

STUDENT AND TEACHER PERCEPTION OF ONLINE LEARNING DURING THE COVID PANDEMIC

Abstract

The assessment system in medical undergraduate education in India is witnessing change with the recent introduction of Competency-Based Medical Education (CBME) and National Education Policy 2020 (NEP-2020). This paradigm shift is comparable with the world wherein the emphasis is now on creating the Indian Medical Graduate IMG who can act not only as a clinician but also as a leader, communicator, professional and lifelong learner. Such reforms focus on formative and longitudinal assessments, student-centred learning, integrated clinical exposure, and a transition from rote memorization to competency-based learning.

The article retraces the Frameworks [for example, Bloom's taxonomy, Miller's pyramid, Dreyfus and Dreyfus's stages in skill acquisition, RIME model and Entrustable Professional Activities (EPAs)] that have informed the structuring of assessments. These frameworks promote evaluation of knowledge, technical skills as well as professional behaviour in authentic settings. The integration of cognitive, affective, and psychomotor domains is necessary for achieving meaningful learning outcomes.

The monograph highlights the shift in assessment - no longer confined to measurement through scores but involves informed judgments and developing systemic evaluations. The introduction of tools such as OSCE, Mini-CEX, DOPS, and Portfolios reflects this shift. Workplace-Based Assessment (WPBA) approaches, feedback loops, and programmatic assessments are being increasingly employed to support ongoing learning and encourage reflection in practice.

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The CBME has been implemented across the country in India, However the system of assessment is still largely summative and internal assessments are contributing marginally towards the final certification, limiting their formative value. The adoption of EPAs and effective formative assessment tools remains inconsistent. Faculty development, creation of validated question banks, psychometric analysis of assessment tools, and integration of technology are recommended to support this transition.

In conclusion, India's adoption of CBME marks a paradigm shift in medical education. However, successful implementation of assessment reforms requires structural, procedural, and cultural changes within medical institutions.

I. IMPORTANCE AND RELEVANCE

COVID-19 was initially identified in December 2019 and was declared a Public Health Emergency of International Concern on January 30, 2020, followed by a pandemic designation on March 11, 2020, by the World Health Organization (WHO) ^[1]. The pandemic has had the highest impact in countries such as the United States, India, France, and Germany. In an effort to curb both mortality and morbidity, lockdowns and quarantine measures were implemented worldwide, impacting various sectors including health, economy, society, politics, and education, and halting physical gatherings for educational purposes ^[1]. In response, a global shift to online education emerged, encompassing e-learning, virtual learning, and video conferencing, as directed by policymakers and educational leaders.

E-learning includes a broad range of digital educational methods such as computer-based learning, web-based learning, virtual classrooms, and digital collaboration ^[2]. Online or web-based learning refers to instructional programs that use the World Wide Web's features to create supportive and effective learning environments ^[3]. Virtual learning is defined as learning conducted over the Internet without face-to-face interaction ^[4].

This mode of education requires an IT infrastructure for communication and content delivery, which differs significantly from traditional face-to-face instruction. Essential for students are a computer or mobile device, a stable internet connection, and self-discipline. Before the pandemic, online or web-based learning was typically an adjunct to in-person instruction in some regions and rarely used in others, particularly in medical education. With the onset of quarantine measures, education transitioned entirely online, eliminating in-person interactions between students and teachers. This abrupt shift left educators with limited time to adapt their teaching strategies, and many communication tools were underutilized. Additionally, students, particularly in developing countries, faced challenges with motivation and responsibility in this new learning format.

This review aims to assess how undergraduate medical students and teachers experienced this emergency shift to remote learning during the COVID-19 pandemic. It seeks to evaluate the effectiveness of online teaching and learning, identify the benefits and challenges encountered, and examine differences in perceptions and implementation strategies across various countries. This article intends to provide a comprehensive overview of the global experience with online learning during the pandemic and offer insights into how e-learning can be integrated into traditional educational practices to enhance conventional learning environments.

II. BRIEF HISTORY

1. E-Learning

“e-learning encompasses a pedagogical approach that typically aspires to be flexible, engaging and learner-centered; one that encourages interaction (staff–staff, staff–student, student–student), and collaboration and communication, often asynchronously (though not exclusively so)”^[5].

Two prevalent modes of e-learning are distance learning and computer-assisted instruction. These approaches often use a mix of media, including text, graphics, animations, audio, and video, to create engaging multimedia content for educational purposes.

Various forms of e-learning, such as web-based learning, online learning, distributed learning, computer-assisted instruction, Internet-based learning, virtual learning, mobile learning (M-learning), multimedia learning, and video conferencing, utilize the Internet, storage devices, and cloud computing to facilitate education.

Key structural elements in e-learning include online resources, interactive activities, virtual classes, and assessments. The effectiveness of an online learning environment is significantly enhanced by cognitive, teaching, and social presence^[6]. Garrison defines cognitive presence as "the extent to which participants are able to construct and confirm meaning through sustained discourse in a community of inquiry." Teaching presence involves "facilitating and guiding the cognitive and social processes to achieve meaningful learning outcomes." Social presence is described as "participants projecting their personal characteristics into the online environment, presenting themselves as 'real people'"^[6].

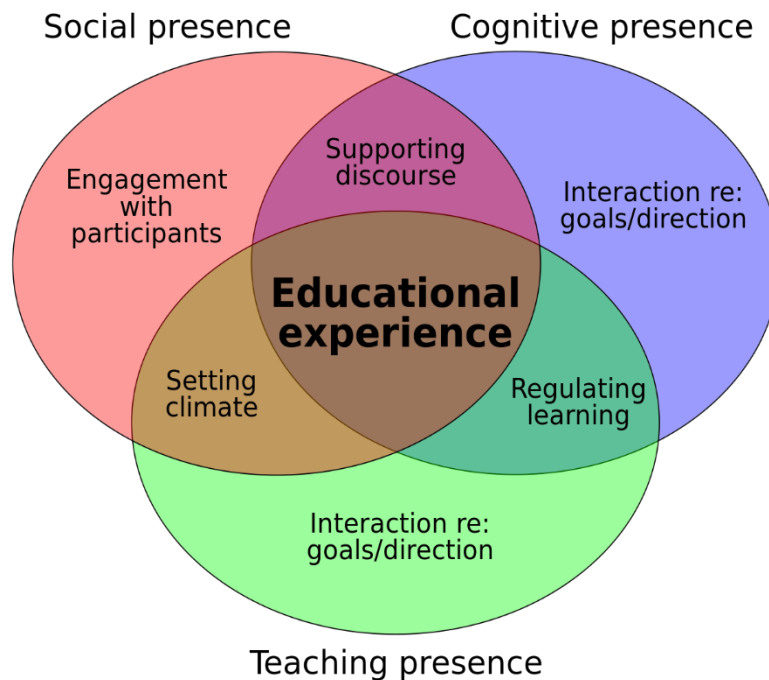


Figure 1: Educational experience of online learning

Effective online pedagogy is based on principles such as student responsibility for learning and interactivity ^[7]. Learning communities benefit from proactive instructors, engaged learners, personalized learning experiences, and the advantages of cloud-based training systems ^[8].

Online learning frameworks are informed by major learning theories: behaviorism, cognitivism, and constructivism. Behaviorism focuses on stimulus-response mechanisms and reinforcement, while cognitivism emphasizes cognitive processes like attention and application. Constructivism highlights the importance of personal relevance and social interaction in the learning process ^[4]. These theories guide decisions about content selection, delivery methods, and interactive activities in online learning, as discussed by Mishra (2002) ^[9].

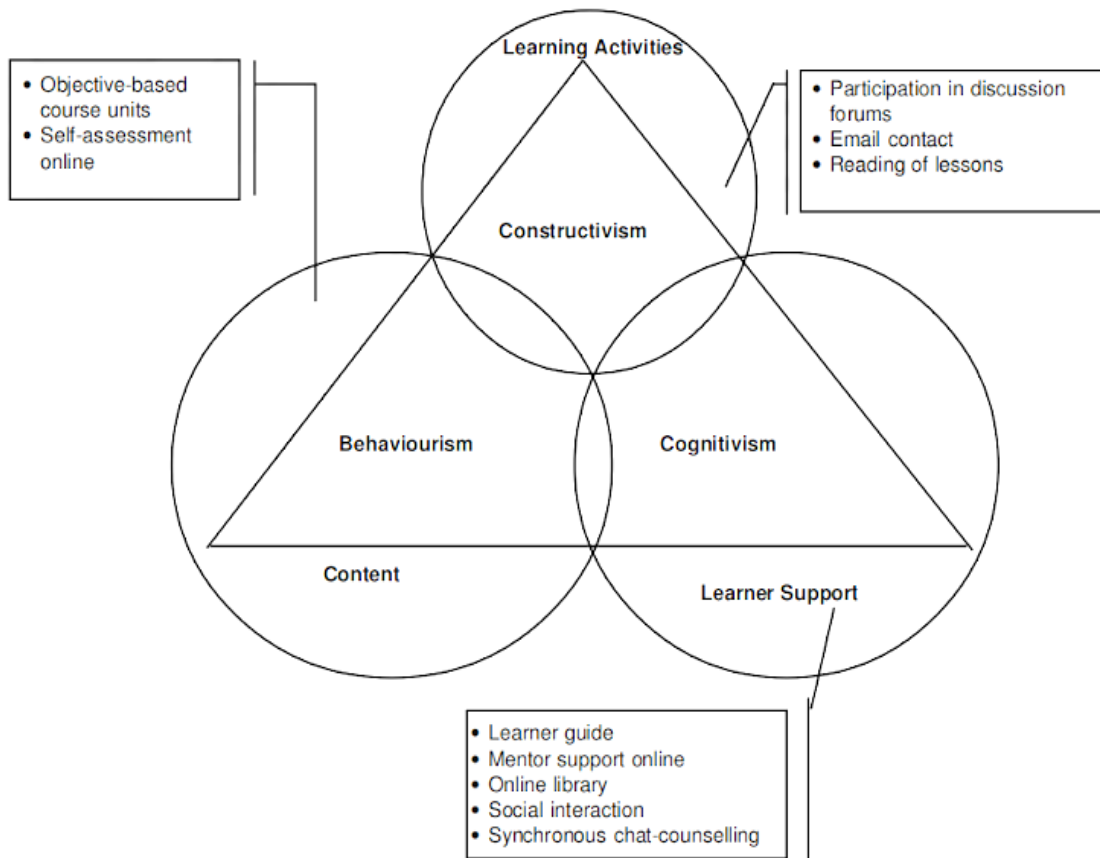


Figure 2: Application of learning theories to online learning

Salmon (2000) outlines a five-stage model for e-moderating, which includes forming a group, facilitating online interaction, exchanging information, engaging in collaborative knowledge construction, and achieving personal goals ^[10]. Each stage requires different e-moderating skills and technical support ^[10].

