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# A Survey on the Effectiveness of Online Teaching–Learning Methods for University and College Students

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**Abstract** Online teaching–learning methods have been followed by world-class universities for more than a decade to cater to the needs of students who stay far away from universities/colleges. But during the COVID-19 pandemic period, online teaching–learning helped almost all universities, colleges, and affiliated students. An attempt is made to find the effectiveness of online teaching–learning methods for university and college students by conducting an online survey. A questionnaire has been specially designed and deployed among university and college students. About 450 students from various universities, engineering colleges, medical colleges in South India have taken part in the survey and submitted responses. It was found that the following methods promote effective online learning: animations, digital collaborations with peers, video lectures delivered by faculty handling the subject, online quiz having multiple-choice questions, availability of student version software, a conducive environment at home, interactions by the faculty during lectures and online materials provided by the faculty. Moreover, online classes are more effective because they provide PPTs in front of every student, lectures are heard by all students at the sound level of their choice, and walking/travel to reach classes is eliminated.

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## Introduction

Critical thinking and creativity of students increase with innovative educational methods according to the world declaration on higher education in the twenty-first century [1]. Innovative educational strategies and educational innovations are required to make the students learn. There are three vertices in the teaching–learning process viz., teaching, communication technology through digital tools, and innovative practices in teaching. In the first vertex, the teacher is a facilitator and provides resources and tools to students and helps them to develop new knowledge and skills. Project-based learning helps teachers and students to promote collaborative learning by discussing specific topics. Cognitive independence is developed among students. To promote global learning, teachers are required to innovate permanently. It is possible when university professors and researchers are given space to new educational forms in different areas of specializations. Virtual classrooms, unlike traditional classrooms, give unlimited scope for introducing teaching innovation strategies. The second vertex refers to the use of Information and Communication Technology (ICT) tools for promoting innovative education. Learning management systems (LMS) help in teaching, learning, educational administration, testing, and evaluation. The use of ICT tools promotes technological innovations and advances in learning and knowledge management. The third vertex deals with innovations in teaching/learning to solve problems faced by teachers and students. Creative use of new elements related to

curriculum, production of something new, and transformations emerge in classrooms resulting in educational innovations. Evaluations are necessary to improve the innovations so that successful methods can be implemented in all teaching and learning community in an institution [2]. The pandemic has forced digital learning and job portal Naukri.com reports a fourfold growth for teaching professionals in the e-learning medium [3]. The initiatives are taken by the government also focus on online mode as an option in a post-covid world [4]. A notable learning experience design consultant pointed out that, educators are entrusted to lead the way as the world changes and are actively involved in the transformation [5]. Weiss notes that an educator needs to make the lectures more interesting [6].

This paper presents the online teaching–learning tools, methods, and a survey on the innovative practices in teaching and learning. Advantages and obstacles in online teaching, various components on the effective use of online tools, team-based collaborative learning, simulation, and animation-based learning are discussed in detail. The outcome of a survey on the effectiveness of online teaching and learning is included. The following sections present the online teaching–learning tools, the details of the questionnaire used for the survey, and the outcome of the survey.

## Online Teaching and Learning Tools

The four essential parts of online teaching [7] are virtual classrooms, individual activities, assessments in real-time, and collaborative group work. Online teaching tools are used to facilitate faculty-student interaction as well as student–student collaborations [8]. The ease of use, the satisfaction level, the usefulness, and the confidence level of the instructor is crucial [9] in motivating the instructor to use online teaching tools. Higher education institutes recognize the need to accommodate wide diverse learners and Hilliard [10] points out that technical support and awareness to both faculty and student is essential in the age of blended learning. Data analytics tool coupled with the LMS is essential to enhance [11] the quality of teaching and improve the course design. The effective usage of online tools is depicted in Fig. 1 comprising of an instructor to student delivery, collaboration among students, training for the tools, and data analytics for constant improvement of course and assessment methods.

### Online Teaching Tools

A plethora of online teaching tools are available and this poses a challenge for decision-makers to choose the tools that best suits the needs of the course. The need for the tools, the cost, usability, and features determine which tools are adopted by various learners and institutions. Many universities have offered online classes for students. These are taken up by students opting for part-time courses. This offers them flexibility in timing and eliminates the need for travel to campus. The pandemic situation in 2019 has forced many if not all institutions to completely shift classes online. LMS tools are packaged as Software as a Service (SaaS) and the pricing generally falls into 4 categories: (i) per learner, per month (ii) per learner, per use (iii) per course (iv) licensing fee for on-premise installation [12].

### Online Learning Tools

Online teaching/learning as part of the ongoing semester is typically part of a classroom management tool. GSuite for education [13] and Microsoft Teams [14] are both widely adopted by schools and colleges during the COVID-19 pandemic to effectively shift regular classes online. Other popular learning management systems that have been adopted as part of blended learning are Edmodo [15], Blackboard [16], and MoodleCloud [17]. Davis et al. [18] point out advantages and obstacles for both students and instructors about online teaching shown in Table 1.

