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# Analysis Of Student Centric Approaches Towards Online Education In Chemistry In Rural Areas During The Covid Pandemic Period

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***Abstract***

*The COVID-19 pandemic led to the unprecedented closure of educational institutions worldwide, forcing a rapid transition to online teaching methods. This study explores the effects of this shift on undergraduate chemistry students from a rural college in India. The students participated in online learning through Google Classroom and YouTube, with performance assessments conducted via online quizzes and assignments. Our findings highlight significant challenges faced by rural students, including limited access to electronic gadgets such as laptops and smartphones and inconsistent internet connectivity. Despite the convenience and flexibility offered by online learning, 90.5% of the students expressed a preference for traditional face-to-face classroom teaching. This preference was largely due to the enhanced interaction and clarity provided in a physical classroom setting. In the context of learning chemistry, students appreciated the use of animations and videos for explaining complex concepts. However, when it came to understanding chemical reactions and mechanisms, most of the students preferred the traditional chalk-and-talk method over prerecorded videos. The data indicates that while online education served as a crucial alternative during the pandemic, it is not a comprehensive substitute for in-person learning, particularly for complex subjects like chemistry. The study suggests that a blended teaching approach, integrating online resources with traditional classroom methods, would be the most effective strategy. This approach would ensure better educational outcomes by leveraging the strengths of both online and offline teaching while addressing the technological and socio-economic challenges faced by rural students.*

***Keywords***: *Online learning, Blended teaching, Chemistry education, Rural education, COVID-19 education impact*

## 1.INTRODUCTION

The emergence of COVID-19, a novel coronavirus, imposed extraordinary measures worldwide, including widespread lockdowns and severe restrictions on citizens' movements. Governments across many countries ordered the closure of educational institutions to protect students, recognising the high risk of transmission within densely populated and highly interactive student communities. According to UNESCO, by the end of April 2020, 186 countries had closed their educational institutions, affecting 73.8% of enrolled students globally [1]. The pandemic has had a profound impact on various sectors, including education, fundamentally altering the traditional modes of teaching and learning. The COVID-19 pandemic has created a clear demarcation in the timeline of human life, dividing it into pre-COVID and post-COVID eras. The effects are so extensive that they have reshaped societal norms, economies, healthcare systems, and educational practices worldwide. The education sector, involving future generations, has been significantly disrupted, with students carrying the burden of these transformative experiences throughout their lives.During the pandemic, educational institutions rapidly transitioned to online teaching, utilising digital platforms such as Google Classroom, Microsoft Teams,

and Zoom. The necessity to continue education while adhering to social distancing guidelines drove this shift. However, this abrupt transition caused major issues, especially in rural areas with limited access to technology and internet connectivity. The transition to online learning during the COVID-19 pandemic has been both a challenge and an opportunity for educational institutions worldwide.

## 2.LITERATURE REVIEW

Numerous studies have investigated the impact of online education on the teaching and learning environment.

### 2.1 Student Readiness for Online Learning

Adam & Nel [2] examined how online teaching affects learners' ability to assimilate information, concluding that e-learning can be as effective as traditional face-to-face instruction if it is appropriately designed to meet students' needs and psychological behaviours. This study highlighted the importance of tailoring e-learning experiences to ensure they are engaging and effective. The concept of readiness for e-learning within the Australian vocational education and training sector was explored [3]. They proposed that readiness for online teaching depends on three key factors: (a) students' mindset and willingness to embrace online learning, (b) their confidence and ability to use electronic devices and internet technology, and (c) their capacity to stay engaged with e-learning. The challenges higher education faced during the pandemic and its impact on student performance have been studied [4]. The study found a decline in academic performance due to the sudden shift to online learning, with many students struggling to adapt to the new format.

Other studies have presented mixed outcomes, noting both favourable and unfavourable impacts on student learning experiences. For instance, Sun and Chen [5] argued that effective online teaching requires well-structured course content to engage students meaningfully, advocating structured and well-organised course content as essential for successful online education. As the saying goes, "Failing to plan is planning to fail," underscoring the importance of meticulous course design. Smith et al. [6] validated McVay's questionnaire, which assesses students' attitudes towards online learning. They identified two key factors: "Comfort with e-learning" and "Self-management of learning". Subsequent studies have explored similar concepts. Some studies emphasised the importance of willingness and readiness for online learning, with self-directed learning being a critical component [7]. Furthermore, some researchers also highlighted that students who are self-motivated and can manage their learning processes tend to perform better in online environments [8,9].