Various tools support online learning, including:

1. Online Collaboration Tools: Google Apps, Google Classroom, Google Meet, Zoom, Cisco Webex, Free Conference Call, Microsoft Teams, and GoToMeeting.
2. Presentation Software: Microsoft PowerPoint and Google Slides.
3. Learning Management Systems (LMS): Canvas, Swayam, Moodle, Google Classroom, Coursera, Clinical Key, Udemy, and Teachable.
4. Audience Response Systems: Clickers and polls.
5. Lecture Capture Tools.

An LMS is a software platform that organizes and manages educational activities, including administration, teaching, assessments, and content delivery, either through institutional servers or cloud-based services ^[12]. Benefits of online learning include flexibility in time and location, dynamic and interactive experiences, increased learner control, and seamless integration of multimedia ^[13, 14]. However, challenges such as content quality, standardization, adaptation to different learning styles, information overload, and the need for

additional skills training have been identified ^[12]. Technological advancements and the availability of portable devices have led to new competencies that learners and educators need to master ^[10]. Ongoing training and technical support are crucial for both teachers and students.

2. E-Learning in India

The Indian Ministry of Education has launched various programs to promote "learning by all, with all, and for all," leveraging televisions, smartphones, and internet access to support equitable education ^[15]. The DIKSHA (Digital Infrastructure for Knowledge Sharing) program provides QR-coded digital textbooks for students from grades one through twelve. The PM e-VIDYA program, initiated in 2020, aims to develop digital content for visually and hearing-impaired students and offers radio/podcast resources. The SWAYAM platform, introduced in 2017, provides Massive Open Online Courses (MOOCs) across various disciplines ^[16]. SWAYAM PRABHA offers educational content via 34 Direct-to-Home (DTH) channels with multiple daily broadcasts. The e-Pathshala portal provides instructional materials in various Indian languages and English ^[17]. The National Initiative for School Heads and Teachers' Holistic Advancement (NISHTHA) offers training for high-school teachers nationwide, supported by the National Digital Educational Architecture (NDEAR) ^[18, 19].

3. Medical Education and E-Learning

Research on e-learning in medical education highlights its effectiveness compared to traditional methods, improving student learning and retention. Online learning methods are favored for their accessibility, interactivity, and flexibility but are generally seen as complementary to face-to-face instruction, often forming part of a blended learning approach ^[20-25].

Based on the type of interaction between the teacher, learner, and content, a variety of online communication and content creation tools are available to suit different needs:

Table 1: Type of Interaction and Corresponding Online Tools ^[26]:

Learner-Content:	Online videos, PowerPoint presentations, virtual simulations, webcasts, webinars, and video conferencing.
Learner-Teacher	Online lectures, seminars, discussions, e-portfolios, and emails
Learner-Learner	Social media platforms (such as Facebook, WhatsApp, YouTube), online seminars, and group work

Depending upon the nature of media and interaction required different online teaching learning tools are as summarized below and can be used in medical education

Table 2: Application of online learning tools in medical education-
Adapted from accessed on 30.04.2023 ^[27]

Purpose	Tool	Application in medical education
record both your screen and webcam	Loom	PPT recording with voice over
to record live lectures in the classroom.	Lecture Capture	Lectures /demo /clinicsl teaching recording
Share videos, generate embed codes, including YouTube Live stream	YouTube / YouTube Live- Vimeo	All procedural, communication related videos - with checklists Can be used to practice and formative assessment
audio recordings	Sound Cloud	Heart sounds, breath sounds - normal and abnormal -practice
video discussion platform	FlipGrid	Case presentations, discussions , AETCOM sessions -formative assessment,virtual patients
flashcard application, Quiz, gamification	Quizlet ,Quizizz, ANKI ,Kahoot	Practice, SDL, formative assessment
Interactive presentations, collaboration boards with multimedia links to add	Nearpod, Peardeck ,Padlet	Case discussions,virtual patients , differential diagnosis, treatment planning ,formative assessment
Live poll, during /in PPT	PollEverywhere, Mentimeter	Informal assessment
Mind mapping tool	Coggle ,webjet	Differential diagnosis/ , summary
Video conferencing tools	Zoom or WebEx. Skype	Live seminars, case discussions, simulations , student seminars ,formative assessment

In addition to tools offered by Google and Microsoft, various other compatible resources are available for content creation, storage, sharing, live streaming, and video conferencing. Google Classroom, for example, is extensively used for managing educational activities, including lectures, notes, assignments, and feedback.

4. Medical Education and E-Learning in India

With the implementation of Competency-Based Medical Education (CBME), Indian medical graduates are expected to fulfill roles as clinicians, leaders, communicators, professionals, and lifelong learners. Online methods are particularly effective for teaching medical knowledge, including aspects such as history taking, physical examination, diagnosis, and referral, which can be supported by a blended learning approach incorporating flipped classrooms.

The structure of healthcare settings and operational systems can be understood through materials provided by educators or resources available on government and educational websites. Health promotion, disease prevention, and quality improvement in healthcare can be enhanced through group discussions, online projects, and collaborative tools.

Professional skills such as humane, ethical, empathetic, and trustworthy communication with patients and families can be developed by recording patient interactions. These recordings can be used to analyze performances, provide feedback, and facilitate discussions, serving as valuable learning resources through observation, reflection, and self-assessment. Students can independently practice and monitor their progress.

For self-assessment, continuous learning, skill refinement, and critical evaluation of literature, online tools and resources are essential to keep pace with the ever-expanding medical knowledge base. The introduction of CBME, along with foundation courses that include computer skills and online learning modules, aims to enhance digital competencies among learners, enabling them to access, evaluate, and apply information effectively.

The National Medical Commission (NMC) promotes both synchronous and asynchronous online learning in a blended format to teach procedural skills, humanities, and communication skills. Furthermore, the NMC recommends various assessment formats, including multiple-choice questions, extended matching questions, audiovisual stimuli (e.g., clinical photographs, X-rays, and auscultation sounds), simulations, electronic patient management problems, virtual patient scenarios, and electronic portfolios ^[28]. These methods offer diverse ways to assess students online.

Although online learning and assessment show promise as complementary to traditional face-to-face methods, challenges remain regarding infrastructure, faculty and student training, content standardization, and the validity, reliability, cost-effectiveness, and acceptance of online assessments. The educational impact of emergency online learning and assessment, introduced during the pandemic, varies and must be critically evaluated.

III. ORIGIN AND INITIAL EXPERIENCE

Current literature on the topic- pros and cons or merits and demerits & Results of previous studies abroad-

For the review of this topic, all studies are from 2019 onwards and can be considered current as the pandemic situation leading to a complete lockdown of global activities is never experienced. the search engine results were collected, reviewed, and sorted as per inclusion and exclusion criteria and the studies considered for review are discussed region-wise for ease of analysis.

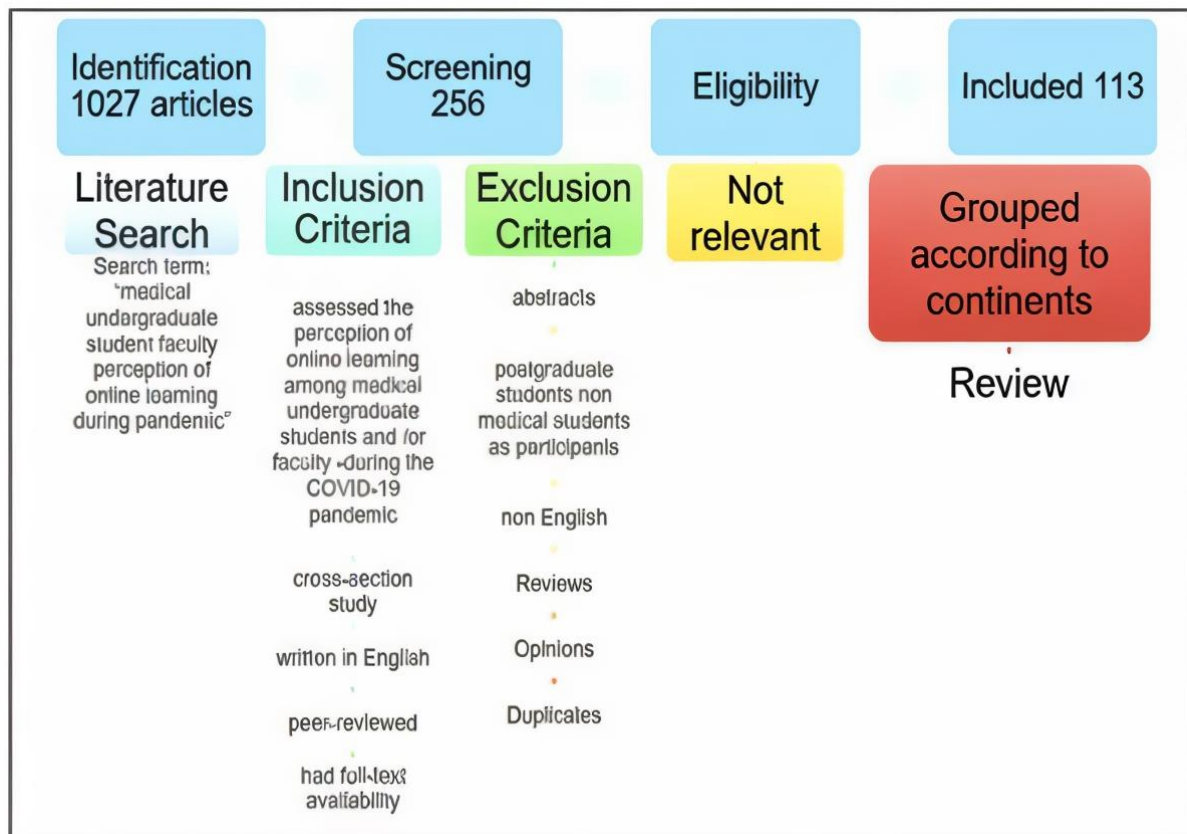


Figure 3: flowchart to show screening and selection of articles for review.