The effectiveness of course delivery depends on using the appropriate tools in the course design. This involves engaging the learners and modifying the course design to cater to various learning styles.

## A Survey on Innovative Practices in Teaching and Learning

The questionnaire aims to identify the effectiveness of various online tools and technologies, the preferred learning methods of students, and other factors that might influence the teaching–learning process. The parameters were based on different types of learners, advantages, and obstacles to online learning [10, 18]. Questions 1–4 are used to comprehend the learning style of the student. Questions 5–7 are posed to find out the effectiveness of the medium used for teaching and evaluation. Questions 8–12 are framed to identify the various barriers to online learning faced by students.

This methodology is adopted as most of the students are attending online courses from home and polls of this kind will go well with the students from various universities. Students participated in the survey and answered most of the questionnaire enthusiastically. The only challenge was a suitable environment and free time for them to answer the questionnaire, as they are already loaded with lots of online

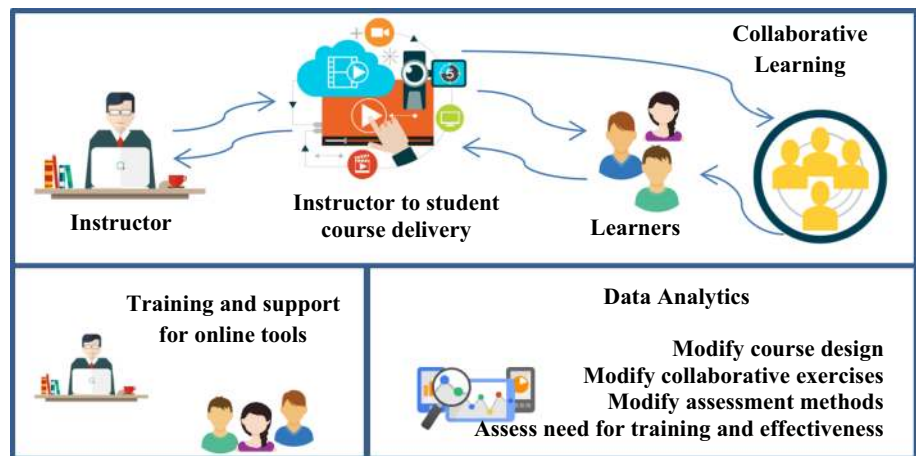**Fig. 1** The various components of effective usage of online tools



**Table 1** Advantages and obstacles in online teaching

|  | Students | Instructors |
| --- | --- | --- |
| Advantages | Flexibility |  |
|  | Self-motivation | Improved communications |
|  | Working independently | Course management |
|  |  | Course design |
| Obstacles | Interpersonal relationships |  |
|  | Misinterpreting expectations | Setting expectations |
|  | Time management | Providing feedback |

work. Students from various universities pursuing professional courses like engineering and medicine took part in this survey. They are from various branches of sciences and technologies. Students are from private universities, colleges, and government institutions. Figure 2 shows the institution-wise respondents. Microsoft Teams and Google meet platforms were used for this survey among university, medical college, and engineering college students. About 450 students responded to this survey. 52% of the respondents are from VIT University Vellore, Tamil Nadu, 23% of the respondents are from CMR Institute of Technology (CMRIT), Bangalore, 15% of the respondents are
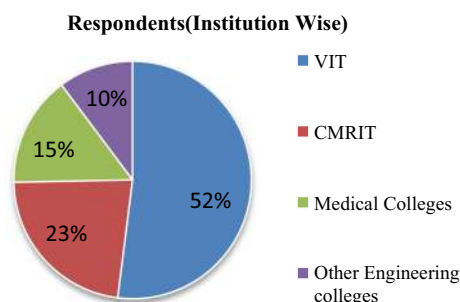
from medical colleges and 10% are from other engineering colleges. During this pandemic period, VIT students are staying with parents who are living in different states of India like Andhra, Telangana, Kerala, Karnataka, MP, Haryana, Punjab, Maharashtra, Andaman, and so on. Only a few students are living in Tamil Nadu. Some of the students are staying with parents in other countries like Dubai, Oman, South Africa, and so on. Some of the students of CMRIT Bangalore are living in Bangalore and others in towns and villages of Karnataka state. Students of medical colleges are living in different parts of Tamil Nadu and students of engineering colleges are living in different parts of Andhra Pradesh. Hence, the survey is done in a wider geographical region.