Motivation is another crucial factor influencing online learning readiness. Some studies revealed that intrinsic motivation is vital for student engagement and success [10]. As the proverb goes, "You can lead a horse to water, but you can't make it drink," emphasising that true learning comes from within. A study by Dassannayaka et al. (2022) revealed that attitudes towards online teaching are primarily influenced by factors such as perceived usefulness, teacher readiness, and perceived student participation. In contrast, elements like actual active student participation, a supportive teaching environment, and institutional backing do not significantly affect teachers' attitudes towards online teaching [11]. Learner control, or the ability to direct one's learning activities, also plays a significant role, and subsequent studies have shown that students' confidence in using computers and the internet is crucial for effective online learning [12,13]. Moreover, some studies also discussed the importance of online communication self-efficacy, which refers to students' confidence in their ability to communicate effectively in an online environment [14, 15].This highlights the necessity for students to develop critical thinking skills, which can be facilitated by both traditional and online learning methods.

### 2.2 Challenges of Online Learning

Despite the potential benefits, online learning presents several challenges. Common issues include delays in response times from instructors, feelings of loneliness and isolation among students, a lack of self-motivation, and higher attrition rates. These challenges underscore the complex dynamics of online learning compared to conventional classroom experiences. Some authors identified delays in response times from instructors as a significant issue [16,17]. These delays can cause students to lose focus and deviate from the learning process, highlighting the importance of timely intervention. Feelings of isolation and lack of community are other significant drawbacks of online education, and it was found that the absence of social interaction can lead to loneliness and mental health issues among students, emphasising the need for social connectedness in learning environments [18].

Higher attrition rates have also been associated with online learning. Laine, in 2003, pointed out that students are more likely to drop out of online courses than traditional ones [19]. The abrupt shift to online learning during the COVID-19 pandemic exacerbated these issues, as institutions were unprepared to adapt their curricula to the new format quickly. Further, Yang & Zhang, in 2024, studied the gender differences in online teaching of maths and Chinese language and found that online teaching positively affects maths and Chinese language performance of girls in key classes in high-performing schools in both the short term and medium term, but it adversely affects boys' performance [20].

Chemistry, as a subject, poses unique challenges in an online learning environment. Students often struggle with complex concepts and reactions that are traditionally taught using hands-on experiments and interactive demonstrations. As part of our study, we found that students preferred traditional classroom methods for understanding chemical reactions, despite recognising the usefulness of animations and videos for illustrating concepts. It is concluded from the literature review that the rapid transition to online education during the COVID-19 pandemic has highlighted both the potential and the limitations of e-learning. While online education can be effective, it requires careful design and consideration of students' psychological and motivational needs. Addressing the challenges of isolation, timely feedback, and maintaining engagement is crucial for the success of online learning.

Our study provides valuable insights into the preferences and experiences of rural students with online learning, particularly in chemistry. These findings can inform the development of more effective and inclusive online education strategies that balance technological advancements with the need for personal interaction and support. This underscores the importance of continually refining educational approaches to meet the needs of all students, ensuring that learning remains a powerful and transformative tool in any format. This study aims to delve into these dynamics by focusing on undergraduate chemistry students from a rural college in India. Given the unique challenges faced by students in rural areas, such as limited access to technology and internet connectivity, this research seeks to provide insights into their experiences and preferences regarding online education. By understanding these factors, the study aims to identify strategies to enhance learning outcomes during and beyond the pandemic.

## 3.METHODOLOGY

To assess the impact of online teaching on undergraduate chemistry students, a systematic approach was employed. A Google Classroom was set up to cater to 250 B.Sc. students enrolled in the chemistry course. Recruitment involved inviting students via unique codes or links through various channels, ensuring their consent before participation.

### 3.1 Instructional Materials

Lecture notes, reading assignments, and problem sets were regularly uploaded to Google Classroom. Due to internet limitations, pre-recorded video lectures were hosted on YouTube, with links shared for easy access by students at their convenience.

### 3.2 Assessment and Monitoring

Continuous evaluation was carried out through online quizzes and assignments to gauge student understanding and application of theoretical concepts. Assessments included multiple-choice questions and problem-solving exercises relevant to the curriculum.

### 3.3 Data Collection

A detailed questionnaire captured feedback on technical accessibility, content delivery, engagement, and learning outcomes. Both quantitative (Likert scale) and qualitative (open-ended) responses were collected to provide comprehensive insights.