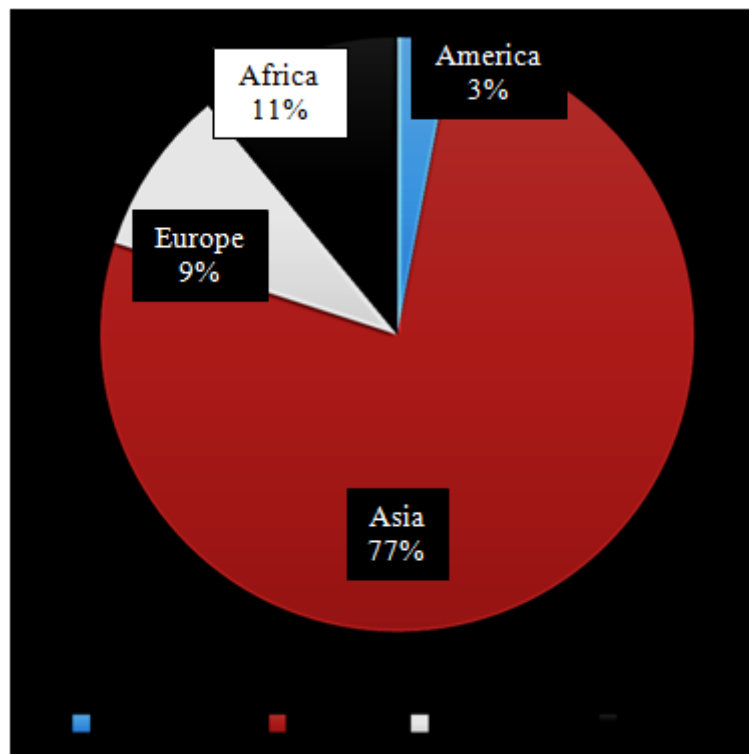


Figure 4: showing proportion of articles used for review.

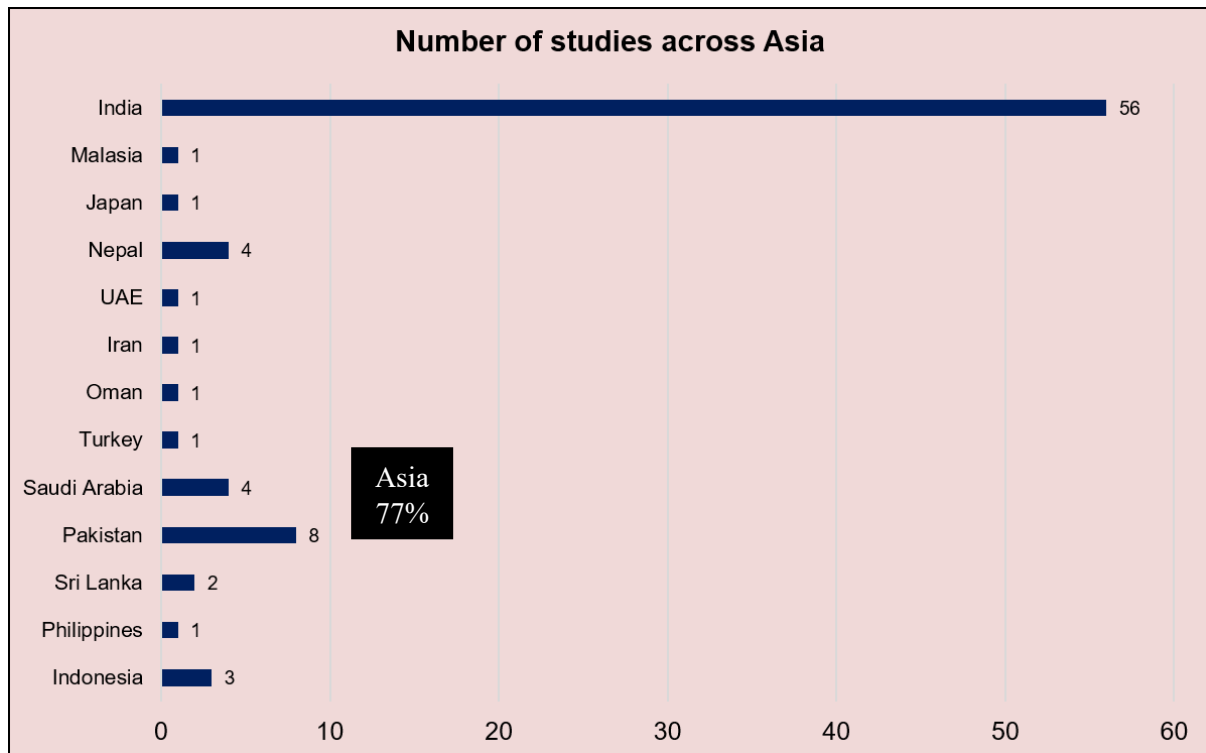


Figure 5: shows country wise number of articles for review in Asia region

Table 3: shows region-wise [continents] Methodology and Participants specifics used in studies

Region	Total	Methodology					Participants		
		cross-sectional study	Focused interview	mixed	Narrative writing	Case study	Students	Teachers	students and teachers
America	04	4	0	0	0	0	3	0	1
Asia	88	84	3	1	1	1	69	8	11
Europe	10	7	1	2	0	0	6	0	1
Africa	11	11	0	0	0	0	10	1	1

Table 4: Details of studies reviewed in American countries

	Author	Country	Sample size & characteristic	Study type	Main findings/ feedback given
1	Moya-Salazar 2022 [29]	PERU	Universidad Nacional Mayor de San Marcos (UNMSM) and Universidad Nacional San Luis Gonzaga (UNSLG) 325 students	a cross-sectional study survey student attitudes about virtual education, platform (interface and security), eLearning in medicine	Virtual platforms were found to be effective, though there were gender differences in access. 73% of UNMSM students were unfamiliar with virtual platforms before the pandemic. 81.7% of students were opposed to paying for online classes. Positive feedback was received for recorded lectures and lesson organization, although the latter was less favorable A significant portion felt that virtual learning negatively impacted their academic performance, with differences observed between UNMSM and UNSLG in perceptions of exam fairness.
2	Faiz Tuma et al 2021 [30]	USA	636 students 81 instructors	Survey- Cross-sectional Study Mentions changes in T-L	33% of students and 51% of instructors believed online education was on par with or better than traditional methods. - Challenges such as technological issues, unreliable internet, and fatigue were reported by 69% of students and 51% of instructors - Instructors were generally more positive about online teaching compared to students, who showed less enthusiasm.
3	Chakladar et al(2022) [31]	US	300 students	Surveyed	77.2% felt that course content was effectively delivered online. - 60% were content with the adaptations made by instructors and institutions. A large majority experienced Zoom fatigue. 44% of clinical students felt their training would suffice for residency, but 54.7% observed a decline in the quality of clinical and small-group training. Many reported increased levels of depression, anxiety, and diminished confidence in their future careers.
4.	Maximilian Servin Rojas (2022) [32]	MEXICO	671 students last year	cross-sectional study Virtual rotations	95% of students agreed on the importance of clinical rotations for their training. 72% experienced cancellations, and 27% had their rotations moved online. Private school students were less affected by cancellations and had better access to virtual training compared to public school students. 80% felt their clinical training was inferior compared to previous batches, and 82% wanted to redo their training. 96% believed the changes would impact their future training and internships

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Based on the reviewed studies, students generally view e-learning positively, appreciating its effectiveness, flexibility, and the variety of tools available. Recorded lectures were particularly favored as valuable resources. However, students have also highlighted several challenges, including insufficient training for both teachers and students, security concerns, perceived unfairness in exams, and platform costs. Variations in training exposure between private and public institutions, as well as differences in prior e-learning practices, have also been noted.

Recommendations from these studies suggest the development of educational platforms tailored for virtual medicine, emphasizing self-learning and self-management. It is crucial to ensure high-quality audiovisual materials and reliable internet access, along with engaging student activities and content organization suited to each subject. Additionally, measures should be implemented to support the psychological and physical well-being of students during and after the pandemic ^[29-31]. The cancellation of in-person clinical instruction has significantly affected final-year medical students, many of whom would consider repeating their final year to make up for lost training. Virtual or simulation-based instruction has been found beneficial for clinical training ^[32].

Table 5: Details of studies reviewed in EUROPEAN countries

Sr no	Author	EUROPE	Sample size characteristic	Study type	Main findings/ feedback given
	Roberto De Ponti 2020 [33]	ITALY	115 students	survey Change to virtual patient-based training,	A shift to virtual patient-based training was well-received, with 90% of students reporting a positive experience with virtual reality training. The structured format was appreciated by 93%, and 77% found it realistic for initial clinical assessments. The tool was deemed useful for diagnosing (94%) and prescribing treatment (81%). However, 28% of students reported technical difficulties.
	Emmanuelle Motte-Signoret et al (2021) [34]	GERMAN FRANCE	146 Students 26 teachers	cross-sectional survey-	Prior to lockdown, online teaching was rarely used. Students preferred live classes, but 89% agreed that online learning was appropriate during the pandemic. Both learners (58.6%) and teachers (69.2%) felt that the quality of training was reduced. About one-third of participants supported blended learning.
	Danica Rotar-Pavlic [35]	Slovenia	16 students interviews	questionnaire was developed, focused interview a qualitative study four categories summarizing 1) technical issues, 2) organization of distance-based education, 3) social exclusion of students, and 4) suggestions for improvement.	Four key issues were identified: technical problems, organization of distance education, social exclusion, and suggestions for improvement. Challenges included tool literacy and issues with live class tools like Zoom and Webex. Advantages noted were flexibility, time savings, and the usefulness of recorded lectures and patient videos.