Figure 3 shows the branch-wise respondents. It is shown that 158 students belong to mechanical/civil engineering. 108 respondents belong to computer science and engineering, 68 students belong to medicine, 58 students belong to electrical & electronics engineering, and electronics & communication engineering. 58 students belong to other disciplines.
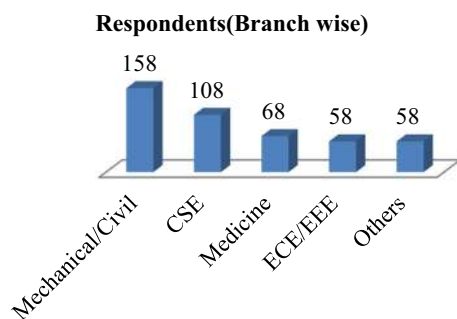


**Respondents(Institution Wise)**

**Fig. 2** Institution-wise respondents

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**Respondents(Branch wise)**

158
108
68 58 58

Mechanical/Civil    CSE    Medicine    ECE/EEE    Others

**Fig. 3** Branch-wise respondents

## Questionnaire Used

Students were assured of their confidentiality and were promised that their names would not appear in the document. A list of the questions asked as part of the survey is given below.

Questionnaire:

Sample group: B Tech students from different branches of sciences across various engineering institutions and MBBS medical students.

1. Which of the methods engage you personally **to learn digitally**?

   a. Individual assignment
   b. Small group (No. 5 students) work
   c. Large group (No. 10 students and more) work
   d. Project-based learning

2. Which of the **digital collaborations** enables you to work on a specific task at ease

   a. Two by two (2 member team)
   b. Small group workgroup (No. 5 students) work
   c. Large group (No. 10 students and more) work

3. Which of the **digital approaches** motivate you to learn

   a. Animations
   b. Whiteboard and pen
   c. PowerPoint presentation
   d. Digital pen and slate

4. My experience with online learning **from home** digitally

   a. I am learning at my own pace comfortably
   b. My situational challenges are not suitable
   c. I can learn better with uninterrupted network connectivity
   d. I am distracted with various activities at home, viz. TV, chatting, etc.

5. Which type of recorded video lecture is more **effective for learning**?

   a. delivered by my faculty
   b. delivered by NPTEL
   c. delivered by reputed Overseas Universities
   d. delivered by unknown experts

6. Which type of quiz is more **effective for testing** the understanding?

   a. Traditional—pen and paper—MCQ
   b. Traditional—pen and paper—short answers
   c. Online quiz—MCQ
   d. Online quiz—short answers

7. Student version **software downloaded** from the internet is useful for learning

   a. True
   b. False
   c. Unable to decide

8. **Online teaching–learning takes place effectively** because:

   a. Every student can hear the lecture clearly
   b. PPTs are available right in front of every student
   c. Students can ask doubts without much reservation
   d. Students need not walk long distances before reaching the class

9. Which of the following statements is true of **online learning off-campus**?

   a. No one disturbs me during my online learning.
   b. My friend/family member/roommate/neighbor occasionally disturb me
   c. My friend/family member/roommate/neighbor constantly disturb me

10. At home/place of residence, how many **responsibilities** do you have?

    a. I don't have many responsibilities.
    b. I have a moderate amount of responsibilities, but I have sufficient time for online learning.
    c. I have many responsibilities; I don't have any time left for online learning.

11. What is your most **preferred method for clearing doubts** in online learning?

    a. Ask the professor during/after an online lecture
    b. Post the query in a discussion forum of your class and get help from your peers
    c. Go through online material providing an additional explanation.

12. Which of the following **devices do you use** for your online learning?

    a. A laptop/desktop computer
    b. A tablet
    c. A smartphone
    d. Other devices

## Outcome of the survey

Students would prefer to work in a group of 5 students to engage personally in digital learning as seen from Fig. 4.

Digital collaboration to enable students to work at ease on a specific task is to allow them to work in small groups of 5 students as seen in Fig. 5.

Animations are found to be the best digital approach motivating many students to learn as seen in Fig. 6.

The online learning experience of students is shown in Fig. 7. The majority of students have said that they can learn at their own pace comfortably through online learning.

The effectiveness of the recorded video lecture is shown in Fig. 8. The majority of students agree that the video lectures delivered by his/her faculty teaching the subject help students to learn effectively.

Online quiz having multiple-choice questions (MCQ) is preferred by most of the students for testing their understanding of the subject as seen in Fig. 9.

The usefulness of the student version of the software downloaded from the internet is shown in Fig. 10. 45.7% of the students agree that it is useful for learning whereas 45.2% of them are unable to decide. The rest of the students feel that the student version of the software is not useful.

The reasons for the effectiveness of online teaching–learning are shown in Fig. 11. The majority of the students, feel that the PPTs are available right in front of every student so that following the lecture makes the learning effective. In universities where a fully flexible credit system (FFCS) is followed, students need to walk long distances for reaching their classrooms. Day Scholars in universities as well as engineering colleges are required to travel a considerable distance before reaching the first-hour class. According to many students, online learning is more effective since walking/traveling is completed eliminated. If the voice of the faculty member is feeble, students sitting in the last few rows of the class would not hear the lecture completely. Some students feel that online learning is more effective since the lecture is reaching every student irrespective of the number of students in a virtual classroom.