### 3.4 Data Analysis

Quantitative data were analysed using statistical methods, including descriptive and inferential statistics, to identify patterns and correlations. Qualitative responses underwent thematic analysis to extract recurring themes and deeper insights into student experiences.

### 3.4 Ethical Considerations

The study adhered to ethical guidelines, ensuring participant confidentiality and informed consent. Data were used solely for research purposes and stored securely.

### 3.5 Limitations

Limitations included variability in internet access and reliance on self-reported data, suggesting the need

for future studies to address these challenges through hybrid learning models and robust data collection methods.

## 4.RESULTS AND DISCUSSION

### 4.1 Demographic Details of Participants

As the college is situated in a rural and hilly area, it primarily attracts students from nearby rural regions. Table 1 shows a detailed demographic picture of student participants. These students are often drawn from farming families, with approximately 79% of parents relying on agriculture for their livelihoods. Interestingly, urban students represent only a small fraction, comprising about 3.91% of the student population, and are predominantly male. Despite this, the college boasts a higher enrolment of female students, accounting for approximately 54.15% of the total student body, while males make up around 47%.

This demographic composition sheds light on the unique socioeconomic background of the student community. The prevalence of rural students, coupled with the prominence of agricultural livelihoods, suggests a close connection between the college and its surrounding rural environment. The gender distribution further adds nuance to the student body, reflecting potential variations in experiences and perspectives within the college setting.

**Table 1. Demographic Details of Participants**

| Sr. No. | Demographic Variable | Attributes | Percentage (N=256) |
|---|---|---|---|
| 1 | Sex | Male | 46.85% |
| | | Female | 54.15% |
| 2 | Place of Residence | Rural | 96.09% |
| | | Urban | 3.91% |
| 3 | Father's Occupation | Agriculture | 79.69% |
| | | Govt. / Private Service/Other Job | 20.31% |

### 4.2Technical Availability

However, accessing online learning necessitates specific technological resources and dependable internet connectivity. Students, predominantly from rural, hilly, and agricultural backgrounds, often find themselves grappling with economic constraints, making it challenging to obtain costly electronic devices like laptops or computers. Moreover, the geographical remoteness of their locations worsens their struggle to secure stable internet connections, with some facing the added hurdle of sluggish internet speeds.

Compounding these challenges is the limited availability of electronic devices within households. In many cases, families possess only one smartphone, shared among family members, thereby restricting students' access to online learning resources. Consequently, students must often contend with scheduled access to these devices, typically during evenings or at night.

Despite these obstacles, smartphones emerge as the preferred device for online learning due to their affordability and accessibility. However, a significant portion of students still lack access to laptops, desktops, or tablets, underscoring the disparities in technological access prevalent among student populations. As can be seen in Table 2, the usage statistics further underscore these trends, with smartphones emerging as the primary device for online teaching, followed by laptops and desktops, albeit to a lesser extent. Among the surveyed students, approximately 93.36% relied on smartphones, while only 2.73% had access to laptops, and 3.91% used desktop computers. These figures highlight the prevalent reliance on smartphones among students, underscoring their significance in facilitating online learning experiences. The table below provides a detailed breakdown of electronic gadget usage among students, offering insights into their preferences and the challenges they face in accessing online education. Most of the students rely on mobile data for internet connectivity rather than LAN or Wi-Fi, as can be seen in Table 2. This is evident as most of them prefer using smartphones over desktops and laptops. Nearly 4.3% of students can avail of the LAN facility, and very few, about 1.56%, use Wi-Fi for

internet connectivity. Overall, the technical availability of electronic devices and reliable internet connectivity remains pivotal in shaping students' online learning experiences, highlighting the need for targeted interventions to bridge the digital divide and ensure equitable access to education for all.

**Table 2. Technical Availability Details**

| Sr. No. | Technical Availability | Attributes | % N= 256 |
|---|---|---|---|
| 1 | Electronic Gadgets | Smartphone | 93.36 |
| | | Laptop | 2.73 |
| | | Desktop | 3.91 |
| | | Tablet | 0.0 |
| 2 | Internet Connectivity | LAN | 4.3 |
| | | Mobile Data | 94.14 |
| | | WiFi | 1.56 |