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	Ernest Z. 2022 [36]	IRELAND	175 students	Cross-sectional survey	Tutorials and problem-based learning (PBL) were seen as the most effective teaching methods (53.1%), followed by laboratory and clinical placements (44.6%) and hybrid learning (48.6%). Reactions to educational changes were mixed: 40.6% were happy, 38.8% were neutral, and 20.6% were unhappy. Most students felt that the pandemic negatively impacted their mental health (55.8%). About 58% used campus support services, with 49% satisfied with the services provided.
	Kui A 2020 [37]	ROMANIA	459 students 231 and medical 228 dental	A questionnaire containing regarding the online educational process implemented during the pandemic period.	Acceptance of remote lectures was noted, but 80% preferred face-to-face activities, especially practical and clinical sessions. While 67% found online activities useful and desirable for the future, 50% experienced difficulties communicating with teachers online. Many students preferred to resume traditional activities as soon as possible.
	Dost S 2020 [38]	UK	2721 medical students 68% females 32% males across 39 medical schools	Cross-sectional, online national survey. 40 medical colleges in UK. Changes in TL methods mentioned	Screen time increased from 4-6 hours per week to 7-10 hours per day for 29% of preclinical and 20% of clinical students. 42% reported that colleges adapted by introducing new resources or modifying existing ones. Although 66% agreed that teaching followed the preset curriculum and 60% found it interactive, engagement and interaction did not meet expectations. Many stressed the necessity of patient contact learning in clinical education, which online training could not fully replace. Advantages included time savings and a less intimidating environment, while limitations included distractions, space issues, and internet reliability.
	Wurth et al 2021 [39]	SWITZERLAND	467	Mixed method - phenomenology - 75 items mixture of open-ended and closed questions - to know impact of the crisis on personal life, on training, professional identity, level of stress, coping strategies	58.8% reported feelings of isolation since the pandemic, with coping strategies including physical activity and increased communication with loved ones. Negative impacts included decreased motivation and distractions at home. However, 72.5% participated voluntarily in COVID-related activities, which had a positive impact on their clinical exposure, stress management, and professional identity.

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	Virumbrales M et al 2022 [40]	SPAIN	244 students	convergent mixed methods survey addressed One group with nine first- and second-year medical students and another group with 13 third-, fourth-, and fifth year medical students	Thirteen categories related to online learning were identified, including course planning, communication, and pedagogical coherence. Students reported good rapport with faculty during synchronous sessions on clinical cases, and concerns included learning outcomes, methodology, resources, assessments, and time management.
	Bączek et al. [41]	POLAND	804 Medical students	<i>Questionnaire-cross sectional study</i>	60% of students had no prior experience with e-learning, but 73% found it enjoyable. Advantages included access to online materials (69%), learning at one's own pace (64%), and staying at home (69%). Disadvantages included reduced interaction with teachers (45%), technical problems (54%), lack of patient interaction (70%), and poor home learning conditions (15%).
	Iskra Alexandra Nola et al 2021 [42]	Croatia	142 students- 4,5,6 th year	<i>Questionnaire for 28 items - six sub scales.</i>	Students' overall perception of distance learning organization was poor, while perceptions of the educational environment and personal academic achievements were positive. Differences were observed between year groups, with sixth-year students reporting higher satisfaction with teacher work and educational environment. Despite good equipment quality and internet connection, 47.9% felt teachers were not adequately qualified to handle online tools.

Students show positive opinion about usability of online medical learning, as supplement not replacement to onsite learning, except few ^[42] lacks the advantage of bedside teaching and hands-on training ^[36-38] simulated clinical scenarios with good perceived quality if online access to this virtual reality platform to all students is available ^[33], social isolation, technical problems, digital literacy and need for improvements in terms of coordination, communication, interaction and blended practice ^[35, 40].

Table 6: Details of studies reviewed in African countries

Sr no	Author	Country	Sample size Sample characteristics	Study type	Main findings/feedback given
1.	Agormedah et al. 2020 [43]	Ghana	467 Undergraduate students	survey	Approximately 24% of students were unaware of e-learning. A significant majority (76.7%) used mobile phones for e-learning, while 43.3% had a negative perception of online learning. WhatsApp was the preferred platform for accessing online materials. Most students (91.9%) had no prior online learning experience, and 85.2% reported unreliable internet access. Additionally, 67.9% faced difficulties in purchasing internet data, and many students were unprepared for online learning due to distractions at home.
2.	Tayem et al. 2022 [44]	Bahrain	559 students	cross-sectional study survey	54.6% of students were satisfied with distance learning, though 46.3% experienced lower motivation and 32.2% found it required more effort. Students preferred distance learning for theoretical content but favored face-to-face methods for practical components (73.3%). Interaction with instructors (45.6%) and peers (48.9%) improved, and 75.3% found independent learning beneficial. Online assessments were comfortable for 60.1%, and there was a positive impact on written (42.1%) and practical exams (46%), but not on professional skills grades (21.6%). WiFi availability and participation in college activities positively correlated with performance.
3.	Hassan 2022 [45]	Bahrain	42 faculty 97 students T-L Changes	descriptive, cross-sectional, survey	Both students and faculty believed that recent changes in teaching and learning (T-L) had a moderate to high impact on achieving clinical competencies. Faculty rated "Interpretation of investigations" highly (3.93 ± 0.84), while "Performing clinical procedures" received lower scores (faculty: 3.10 ± 1.21 , students: 2.57 ± 1.36). Students felt inadequately equipped to assess their own progress, contrary to faculty opinions.
4.	Mortagy et al. 2022 [46]	EGYPT	4935 Students	A 29-item online survey across 26	54.6% of students felt online education was less effective than face-to-face instruction. A significant increase in online study hours was noted. Online recorded video tutorials (63%) were considered most effective, followed by live tutorials (25%). Online question banks were valued by 13%. Advantages included comfort (21%), learning at one's own pace (14-16%), and cost savings. However, 23% experienced poor internet connections, 17% felt less motivated, and 18% perceived reduced communication.

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5.	Zalat MM, (2021) ^[47]	EGYPT	346 staff members.	questionnaire	88% of faculty agreed that technological skills enhance teaching. The usefulness of e-learning was affirmed by 77.1%, accessibility by 76.5%, and overall acceptance by 80.9%. Barriers included connectivity issues (40%), inadequate infrastructure (36%), lack of devices (32%), and technical problems (32%). Younger and male faculty members showed greater acceptance of e-learning.
6.	<i>Khadiga M. et al</i> 2022 ^[48]	EGYPT	99 students 5th year medical students	A cross sectional study	96% of students found online quizzes to be useful for identifying weak areas and self-assessment. The majority appreciated the flexibility and comfort of e-learning (78%) and found Moodle and Telegram user-friendly (84.8%). Interaction quality was nearly equal to face-to-face sessions (73.8%). Immediate feedback in online sessions was considered equivalent to face-to-face (89.9%). Blended learning was preferred for future education.
7.	Noha M Abu Bakr Elsaid 2021 ^[49]	EGYPT	340 students	cross-sectional study	63.8% of students had no prior online learning experience. Advantages of online learning included comfort (63.8%), a comfortable environment (52.1%), and access to materials (47.1%). Disadvantages included technical issues (67.6%) and reduced interaction with patients and teachers (58.8% and 48.5%, respectively). Despite these challenges, 77% found online learning enjoyable, though it was perceived as less effective than face-to-face learning for improving knowledge and skills ($p < 0.001$).
8.	AllamH, 2022 ^[50]	EGYPT	500 medical students	cross-sectional study. Questionnaire	Students found shared materials useful, but there was notably poor student-teacher interaction during online classes. 46.2% preferred physical classes, while 28% favored online classes, and 25.8% felt both methods were equally effective.
9.	Gismalla et al.(202) ^[51]	SUDAN	358 students	A cross-sectional survey	64% of students believed e-learning was the best solution during COVID-19. A significant correlation was found between students' opinions on starting onsite learning for clinical training and their level of medical education and place of residence ($p < 0.05$). Challenges included internet bandwidth and connectivity issues, unfamiliarity with e-learning systems, technical support limitations, and lack of face-to-face interaction.
10.	*Adeleke Victor Fasiku, 2021 ^[52]	NIGERIA	623 students from 33 institutions	online questionnaire	92% of students from private institutions and 21% from public institutions attended online lectures or tutorials. Among those who did not attend online classes, 30.5% opposed them due to internet cost/availability and perceived inefficiencies. About 65% were aware of student-organized online tutorials or seminars. 80% did not feel motivated and perceived their studies as less effective.

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11.	Alimah Komuhangi [53]	UGANDA	109 students	A cross-sectional study	65.1% of students adopted e-learning. Low adoption was observed among first-year students, those with low e-learning expectations, and those lacking confidence in using IT devices. High internet costs and lack of prior experience with e-learning were also significant barriers.
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At the time the questionnaire was administered, most institutions had not yet transitioned to online teaching. Among the 33 institutions surveyed, only 25% of public institutions had started online lectures, whereas all private institutions had implemented them (Adeleke Victor Fasiku, 2021) [52].