50.3% of students agree that they do not have any disturbance during online learning and it is more effective. Many of them feel that occasionally their friends or relatives disturb students during their online learning as shown in Fig. 12.

Figure 13 shows the environment at home for online learning. 76.9% of the respondents stated that they have a moderate amount of responsibilities at home but they have sufficient time for online learning. 16.1% of them have said that they do not have many responsibilities whereas 7% of them claimed that they have many responsibilities at home and they do not have any time left for online learning.

Figure 14 shows the methods adopted for clearing doubts in online learning. 43.2% of the respondents ask the Professor and get their doubts clarified during online lectures. 25.5% of them post queries in the discussion forum and help from peers. 31.3% of them go through the online materials providing additional explanation and get their doubts clarified.

Figure 15 shows the devices used by students for online learning. Most of the students use laptop/desktop computers, many of them use smartphones and very few students use tablets.

The association between responses 1 and 2 is tested using the chi-square test. The results are presented in Table 2 which shows the observed cell totals, expected cell values, and chi-square statistic for each cell. It is seen that

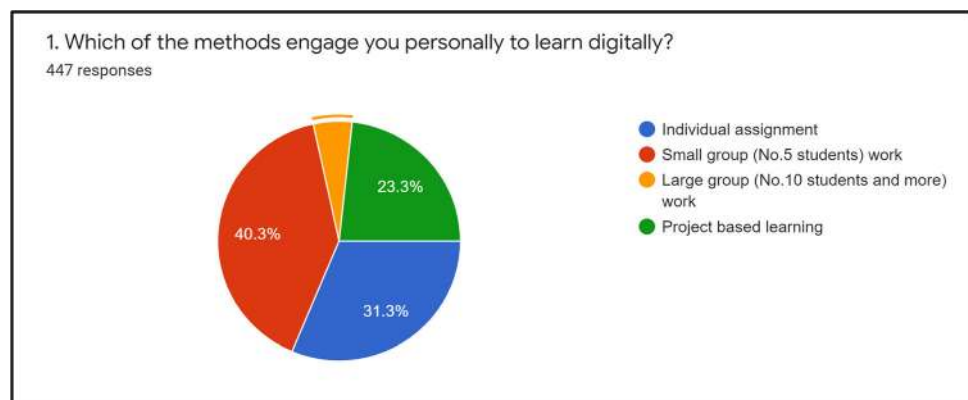**Fig. 4** Personal engagement in digital learning

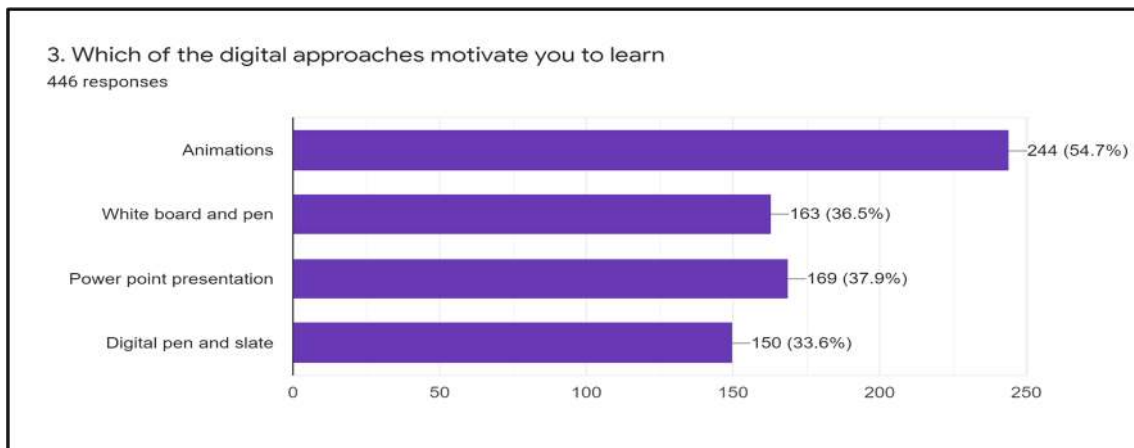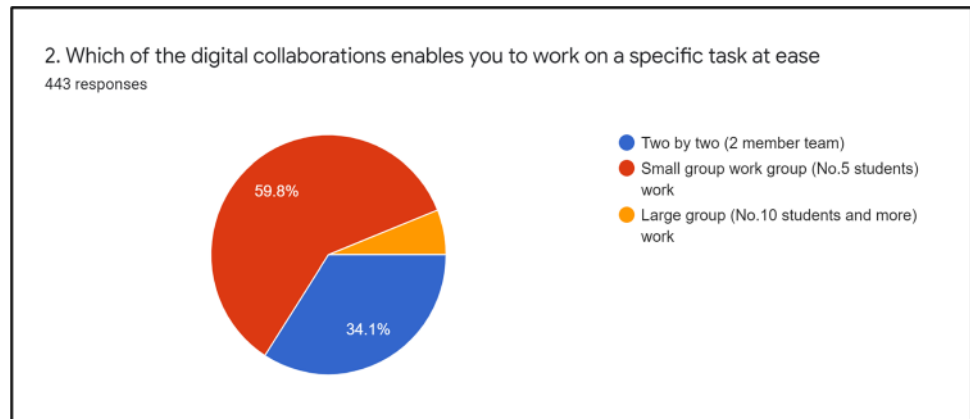**Fig. 5** Digital collaboration to enable students to work at ease