**4.3 Access and Utilization of E-Learning Tools**

The investigation into students' preferences for e-learning offered valuable insights into the dynamics of access, engagement, and assessment within online education. The study highlighted the crucial importance of electronic devices and internet access in rural or remote areas. Due to inadequate internet speed for live classes, course content was delivered through prerecorded YouTube videos created by the respective teachers. Updates about Google Classroom were sent to students via WhatsApp, a familiar and popular app among them. There are both advantages and disadvantages to prerecorded videos. On the plus side, students can watch the videos at their convenience, replaying them as needed until they fully understand the concepts. They can access the videos anytime and anywhere. However, the main drawbacks include the inability to monitor whether students are watching the videos honestly and continuously as expected. Additionally, students' questions and doubts cannot be addressed immediately. To address this, a discussion forum on Google Classroom was provided, and students were encouraged to ask questions on WhatsApp or via personal mobile contact. Reading materials and topic notes were also made available on Google Classroom.

**4.5 Engagement and Retention Strategies**

Table 3 provides information about students' perspectives towards online learning. Regarding student engagement, while an initial wave of enthusiasm towards online learning was evident, a gradual decline in interest was observed over time, particularly with longer video durations. A detailed examination of viewer behaviour revealed a striking trend: videos exceeding 20 minutes experienced a notable reduction in viewership, contrasting with the higher engagement observed with shorter videos. This preference for concise and focused content delivery was further validated by the tabular data, which indicated a clear inclination towards videos of shorter durations among students. 71.48% of participants agreed that the length of the video should have been less than 20 min, whereas very few, i.e., 6.25%, are in favour of videos of more than 30 min duration. It was expected that students would watch videos from start to end continuously.Moreover, the data revealed that 95.31% of students watched videos from start to end continuously, indicating a strong commitment to learning. Students could not watch videos continuously because of various factors like internet range, their dependency on electronic gadgets on parents, interruption due to power cuts, etc.

A significant majority (85.16%) expressed a preference for spending 2-3 hours on online teaching, emphasising the importance of balancing screen time with other activities, including working on assignments. Only 4.4% of students opted for spending 4 h on online teaching.Actually, the human capacity to watch electronic screens continuously is very limited. It can adversely affect the eyesight of students and may cause neck and back pain.

**Table 3. Access and Utilization of E-Learning Tools observations**

| Sr. No. | Students Perspective towards online teaching | Attributes | % N= 256 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Suitable duration of prerecorded videos | 15-20 min | 71.48 |
| | | 20-30 min | 22.27 |
| | | 30-40 min | 6.25 |
| 2 | Whether Animations are necessary in videos | Yes | 97.66 |
| | | No | 2.34 |
| 3 | Whether videos are watched from start to end continuously | Yes | 95.31 |
| | | No | 4.69 |
| 4 | How much time would you like to spend on online teaching | 2-3 h | 85.16 |
| | | 3-4 h | 10.55 |
| | | 4-5 h | 4.29 |
| 5 | How many times you watch one particular video to grasp the points covered in video lecture? | Once | 32.03 |
| | | Twice | 62.89 |
| | | More than twice | 5.08 |
| 6 | Satisfied with the content of videos? | Yes | 94.02 |
| | | No | 5.98 |
| 7 | Whether queries / questions raised by you responded within due time | Yes | 86.72 |
| | | No | 13.28 |

Additionally, the study highlighted the pivotal role of animations in enhancing engagement and comprehension, particularly in complex subjects like chemistry. Animations create curiosity among students. With the help of animations, the concept in chemistry can be well understood and assimilated by students. For instance, concepts like homolytic bond fission and heterolytic bond fission can be well illustrated by animated videos. The animation can include the transfer of electrons from one atom to another atom by arrow and the development of charges. The tabular data demonstrated overwhelming support for the integration of animations within instructional materials, with 97.66% of students indicating their necessity.

86.72% of participants answered yes for attending to their queries and doubts within due time by the concerned teacher. It is obvious that it would take more time to clarify students' queries in online teaching by the respective teacher as compared to live classroom teaching.Only 13.28% of student participants are not satisfied with the time taken to answer their queries. The most striking feature of the survey is that the majority of students (94.02%) found the content of the topic satisfactory. It means that the role of instructor of designing lecture videos plays an important role in online teaching. Additionally, nearly two-thirds of students (62.89%) reported watching a particular video lecture twice to grasp the covered points, highlighting the importance of review and reinforcement in the learning process. Overall, the study's findings underscored the need for tailored approaches to online education, taking into account factors such as video duration, multimedia integration, and students' preferred learning time.