In African countries, challenges such as a lack of awareness and experience with online learning, high internet costs, and insufficient formal orientation and training in e-learning have been prevalent (Agormedah et al., 2020) [43]; (Noha M Abu Bakr Elsaid, 2021) [49]. Additionally, issues related to the availability of e-learning platforms and internet access have contributed to largely negative perceptions of online learning (Gismalla et al., 2021) [51]; (Adeleke Victor Fasiku, 2021) [52]. Recommendations suggest integrating online teaching with face-to-face instruction to address these challenges effectively (Tayem et al., 2022) [44]; (Hassan, 2022) [45]; (Noha M Abu Bakr Elsaid, 2021) [49]; (AllamH, 2022) [50]

Table 7: Details of studies reviewed in Asian [excluding India] countries

Sr no	Author	ASIAN	Sample size Sample characteristics	Study type	Main findings/feedback given
1.	Dina Qurratu Ainin1 (ICME 2021) [54]	Indonesia	260	cross-sectional study	students' experience was significantly associated with online learning behavior during pandemic and their online learning behavior was associated with perceptions of online learning
2	Hendriati1 Muhammad Syauqie 2020) [55]	Indonesia	64 clinical Ophthalmology	Qualitative	most students concur -to get it learning objective in online learning. face-to-face strategy was more compelling, particularly in clinical skills, students preferred online and offline mixed learning. well-prepared the instructive video were appreciated and found to be assets for securing clinical aptitudes, well-understood and the instructive video makes a difference
3	Dewi L 2022 [56]	INDONESIA	286 students,	questionnaire	In-spite of Favoured online learning experiences, learning motivation was inclining towards lower inspirations.student effortlessly lose center amid online session. Most students more over seen that online learning is less successful compared to confront learning on site
4	Baticulon et al. (2020) [57]	Philippines	3670 Medical students	Questionnaire	Students preparedness for online learning (41%) Technological issues, Trouble altering learning styles, Having to perform duties at domestic Poor communication between teachers and students were reported

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5	Anuradha Baminiwatta (2022) [58]	SRI LANKA	644 students	survey	Patient availability (mean = 7.08), psychological assessment (mean = 6.3), counseling (mean = 6.2) and diagnostic knowledge (mean = 5.9) were more affected, while peers assisted learning were more affected (mean = 5) has been reported. As compared to self-study (mean = 3.6) are relatively low. The impact on the clinical part of the final exam (mean = 6) is higher than the theoretical part (mean = 4.5). clinical competencies involving, training of examination, diagnosis were affected largely
6	Nafrees et al. 2020 [59]	SRI LANKA	310 A random sample		Online content met expectations (56.5%) Increased workload Students satisfied with supportive environment Insufficient study opportunities (20%) Students received timely feedback from their teachers (59.8%)
7	Shahzaib Maqbool 2022 [60]	PAK IRAN	402=202+200	This cross-sectional questionnaire-based study	Students are familiar with secondary IT skills. Approximately 75.8% of students have no previous e-learning experience. The advantage of e-learning is to stay at home and study on your own and access information online. Problems of learning without interaction are the most negative of face-to face learning in terms of increased knowledge, skills and relationships and is considered a genre best studied by Pakistani and Iranian students. The effectiveness of face-to-face learning is significant (p-value = 0.019). Acceptance of e-learning was better with Pakistani students, 51% students rated e-learning as fun.
8	Syed TP, 2021 [61]	PAKISTAN	93	DREEM survey	The mean total DREEM score was calculated as 119.85 ± 37.86 . It's better, but it has a high standard deviation. Students give their teachers the lowest score with an average of 55%. Self-learning was given the highest score, 65.06%. Open-ended responses were divided into five points, and only nine students reported positive online learning experiences. Most students rated the learning environment as good but did not like online classes, should improve teacher- student relationships and include new online teaching methods.
9	Mukhtar K, 2020 [62]	PAKISTAN	- 12 faculty members and 12 students	qualitative case study	Convenience, distance learning, interaction, ease of management, accessibility, time place convenience, student-centeredness, self- and asynchronous learning are strengths Constraints of e learning were-Hands-on training is ineffective. Teaching approval and reduced monitoring of learning and self regulation. Need for- Teacher development programs, inclusion of CBL, review of courses, appropriate integration of tests, enhanced supervision for conducting assessments

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10.	<i>Narmeen Ahmed</i> 2022 [63]	ZIA UNIV PAK	45 FACULTY	online questionnaire cross-sectional strategies online and recorded lectures and e-PBLs.	49% faculty participants agreed that online teaching provides rich learning and is an effective teaching method. 55% said it causes academic conflict and students. 38% said online training must standardize the content and helped develop an assessment process, but more than 90% said it was a cumbersome process that required professional education, training and technology systems designed to be effective.
11	Ansar F, 2020 [64]	PAKISTAN	600. Students Zoom classes	A cross-sectional descriptive study	78% of students are not interested in learning online. Students also expressed concerns about the assessment process, student-teacher communication, fair examination, and difficulty in understanding the content. Most students preferred classroom education and 81% of respondents do not want to learn more online.
12	Wahad Khan 2023 [65]	PAKISTAN	368 faculty	cross-sectional study	Zoom was the most used software (69.0%). E-learning is a useful tool in medical education 56% 35% disagree with using e-learning instead of traditional 30% of respondents oppose changes. 46% of respondents believe that technology background is important for the success of e-learning. However, they think it is needed because the system is suitable for interference-free use.
13	Sarfraz, M. 2022 [66]	PAKISTAN	517 students' responses 88 teachers' responses	cross-sectional study	Students' readiness for online learning leads to a positive learning perceptions and learning outcomes. The HLM results also support the positive impact of online teaching preparation teachers on medical students' understanding of online learning and learning outcomes; that is, when students' experience of understanding online learning and teachers' readiness for online teaching are high, their learning outcomes are also high.
14	Abbasi et al. 2021 [67]	PAKISTAN	382 Students	cross-sectional study	Using mobile devices for online learning [76] Insufficient understanding of online learning (77%) Inadequacy in online learning (69%) Low attractiveness of online learning for practical content Less teacher-student interaction
15	Khalil et al. 2020 [68]	SAUDI	60 students	cross-sectional study	Interested in learning theoretical concepts and online meetings, can return to watch recorded lessons, - flexible. saves travel, asynchronous self-study, Limitations -long teaching hours, no direct communication with teachers and classmates, patients slow internet speed, lack of distraction at home loss of concentration.

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16	<i>Arain SA, 2022</i> [69]	SAUDI	209 students and 13 faculty members	cross-sectional study,	30% of students satisfied - high achievers - not satisfied (35%) Reduced opportunities for teacher student interaction. Small group discussions improved learning (53 %), blended learning was the most preferred teaching method (43%), and 46% of teachers were satisfied with the online experience. Most people found virtual apps easy (77%). Conversely, few teachers engage in positive interactions (54%), while 69% prefer mixed models.
17	<i>Pauline Dergham, 2023</i> [70]	SAUDI	563	A cross-sectional study	significant increase in hours devoted to online learning. Lectures/lectures delivered live on the Zoom website showed the highest participation rate compared to previous lectures and course materials published on Blackboard. Online teaching is not as good as face-to-face teaching. 17% of students reported poor understanding via online PBL. More than 50% of students revealed that online theoretical lectures are as good as classroom or better. 70% students said they could not learn clinical skills and also hampered students' physical well being (80%). Impacts were higher on pre-clinical students' health and social life than on clinical. Student online accessibility of materials Vs internet connection
18	<i>Joji et al. 2022</i> [71]	ARABIAN GULF	168 STUDENTS 7 FACULTY	Questionnaire and, FGD for students and faculty separate	Preference to face-to-face 50.6% was more than 30.4% of online labs, faculty, 85.7% preferred onsite mode of teaching. 100% faculty disagreed labs skills can be taught online for microbiology Both faculty and students hold that a blended mode is vital and indispensable for the transfer of skills and knowledge for microbiology students.
19	<i>Kemal Emre Özen1 (2022)</i> [72]	TURKEY	355 students	online questionnaire	The results showed that face-to-face theoretical anatomy learning was better than tele-anatomy learning using video recordings. cadaver and laboratory education has been disrupted, spent more time on supplementary resources for anatomy education.
20	<i>Firdous Jahan, 2021</i> [73]	OMAN	Ninety-one students	A cross-sectional study	27.5% of the students are in the 6th grade and 72.5% of them are in the 7th grade. Overall, 69.2% of students had no problem logging in/registering in GoToWebinar. A significant statistical difference ($p < 0.001$; 95 % CI: 0.34-0.91) was observed between 6th year (mean-2.79±0.62) and 7th year students (mean- 2.16±0.51). Medical students at the medical level are independent learners, but they need in-depth learning through advanced hands-on practice.

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21	Rokhgireh S (2023) [74]	IRAN	130	cross-sectional study	Increased learning, home is the preferred place, 66.9% were of opinion that Distance e-Learning was not an appropriate method for learning basic clinical skills & 69.3% strongly agreed or agreed that because of distance e-Learning theoretical knowledge can be gained to medical practice.
22	Alsharif MHK, 2022. [75]	UAE	666 students	a cross-sectional, mixed-methods 14 schools Questionnaire & Delphi Technique-faculty 14 anatomy	Less than half (41.74%) stated that they could talk to the teacher more comfortably and easily than face-to-face. described issues and received recommendations for improving online teaching, including staff development, technology support, appropriate software to increase student engagement, and classroom improvements to adapt to the same environment. They also recommend steps to improve the design and development of tests and eliminate fraud, train employees, and choose the right software. As a result, student and instructor experiences with e-learning in Anatomy are generally positive.
23	Khatri, S(2021). [76]	NEPAL	300 students	cross-sectional research design.	Good attitude towards online courses. Online education is considered good as it provides convenience and convenience to students. Also, teachers plan study time appropriately, encourage students to be interested in learning, and emphasize learning for students. However, due to the lack of education and knowledge of modern information technology, students are not interested in online teachers.
24	Sarraf DP [77]	Nepal	158 faculties	semi-structured questionnaire,	10.13% of teachers received training in planning and/or conducting online teaching and learning. 84.18% of the teachers encountered learning and internet problems. The best is "not limited by time and place" ,94.3% of them had positive perception . Slow internet (91.77%),no interaction with students (82.%) and electricity interruption (82.91%) were the most common perceived barriers to online teaching learning. Recommendations -to provide uninterrupted internet connection and power connection, online education platform and timely support.
25	Manandhar et al. 2021 [78]	Nepal	273 students	cross sectional study	Technical difficulties, lack of interaction with teacher and patients, to be addressed for improving e-learning. 83.9% believe that traditional teaching methods are the best and can increase knowledge by developing e-learning to improve teaching.
26	Gupta et al. (2020) [79]	NEPAL	769 students	Cross-sectional	Use a smartphone to access online material No prior experience with online learning (89.2%) Unreliable internet access (31.2%) Distracting, Faculty not trained for online Practical and simulation are not good Recommend alternative effective educational tool. system upgrading, capacity building of the student-teacher ,training on online class is required for course recipients and providers.