**Fig. 6** Digital approaches that motivate students to learn
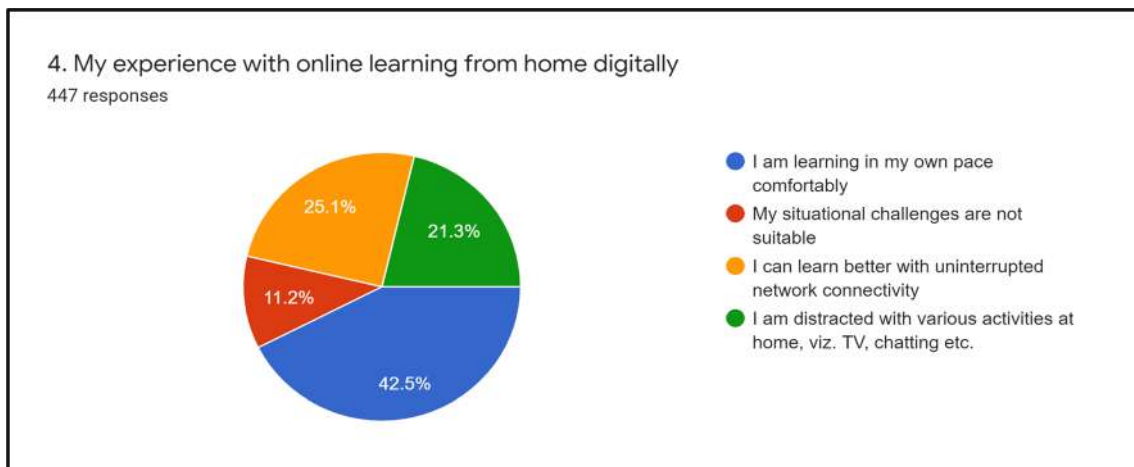


**Fig. 7** The online learning experience of students



association exists between several responses between questions.