**4.6 Students' Perspectives on Online Teaching in Chemistry**

The examination of students' perspectives on online teaching in chemistry sheds light on their preferences and perceptions (Table 4). A significant majority of students (81.68%) believe that chemical reactions are best understood in traditional classroom settings, indicating a preference for in-person instruction. However, a notable portion (18.32%) still sees potential in online teaching for comprehending chemical reactions. The topics chosen for online teaching are from organic chemistry. In general, students are facing problems in understanding chemical reactions in classroom teaching also. So it is presumed that the online teaching of chemical reactions may not be that easy for students. In traditional teaching, teachers use chalk and board for writing reactions. Students somehow learn to write chemical structures of compounds and chemical reactions by mimicking the writings of his/her teacher. The prerecorded videos generally possess readymade reactions and structures of chemical compounds which are constructed in software apps. Students fail to understand how to write reactions or structures step by step.Therefore, students prefer traditional teaching for better understanding of chemical reactions and mechanisms. Regarding understanding reaction mechanisms, a considerable proportion (76.99%) of students lean towards traditional classroom instruction. However, a significant minority (23.01%) acknowledges the potential of online teaching in elucidating complex reaction mechanisms.It

appears that reaction mechanisms incorporating animations, such as the attack of electrophiles/nucleophiles and the bond-breaking and bond-making processes using curved arrow notations, received positive feedback from students. Complicated reactions or those with multiple steps often confuse students in online teaching. Some steps or compound structures are not easily understood, requiring fundamental concepts or answers to queries that prerecorded videos cannot provide. In a classroom setting, students write reactions as the teacher writes them on the blackboard, whereas in online teaching, students only watch the videos. Approximately 64.88% of students expressed a preference for writing reactions while learning in live classroom sessions, underscoring the importance of live classroom sessions.

**Table 4. Students Perspective towards online teaching in Chemistry**

| Sr. No. | Students' Perspective towards Online Teaching in Chemistry | Attributes | % N= 256 |
|---|---|---|---|
| 1 | Chemical reactions are best understood in | Online Teaching | 18.32 |
| | | Traditional Classroom | 81.68 |
| 2 | How to write Chemical structures can be best studied in | Online Teaching | 4.45 |
| | | Traditional Classroom | 95.55 |
| 3 | Reaction Mechanism can be best understood in | Online Teaching | 23.01 |
| | | Traditional Classroom | 76.99 |
| 4 | Writing the chemical reactions while learning becomes convenient in | Online Teaching | 35.12 |
| | | Traditional Classroom | 64.88 |
| 5 | Best way to learn organic chemistry | Online | 12.54 |
| | | Traditional Classroom | 16.34 |
| | | Traditional Classroom blended with Online Teaching | 71.12 |

When it comes to learning how to write chemical structures, the overwhelming majority (95.55%) are in favour of traditional classrooms over online teaching methods, recognising the efficacy of face-to-face teaching and learning interaction. Conversely, only a small percentage (4.45%) believes that online settings are more conducive to learning this skill. Regarding understanding reaction mechanisms, a considerable proportion (76.99%) of students lean towards traditional classroom instruction. In determining the best way to learn organic chemistry, a substantial number of students (71.12%) advocate for a blend of traditional classroom instruction with online teaching methods, recognising the benefits of both approaches. Only a minority (12.54%) believe that online teaching alone is the optimal method for learning organic chemistry.

**4.7 Assessment Methods and Student Preferences**

In the area of student assessment, online tests serve as a primary method, predominantly featuring objective Multiple Choice Questions (MCQs), quizzes, and assignments. Throughout the study, it became evident that a substantial majority (90.63%) of students expressed a distinct preference for MCQs over descriptive assignments. This preference aligns with their desire for clarity and immediate feedback, as evidenced by their curiosity regarding their scores in quizzes and their inclination to seek clarification on doubts and queries related to the questions posed. The data from the tabular representation (Table 5) further reinforces this observation, showcasing the overwhelming preference for MCQ-based assessments among students. About 90.63% of students chose MCQs as their preferred assessment format. Interestingly, only 4.29% are in favour of the descriptive format. This preference highlights the students' inclination towards objective evaluation methods, which offer a structured and definitive approach to evaluating their understanding. Furthermore, it underscores their need for prompt feedback and a clear understanding of their performance, indicating a proactive engagement with the learning process.