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27	Suzuki, T 2022 [80]	Japanese	13 medical students and five medical students from Slovakia, Norway, and Hungary.	snowball sampling method IN DEAPTH INTERVIEW.	The thematic research uncovered four themes representing the advantages and disadvantages of online medical education: time savings and flexibility; skills problems and lack of skills, poor teaching, lack of experience in medical school, and lack of good insurance often miss out on activities they love at university.
28	Siti Yusrina Nadiyah Jamaludin Mohd Salami Ibrahim 2022 [81]	Malasia	6	online Padlet platform their reflective writings thematic synthesis	The analysis revealed four themes. While "adaptation and flexibility" emerged as the main theme, it was followed by "bad education", "bad education" and "policy and support". Education for teachers about collaboration, planning to avoid excessive and frequent online classes, supporting private home learning centers, family involvement to reduce low impact, and students' access to good technology and software. Engineered solutions for cost-effective and reliable Internet connections are aimed at long-term educational goals that address the in variance of tacit learning lost in transition.

Asian countries have contributed maximum to the studies conducted on perception of students and teachers in Covid times, reason could be geographically large countries, populated and with variety of economic prosperity. The positive and negative aspects of e learning are reiterated in these studies with major stress on need provision of sound technical support and internet ^[64-69] of training for students and faculty for new digital skills and skills to make learning more interactive, some studies stressing on quality assurance and efficacy of online learning ^[77].

IV. IMPLEMENTATION IN THE INDIAN SITUATION

If already done, where and what are the results, if not, what are the constraints; how can we implement

India has conducted maximum number of studies on perception of students and faculties on eLearning during Covid. Among Asian countries as shown below –

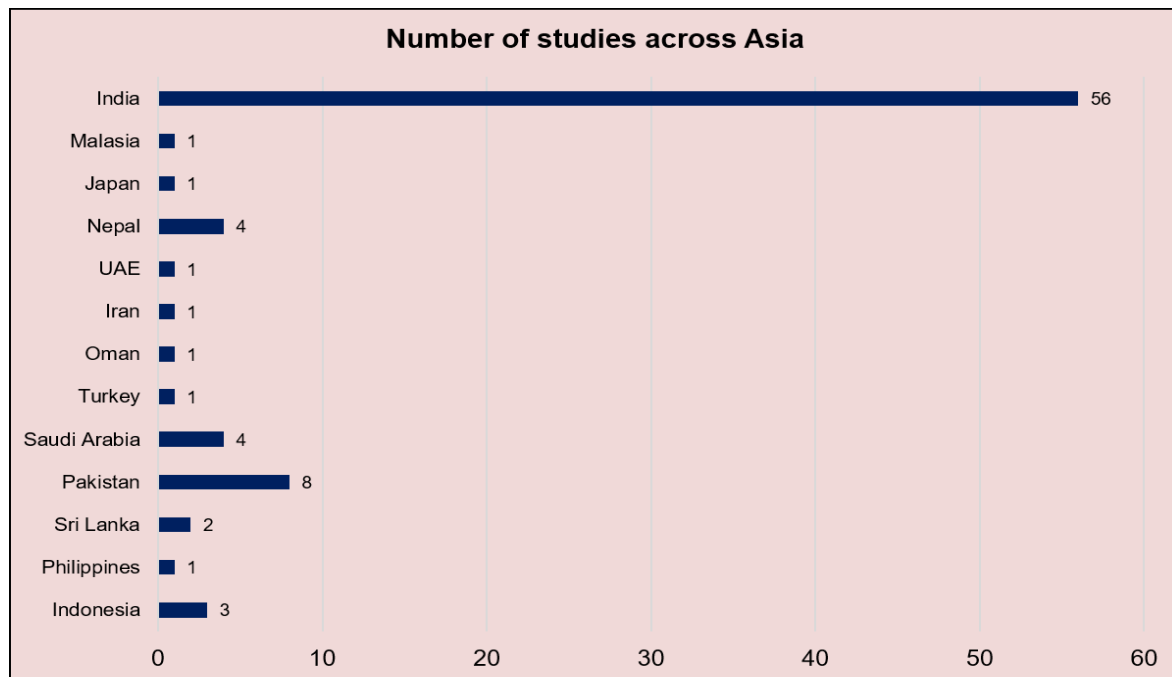


Figure 5: shows country wise number of articles for review in Asia region
Commonest used methodology among these studies was a cross sectional questionnaire based studies, covered mainly students as participants

Table 8: Methodology and Participants specifics used in studies in India

India	Methodology		Participants		
Total studies	cross-sectional study survey	Narrative writing	Students	Teachers	Both
57	56	1	46	6	5

Table 9: Details of studies conducted in India are as

	Author	Sample size Sample characteristics	Study type	Main findings/feedback given
1.	Guruprasad KG 2021 ^[82]	150 students 30 faculty.	questionnaire	Students performed similarly in both online and face-to-face sessions. Face-to-face teaching effectiveness depended on class participation, while interactive learning was influenced by discussion paper submissions. There was a notable gap in comprehension scores between teachers and students. Recommendations Online teaching can complement offline teaching effectively, depending on learning styles, delivery methods, and cost considerations.
2.	Singh VP 2022 ^[83] .	877	questionnaire with 13 items - on lectures	Students preferred learning through lectures and teachers' experiences. The study indicated a need for improved teacher education, better audio-visual tools, and new engagement tools in classrooms.
3.	Susheela Rana	100	questionnaire of 25	E-learning was extensively used during COVID-19, positively impacting first-year subjects like

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	2021 ^[84]		questions	anatomy. No significant gender differences were observed ($p>0.05$).
4.	Kranti Tekulapally 2021 ^[85]	279	questionnaire containing 20 questions	69% of students used smartphones for online work. Issues included internet connectivity problems, with 42% of students preferring online learning. Content comprehension and knowledge were rated as average or above average by 59% and 53%, respectively. - **Limitations:** Problems included long screen time, reduced entertainment, health issues, poor communication, and limited medical knowledge
5.	Della, 2023 ^[86]	150 Students	A cross sectional study	20% of participants found online learning ineffective for medical subjects, while 60% experienced stress. Most students had their own devices, but 14% shared them.
6.	Divia Paul 2022 ^[87]	100 anatomy teachers	survey	Issues included unstable online environments (47%), unfamiliarity with online tools (26%), and insufficient training (17%).
7.	Goel& Kaur 2021 ^[88]	131teachers	cross-sectional study questionnaire	53.4% were female; 33% found online tools easy to use, 35% felt adequately skilled, but 44.3% desired further training. 67.2% of faculty preferred traditional teaching over blended modes post-pandemic.
8.	Kalpana Ramachandran 2021 ^[89]	122 students	cross-sectional descriptive questionnaire based study	78% found online learning interesting and enjoyable. 80% found online education satisfactory, although internet connectivity was a major challenge.
9.	Nimarpreet Kaur 2020 ^[90]	983 students	cross sectional survey	Online classes were deemed equally effective but not superior to traditional teaching methods. Students were generally dissatisfied but accepted online teaching as a necessary alternative.
10.	Vibha Rani 2021 ^[91]	128 mbbs 100 dental students	cross-sectional and questionnaire	Zoom was the most popular platform. 53.9% of students found online courses non-interactive, and 75.8% preferred the college environment over home. - **Recommendations:** Improve management systems and evaluation methods, and provide adequate training for both teachers and students.
11.	Ishita Jana, 2022 ^[92]	199	A questionnaire	41.4% valued time and resource savings. Technical difficulties and student responsibility were significant issues. Academic integrity in online assessments was questioned, and online classes were seen as a supplement rather than a replacement for practical sessions.
12.	Nisha Dabhi ^[93] ,	101 faculties participants	observational cross-sectional study questionnaire	46% wanted to limit online teaching to the COVID period. 71% felt more training and better infrastructure were needed for online learning. 84% believed online teaching had a limited role in medical education.
13.	Susheela Halemani ^[94]	Students 387 46 reachers	Cross-sectional questionnaire	Offline classes were preferred over online across multiple variables, with significant gender differences noted ($p \leq 0.05$). Most participants favored traditional classrooms
14.	Vanita Panchal 2022 ^[95]	710 medical students	Cross-sectional questionnaire	Benefits of online learning included studying at home (80.1%) and accessing online information (59.2%). However, skills development in patient interaction (66.8%) and interactions with teachers and peers were negatively affected.