The observed cell values indicate that the highest association is found between responses 1b and 2b since both these responses are related to a small working group having 5 members. The lowest association is found between the responses of 1c and 2a having the lowest observed cell value and expected cell value. The reason for this is response 1c shows the work done by a 10 member team and the response 2a shows a two-member team. The
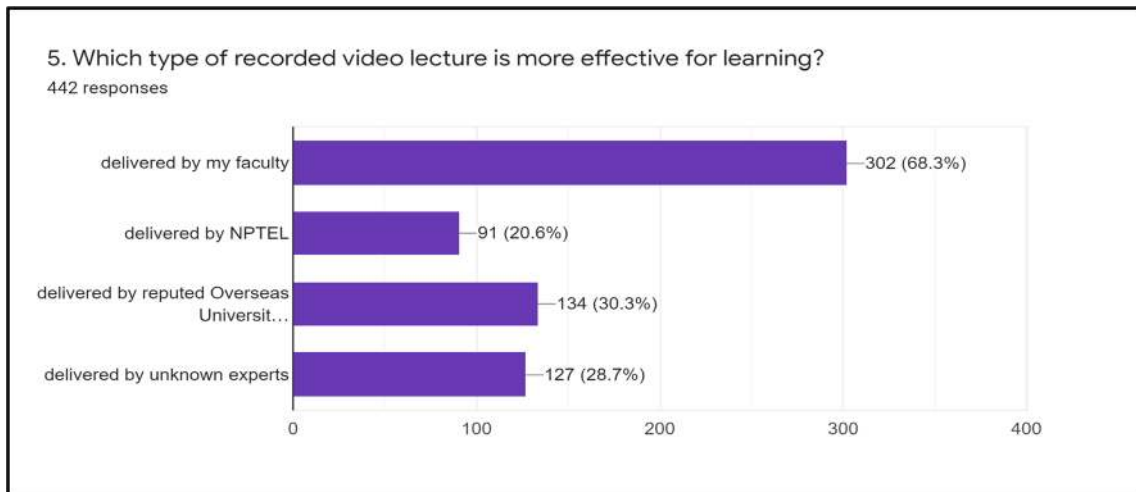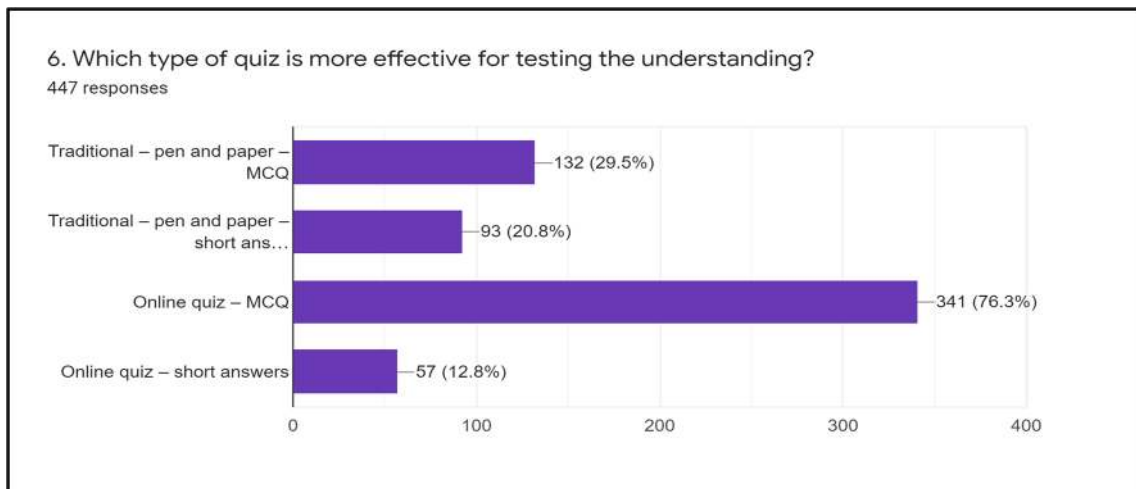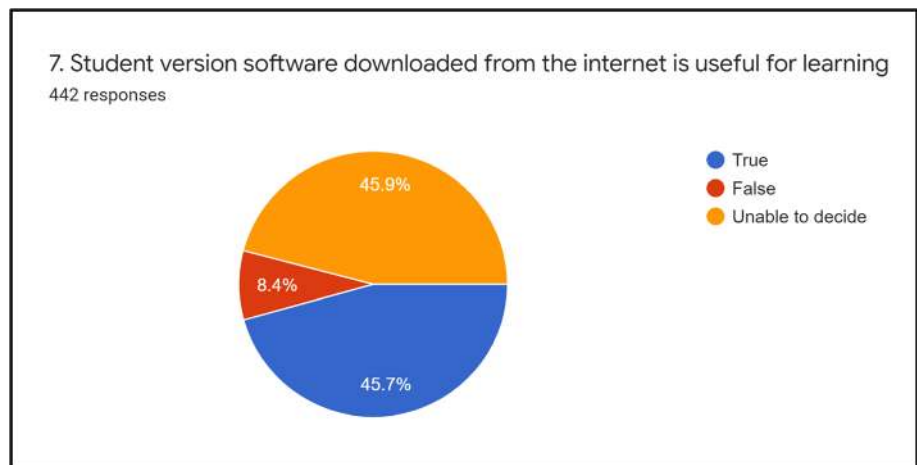
**Fig. 8** More effective recorded video lecture



**Fig. 9** More effective quiz for testing the understanding

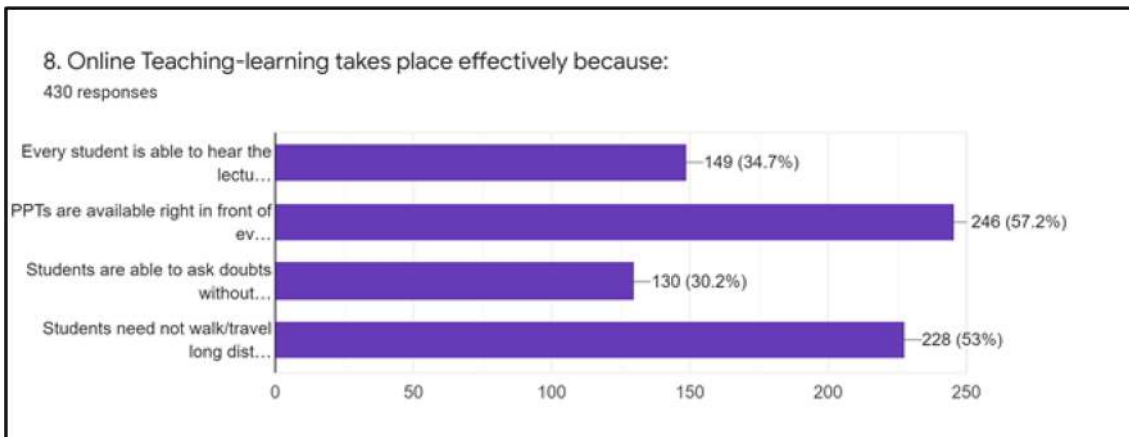**Fig. 10** The usefulness of the student version of the software

