of Interest

The authors state that they have no known competing financial interests or personal ties that might have influenced the research presented in this study.

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