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15.	Rajiv Arora 2023 ^[96]	600 MBBS	Cross-sectional questionnaire	Teachers struggled with explaining concepts and controlling discussions, while students had issues with listening and internet access. Online teaching was considered suitable for theory but inadequate for clinical skills.
16.	Hulke SM 2022 ^[97]	43 number of faculty and 156 number of students.	Cross sectional questionnaire based	Students faced more issues with technical problems and lack of face-to-face interaction compared to faculty. Both groups preferred Google Classroom and had concerns about assessment and interaction.
17.	Krishna Prakash Joshi, 2020 ^[98]	107. faculties	Cross sectional questionnaire based	56% of teachers were well-versed in online teaching before COVID. While 52% had a positive attitude towards online teaching, 95% preferred face-to-face instruction as it is considered better for medical education.
18.	A Yadav 2021 ^[99]	30 teachers	Cross sectional questionnaire based	53% of teachers had a positive view of online teaching but preferred traditional methods. Challenges included network issues and lack of student engagement, with online teaching accepted as a temporary measure during COVID-19.
19.	Praveena Daya A 2022 ^[100]	Anonline- based cross- sectional study w	MBBS, 574	Traditional teaching was found to better improve critical thinking, social interaction, and collaborative learning. Online teaching was beneficial for a comfortable learning environment but faced issues like technical difficulties and lack of self-motivation.
20.	Punathukandi S2022 ^[101]	cross-sectional study	400	oom was commonly used. Concerns included lack of clinical exposure and communication issues. Students preferred traditional education due to these limitations
21.	Shikha Gautam 2021 ^[102]	cross-sectional	91 respondents.	84.6% found online teaching beneficial for learning Physiology theory, but only 43% found online practical sessions useful. Issues included internet connectivity (39%) and device accessibility (51.6%).
22.	Shipra Jain 2021 ^[103]	148 students	Cross sectional Questionnaire	Mobile phones were the most used tool for online learning (86.48%). While online learning saved time (62.83%) and was suitable for homework (68.83%), traditional education was significantly preferred over online methods.
23.	Bhardwaj manisha ^[104]	340 (MBBS) of which 225 females.	cross- sectional survey	97.9% were familiar with e-learning; 55.3% had used e-learning platforms. Advantages included quick material sharing and flexibility, while disadvantages involved suboptimal practical training and lack of face-to-face interaction.
24.	Sonam Bhatia 2023 ^[105]	Students =123 faculty=27	questionnaire based, cross- sectional	Students rated offline instruction higher in motivation, discussion, clarity, and regularity of assessments. Both students and parents preferred offline teaching.
25.	T Suma Latha. 2023 ^[106]	80 faculty	cross sectional study	92.5% support the need for technical training before engaging in online teaching. A significant majority, 87.5%, believe that the absence of face-to-face interaction is detrimental, and 75% disagree with the notion that online teaching could replace traditional methods in the future. Concerns were raised about technology issues and the additional time required for online lesson preparation.
26.	Satabdi Sarkar 2022 ^[107]	263 students	A cross- sectional study	79.36% used smartphones and 81.34% utilized mobile internet for online learning. While 90% preferred traditional anatomy teaching, online

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				methods were favored for embryology, histology, and radiological anatomy. Major issues identified included internet problems (42.06%) and physical problems (34.52%), with a statistically significant increase in screen time observe
27.	Adchitre ^[108]	700 students	cross-sectional study	showed a split preference between online (47%) and traditional education (53%). Many students missed social interactions (72.4%) and experienced symptoms like eye strain, headaches, and fatigue (61.3%) due to online learning. Preferences for platforms included Cisco Webex (324 students), Zoom (123), YouTube (96), and Google (81). Concerns about online teaching included teacher compatibility and technical issues.
28.	Ramesh Kumar Verma, 2022 ^[109]	100 students	semi-structured questionnaire	while online teaching was viewed as comfortable and cost-effective, it was deemed unsuitable for clinical or bedside instruction. Barriers reported included family distractions, internet connectivity issues, physical discomfort, feelings of isolation, and reduced peer interaction.
29.	Asharani 2022, ^[110]	150 students	questionnaire based study	traditional teaching methods like lectures and discussions were preferred over online classes. However, online platforms were seen as the best option for maintaining engagement and safety during the COVID-19 lockdown.
30.	SRIHARSH A RAYAMI 2022 ^[111]	279 students	online cross-sectional descriptive study.	43.36% used mobile phones for e-learning, and 59.14% supported the future inclusion of e-learning. While 63.4% found online teaching accessible, only 50.15% considered it effective. Issues included a lack of co-curricular activities (63.5%) and difficulties in concentrating (58.7%).
31.	Maria Francis et al. 2022) ^[112]	336 medical 336 paramedical student	A cross-sectional study	students highlighted various health issues such as eyestrain, stress, depression, musculoskeletal problems, and weight gain due to virtual learning. The study concluded that virtual learning served as an alternative during the pandemic but lacked the benefits of traditional methods.
32.	Rao Lahiri 2022 ^[113]	821 STUDENTS	cross-sectional study- DREEM	revealed a significant increase in online course engagement ($p < 0.05$). Preferred platforms included YouTube (17.2%) and live teaching (8.9%). Internet connection problems (79.8%), family interference (37.9%), and unsuitable course hours (20.1%) were major concerns.
33.	Dutta 2021 ^[114]	1068 students	cross-sectional, questionnaire-based study	most students used mobile phones for online classes, first-year students showed significant dissatisfaction. The satisfaction index was 78.23%, with concerns regarding communication, interaction, practical learning, and technological issues.
34.	2021Rajiv Mahajan ^[115]	339 students Changes of TL method mentioned	Reflective narrative writing	the study discussed the effectiveness of online learning methods. Despite issues like poor connectivity and physical effects, students found a variety of learning materials helpful. The shift to onsite clinical training was deemed urgent.
35.	2021Ksheera ja Y, ^[116]	136 students	Survey (IT),	72.2% had computer access. For theoretical subjects, 54.8% found e-learning effective, while 25.25% saw benefits for clinical learning. Issues included lack of teacher and peer interaction (57%), connectivity problems (53.3%), and hardware/software issues

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				(45.2%).
36.	Kimi Soumya Padhi 2021 ^[117]	203 learners and 24 teacher	questionnaire-based cross-sectional study	34.5% of learners and 62.5% of educators preferred a blended learning approach. Challenges for teachers included network issues, difficulties in conducting practicals, and lack of controlled environments.
37.	Reddy pulluru 2021 ^[118]	113 MBBS	online survey	online streaming was less effective compared to recorded videos or voice-over PPTs. Preferences shifted towards traditional methods like chalk-and-talk teaching and practical sessions.
38.	Pokkuluri A et al. 2023 ^[119]	329 undergraduate students	Cross sectional study DREEM part students' perception of learning	revealed a perception score of 23.41 ± 4.61 , below the optimal score. Most students preferred face-to-face teaching and faced significant adaptation challenges to online learning.
39.	Hundekari (2020) ^[120]	295 student	questionnaire observational	showed a preference for onsite or blended learning over purely online modes.
40.	Bhandari S, 2021 ^[121]	680	cross-sectional study	72.5% found online classes satisfactory, though issues with internet connectivity and limited faculty interaction were noted. There was a desire for online classes to continue beyond the lockdown period.
41.	Vishwanathan K, 2021 ^[122]	465	DREEM	perception of learning (30.1 ± 6.3), perception of teachers (29.7 ± 4.6), academic self-perception (21.3 ± 4.9), atmosphere (32.5 ± 6.2), and social self-perception (18.7 ± 3.5). While 54.8% were satisfied with online modalities, there was a recognition of the usefulness of online learning during lockdown.
42.	Majumdar Biswas Mondal 2021 ^[123]	600	cross sectional study	41.7% used mobile phones, 33.3% used laptops, 16.7% used desktops, and 8.3% used tablets for e-learning. Only 10% preferred exclusive e-learning, with 50% favoring classical didactic methods and 40% preferring a blended approach.
43.	R K Gupta 2022 ^[124]	90 Students	Questionnaire perceptions for online clinical teaching module.	perceptions of online clinical teaching sessions were generally positive, noting good alignment with learning needs, interaction, and convenience. However, technical issues such as internet and audio quality were significant barriers.
44.	Vishwanathan K 2021 ^[125]	104 out of 160 faculty members p	cross-sectional online survey	70.2% used laptops and 24% used smartphones. Google Meet was the most favored tool. A majority (92.2%) were satisfied with the e-teaching methods and found them useful during the lockdown.
45.	Kumari A, 2022 ^[126]	501	cross-section study	30% liked the arrangement and content of online classes, though more than half were dissatisfied. Live online lectures were preferred, and many students desired a return to face-to-face or hybrid teaching post-pandemic.
46.	Mousumi Datta & Bhattachary 2021 ^[127]	115 demographics perception of online education..	cross-sectional study	while class preparation and teacher responsibility during COVID-19 were appreciated, effective student-teacher interaction and the overall effectiveness of online learning were viewed less favorably.

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47.	Tariq HAMEED 2020 ^[128] .	161 students	cross-sectional questionnaire -	general satisfaction with online classes in terms of frequency, organization, and content. However, dissatisfaction with the curriculum and teaching process was noted, with a preference for blended learning in the future.
48.	Manoj Kumar 2021 ^[129]	185 undergraduate	cross-sectional online survey	62.7% had internet access and 64.9% were comfortable with online communication. While 20.5% felt online learning was as effective as traditional classes, 80% preferred interactive sessions and proper breaks.
49.	Srivastava (2021) ^[130]	.97	questionnaire for anxiety levels and a modified VARK analysis to record changes in learning styles	Results showed that 43.3% of students experienced minimal anxiety, 31.96% mild anxiety, 10.31% moderate anxiety, and 14.43% severe anxiety. The study found that student-teacher interaction (80.41%), feedback (90.72%), and mentoring (81.44%) were seen as beneficial. Small group discussions were preferred, and students adapted to different learning styles suited for online education. Additionally, video calls and gaming were used to alleviate stress.
50.	Suryawanshi DM 2020 ^[131]	296 students	a semi-structured online questionnaire	Only 6.2% of participants were proficient in computer usage. The study found that 48.2% favored a blended teaching approach, while 71.0% preferred slide shares and YouTube videos. Barriers to e-learning included a lack of personal interaction with teachers (62.9%), internet access issues (23.4%), and inadequate hardware (18.5%).
51.	Singh KV et al. 2021 ^[132]	600 medical	descriptive cross-sectional study	The majority appreciated the time (58.8%) and location (62%) flexibility offered by online learning. However, 77.5% missed the engagement of collective learning. Issues noted included lack of concentration (59.7%), reduced understanding (51.0%), and decreased interaction (67.2%). Technical malfunctions and lesson material overload were reported by about two-thirds of the students, with 71.2% favoring blended learning as a future approach and 28.3% suggesting improvements in online education.
52.	Sharma V 2021 ^[133]	200 students	A cross-sectional study	medical students generally did not prefer online learning due to an unsatisfactory home learning environment and technological issues. Concerns included increased course duration and insufficient clinical exposure.
53.	Lyngdoh M 2021 ^[134]	166 students	A cross-sectional study	80% of students did not prefer online learning, citing difficulties such as connectivity issues and the belief that practical skills could not be adequately developed online. The study suggested providing students with better technology and support.
54.	Kuriakose A, 2022 ^[135]	672	questionnaire	The results indicated that 74% had a negative perception of online learning, with live lectures being the most favored online strategy. More than half (57%) of the participants felt that the quality of online classes needed improvement. Additionally, 75% reported health issues due to prolonged online sessions.