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**Fig. 11** Reasons for the effectiveness of online teaching–learning
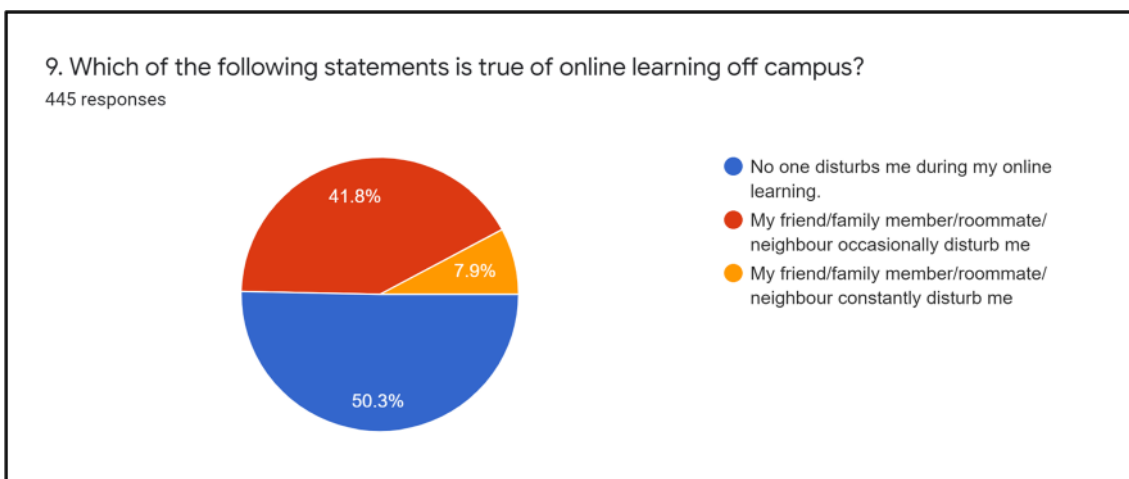