**Table 5. Student Assessment in E-Learning**

| Sr. No. | Aspect of Student Assessment | Perspective | % N=256 |
|---|---|---|---|
| 1 | Preferred Assessment Format | MCQs (Objective) | 90.63 |
| | | Descriptive (Subjective | 4.29 |
| | | Both (Ojective + Subjective) | 5.08 |
| 2 | Curiosity about Quiz Scores | Yes | 99.1 |
| | | No | 0.9 |
| 3 | Preference for Query Resolution in Quizzes | Yes | 93.7 |
| | | No | 6.3 |
| 4 | Drawback of MCQ Exams | Lack of ability to demonstrate depth of understanding | 65.63 |
| | | Limited scope for creative expression or critical thinking | 34.37 |
| 5 | Preference for Timely Feedback | Yes | 97.66 |
| | | No | 2.34 |

However, while MCQs offer benefits such as efficient grading and clear-cut answers, they also come with drawbacks. One notable drawback is the potential for guessing, as students may arrive at correct answers through luck rather than genuine comprehension. Additionally, MCQs may not fully assess higher-order thinking skills such as critical thinking and problem-solving, as they often require simple recall rather than deep understanding.

**4.8 Gender Differences in Response to Online Teaching**

Table 6 shed light on gender differences in response to e-learning. In examining gender differences in response to online teaching, a notable trend emerged: female students displayed a greater interest compared to their male counterparts. This observation suggests a social dynamic wherein female students exhibit a stronger dedication to their studies. In rural areas, girls often balance household responsibilities alongside their academic pursuits, showcasing remarkable time management skills. Conversely, male students in rural settings may be more involved in agricultural activities with their parents, potentially impacting their engagement with online learning. Overall, the inclination of male students towards extroversion and spending more time outside the home could contribute to their relatively lower interest in online teaching.

From the students' feedback, it becomes evident that the flexibility and convenience afforded by online teaching are significant advantages. With a flexible schedule, students can tailor their learning experience to suit their individual needs, allowing them to engage with course materials at their own pace.

**Table 6. Gender Differences in Response to Online Teaching**

| Sr. No. | Gender | Interest in Online Teaching | Reasons for Interest | Comments |
|---|---|---|---|---|
| 1 | Female | 98.21 % | Flexible schedule and convenience | Girls often balance household responsibilities and find online learning |

| | | | | |
|---|---|---|---|---|
| | | | | accommodating to their schedules. |
| 2 | Male | 56.24 | Prefer traditional classroom setting | Boys may be more involved in outdoor activities and perceive traditional teaching methods as more engaging. |

### 4.9 Other Challenges in Online Teaching

This paragraph highlights the challenges of online teaching and the critical need to address them effectively. It stresses the importance of ensuring equitable access to the internet for all individuals to ensure the success of online classes. Additionally, it emphasises the necessity for both teachers and students to possess adequate technological skills to navigate online learning platforms efficiently. Furthermore, it suggests incorporating engaging and interactive teaching methods to sustain students' interest and participation in online lessons. Lastly, it acknowledges the potential impact of online learning on students' physical and mental well-being, emphasising the significance of open communication within families to mitigate any adverse effects and maintain a healthy balance.

## 5. CONCLUSION

In summary, the COVID-19 pandemic has had a significant impact on education and propelled online learning to the centre of global policy discussions. This transition has impacted millions of students and parents, requiring teachers to adapt and embrace technology to manage these changes successfully. While traditional teaching methods foster associative learning and interaction among students from diverse backgrounds, the transition to exclusive online teaching poses challenges, as many students express a preference for blended approaches. The study highlights that the majority of students are more inclined towards traditional teaching, indicating discomfort with 100% online instruction. Instead, they advocate for a blend of traditional live classroom teaching with 30-40% online teaching, which they perceive as beneficial. Notably, the importance of the "chalk and talk" method remains significant, especially in subjects like chemistry, where online teaching can be augmented by appropriate animations. Students express concerns regarding technological constraints, including the availability of electronic gadgets and internet speed. Addressing these concerns through orientation programmes and innovative teaching methodologies, such as incorporating technology to enhance the learning experience, can greatly improve online teaching effectiveness. Interactive sessions, quizzes, and assignments emerge as valuable tools for evaluating learning outcomes and engaging students. Looking ahead, the conclusion drawn from the study suggests that even after the COVID-19 pandemic subsides, there may be a continued increase in educational systems adopting online teaching methods. This transition may take the form of a hybrid model, blending online and conventional teaching approaches to provide comprehensive study aids. Such a shift underscores the enduring impact of the pandemic on educational practices, emphasising the need for flexible and adaptive teaching strategies to meet the evolving needs of students.

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