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55.	Shruti Bhargava 2020 ^[136]	Faculty 40	Cross sectional	Teachers viewed online lessons less favorably, although they acknowledged that these classes could not fully replace traditional classroom education post-crisis.
56.	Mahajan S 2021 ^[137]	50 faculty	Cross sectional	Most instructors were comfortable initiating webinars and using online applications, although they found webinars less comfortable compared to in-person classes. Issues included network problems and technical difficulties during online classes. Some students experienced difficulties, such as leaving and rejoining sessions and hesitating to respond to questions due to technical faults.
57.	Debnath 2021 ^[138]	1042 students	Questionnaire	The study found that 77% of students participated in online classes provided by their institutions. While many students showed interest in online learning via platforms like Google and Zoom, they felt it lacked adequate practical experience. The study suggested that blended learning could be a viable option beyond the pandemic lockdown.

During the pandemic, distance learning served as a substitute for traditional teaching but could not entirely replace it. Online education requires more engaging and interactive methods such as problem-solving exercises, quizzes, discussions, surveys, and polls to be effective. It is crucial for faculty to receive training in effective online teaching practices to ensure success. Key recommendations include upgrading infrastructure, providing hands-on training to boost technological skills, adopting blended teaching methods, and enhancing faculty training and skill development.

Overview -

Comparing the studies across different countries, some which need to be mentioned because of multi-centre studies, nationwide coverage or large sample size and good response rate are as

Table 10: studies with good sample

Dost S 2020 [38]	UK	2721 medical students, across 39 medical schools
Mortagy et al 2022 ^[46]	EGYPT	4935 students
Zalat MM, (2021) ^[47]	EGYPT	346 staff members.
Baticulon et al. (2020) ^[57]	Philippines	3670 Medical students
Nimarpreet Kaur 2020 ^[90]	India	983 students
Rao(Lahiri) P2022 ^[113]	India	821 STUDENTS
Dutta 2021 ^[114]	India	1068 students
Manna Debnath 2021. ^[138]	India	1042 students
Maximiliano Servin-Rojas ^[32]	MEXICO	671 students

Most of the studies were about the convenience, acceptance and to know the usefulness of online shared material or learning processes used. Few studies which gave details of strategic changes made in pandemic times and worth noting and implementing are as follow

Table 11: Changes in strategies approaches for online teaching learning

Author	Changes in TL strategies approaches
Faiz Tuma et al 2021 ^[30]	<ol style="list-style-type: none"> 1. Virtual lectures of 3 hours per day. 2. Virtual small group discussions for 2 hours per day. 3. A bi-weekly virtual open conference. 4. Bi-weekly formative assessments through multiple-choice questions (MCQs) and discussions. 5. Bi-weekly presentations of virtual assignments. 6. Clinical sciences were taught in 13-week blocks, with 5 hours of daily virtual lectures and 3 hours of virtual oral assessments and discussions every two weeks. 7. Combined virtual case discussions were held twice a week. 8. For final-year students, 3–5 hours of weekly virtual case presentations and discussions, along with bi-weekly MCQs-based discussions, were implemented. 9. Synchronous sessions used Free Conference Call software, while asynchronous sessions utilized Google Classroom.
Maximilian Servin Rojas et al (2022) ^[32]	The approach included virtual rotations.
Roberto De Ponti 2020 ^[33]	<ol style="list-style-type: none"> 1. Online training sessions involved simulated clinical scenarios with 21 patient-based cases, each lasting 2 hours, including introductions, virtual patient-based training, and debriefing. 2. Online training featured formal presentations and discussions of clinical cases. 3. Clinical scenarios were presented through simulations.
Emmanuelle Motte-Signoret et al (2021) ^[34]	<ol style="list-style-type: none"> 1. Slide-deck presentations. 2. Pre-recorded PowerPoint lectures
Dost s 2020 ^[38]	Pre-recorded tutorials and online flashcards were utilized. Live tutorials were conducted via online platforms by the school. The approach recommended team-based and problem-based learning through constructive discussions and reflection in blended formats and virtual consultations.
Hassan 2022 ^[45]	<ol style="list-style-type: none"> 1. Live online lectures and case discussion sessions. 2. Posting recorded lectures on Moodle® or OneDrive®. 3. Using social media platforms for information and material communication between students and faculty. 4. Online team-based learning tutorials. 5. Web-based clinical simulations (DxR®). 6. Online role-playing and clinical case discussions.
Narmeen Ahmedi 2022 ^[63]	Employed online and recorded lectures along with e-Problems-Based Learning (e-PBL).
Mahajan R 2022 ^[115]	Implemented 3-hour daily sessions consisting of interactive lectures, practical demonstrations, case discussions, AETCOM sessions, student seminars, and tutorials. Short videos of lab procedures and case-based clinical examinations were prepared and shared online.

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Most of students perceived face to face or blended learning preferable than online mode of learning [100,105,107, 110, 118,119 ,120 ,123, 128, 131-132]. Followed by synchronous live lectures [139], during covid and prior as well [140,141] few studies reported negative perception by majority [80%, 74%] of students to online learning [134].

In Other studies, online learning was reported of help due to flexibility in time, place of learning and online learning materials provided [84, 88, 89, 94,95, 104, 111,112,121, 144]

However, lack of Interaction [91,108,109,116] and technical errors, Internet connectivity [85-87, 103,106,112,113 ,124, 129] were noted to be prominent hindrances

Online learning though good for theory and conceptual understanding, it was perceived not effective for practical and Clinical training [96, 97,105,115, 124, 130,133, 138].

There was a great need felt by students for teacher Training [97, 106, 132, 142-144]. Though Students appreciated the efforts put by Teachers during pandemic for adjusting to new technology and supporting students [122, 125,127, 130, 145-151]

Teachers perceived and accepted online learning as a positive step in pandemic [125], studies reported that teachers satisfaction with interaction and administration of online teaching was not effective, technical errors and connectivity being main reasons [98, 99,115] and would want face to face teaching to resume [98].

Few studies addressed perceptions regarding online assessments as well, which highlighted the difficulties of online assessment as concerns about design and construction of assessment tools, professional skills assessment, student-instructor communication, fairness of examination [29, 44 , 48 ,64 ,75]

As mentioned in the introduction of e learning and medical education, application of pedagogical principles, content standardization, specific changes of teaching learning and efficacy of such teaching methods on medical skills and communication capabilities and quality assurance in the process of online teaching learning and assessment is the next necessary step.

V. CONCLUSION

American countries have a smaller number of studies as compared to Asian and European countries, could be because of large geographical areas, populated countries and variation in cultural context, health needs and economic developments. Students seem to have digital literacy and using e learning regularly on own or supported by institutes. Students are recommending the studies to know efficacy and qualities of e learning and assessments. European students and faculty also have the positive perception about e learning, stressing the improved interaction, student centred learning, standardization of learning content and delivery to match pedagogical principles of online learning and use of the collaborative learning and assessments. Asian countries seem to follow the European and American countries but still in experimental or initial phases of implementation with small, single institutional studies mainly focusing perception of e learning by students and teachers in terms of convenience and acceptance, maximally using cross sectional questionnaire-based studies. Most of the studies are advocating training of students and mainly teachers to

improve digital skills and utilization of online learning. while many African countries are still struggling to make students, teachers aware of digital dimension of education, provide basic structural facilities and internet.

Even though there a range of developmental discrepancies and activities are noted across the world, face to face teaching learning methods and blended methods are accepted and advocated universally - owing to direct communication, engagement, interaction and feedback especially for learning clinical, procedural and communication skills. Though e learning can be advantageously used to reach many students, any time any place, helping them to self-assess, self-direct and responsible learner, patient exposure, teacher guidance, hands on training are key to build successful, confident medical professionals.

Irrespective of huge recommendations of implementing blended learning by students and teachers, it will be interesting to know how the online teaching learning is being utilized now after the emergency is over and we have time to plan and give attention to pedagogical principles for implementing e learning, e-assessments and quality assurance mechanisms used in these.

Issues in Implementation of Online Learning

1. **Technical Requirements:** requirement of devices as computers, laptops, smart phones along with continuous good quality internet connection for live streaming, watching video, attending discussions on live platforms. A digital gap is noted during the pandemic. There are wide variations across countries , within countries , institutions regarding the availability and affordability of these requirements
2. **Human Factor in Training:** though the emergency pandemic situation was managed good enough o continue the learning, it highlighted the need of human interaction in learning, training of medical students. Physical presence of teachers is always encouraging participation of for slow learners, different styled learners and addressing doubts in time is necessary. The student- teacher, student-student, student-teacher-patient interactions are central to medical students training, achieving clinical skills and communication skills. Psychological needs of learners in terms of motivation, attention seeking, collaborative learning, social learning, formal informal feedback from teachers, peers, patients can not be underestimated. Such Human interactions give confidence for learners as a future physicians. These aspects can not be achieved satisfactorily in online learning.
3. **Requirement of Pedagogical Expertise for Designing Course Content:** Teachers as subject experts can not be taken for granted that they will be able to design and deliver pedagogically sound study materials. Awareness that pedagogical requirements of online teaching are different from face to face teaching in terms of modifying interactions as per need, tools of interaction, involvement of large number of learner, attention span is necessary for designing online course material. This would require expert in designing course material and not a teacher would be sufficient, though it was done in during pandemic appreciably.
4. **Requirement of Training for Faculty and Students:** As end user of online learning - teaching, students and faculty would need to develop some skills for using the technology effectively, to its full capacity and should be able to modify to the need of medical

education in terms of human involvement in training and providing services to patients. Teachers should be well versed with use of different tools and application relevant to medical education training and assessments - as simulations, live video streaming, use of LMS, assessment modalities and requirements of authentic practices, possible loopholes. This suggests a strong need to train faculties as a need of evolving pedagogical skill requirements.

- 5. Health Harms:** Use of online teaching learning practices, obviously will increase screen time, sedentary work hours, changes in routine lifestyle- sleep, food patterns and will not be free of side effects in long run

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