**Fig. 12** Disturbances during online learning
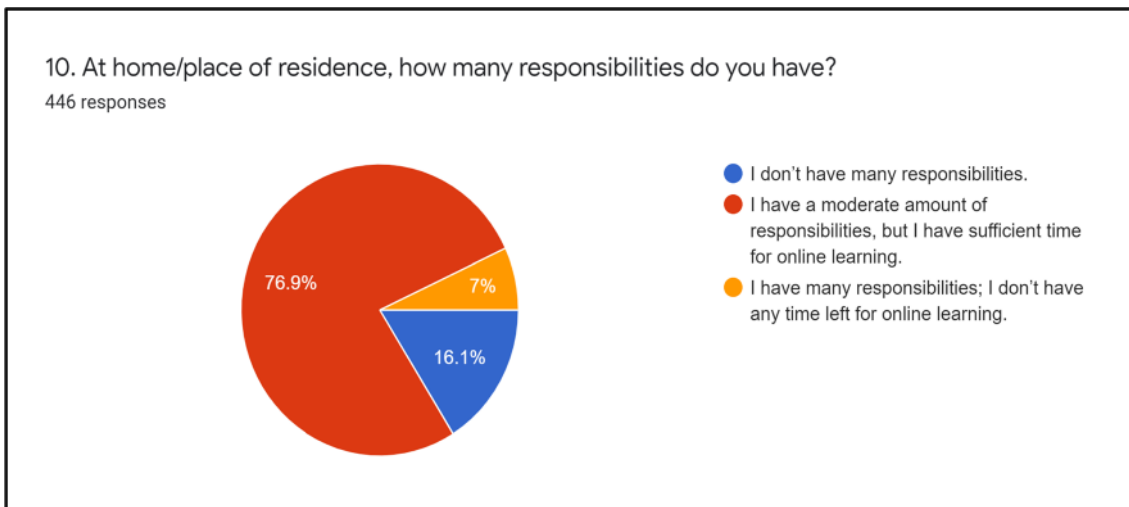


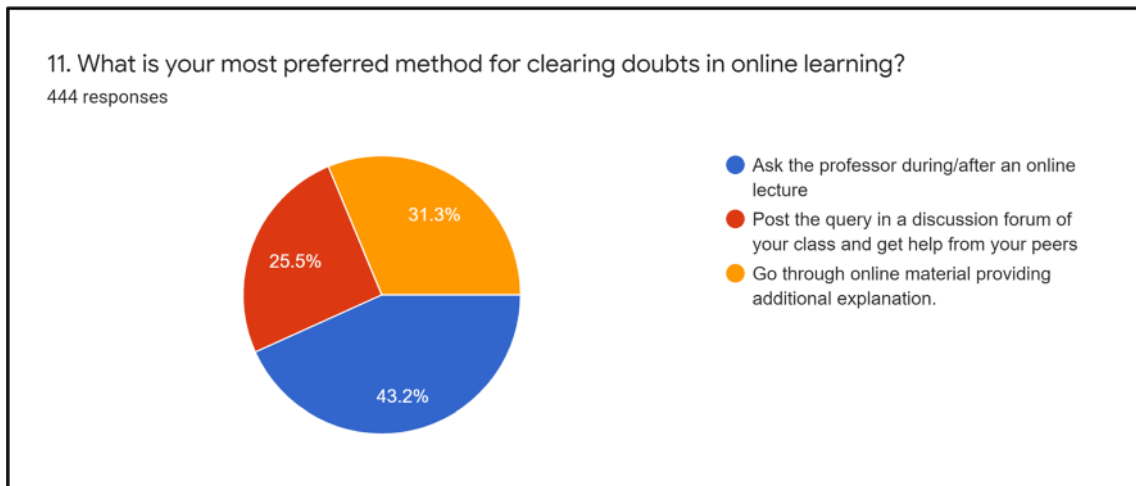**Fig. 13** The environment at home for online learning

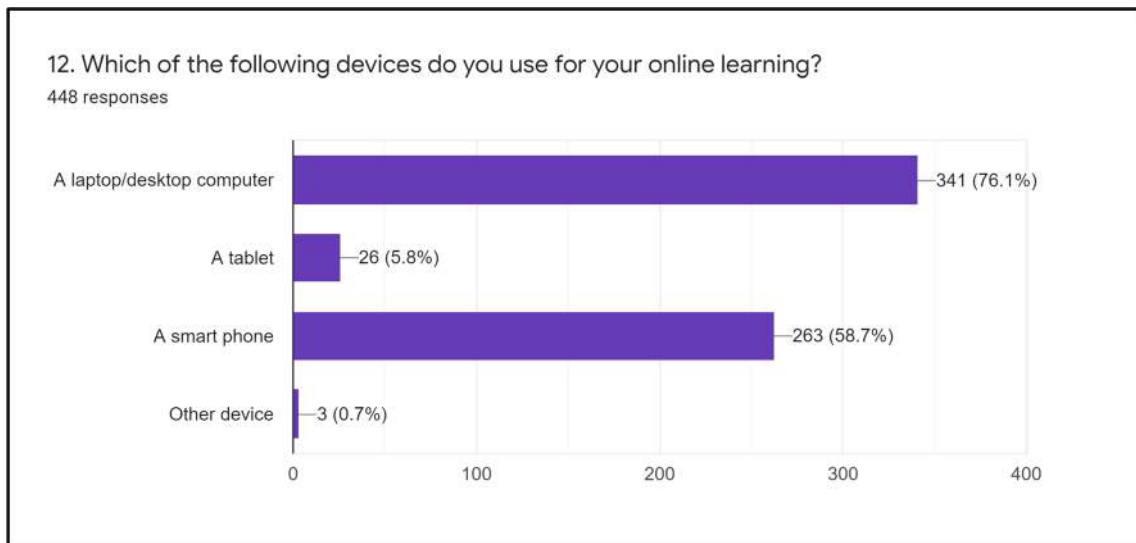**Fig. 14** Methods adopted for clearing doubts in online learning



**Fig. 15** Devices used for online learning

**Table 2** The observed cell totals, (expected cell values) and the [chi-square statistic for each cell]

| Questions | 1a | 1b | 1c | 1d | Row totals |
|---|---|---|---|---|---|
| 2a | 66 (49.91) [5.19] | 45 (64.17) [5.73] | 2 (3.21) [0.46] | 41 (36.72) [0.50] | 154 |
| 2b | 68 (84.91) [3.37] | 133 (109.17) [5.20] | 3 (5.46) [1.11] | 58 (62.47) [0.32] | 262 |
| 2c | 6 (5.19) [0.13] | 2 (6.67) [3.27] | 4 (0.33) [40.33] | 4 (3.81) [0.01] | 16 |
| Column totals | 140 | 180 | 9 | 103 | 432 |

chi-square statistic is 65.6025. The $p$ value is $< 0.00001$. The result is significant at $p < 0.05$.

## Conclusion

The outcome of a survey on the effectiveness of innovations in online teaching–learning methods for university and college students is presented. About 450 students belonging to VIT Vellore, CMRIT Bangalore, Medical

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College, Pudukkottai, and engineering colleges have responded to the survey. A questionnaire designed for taking is survey is presented. The chi-square statistic is 65.6025. The $p$ value is $< 0.00001$. The result is significant at $p < 0.05$. Associations between several responses of questions exist. The survey undertaken provides an estimate of the effectiveness and pitfalls of online teaching during the online teaching that has been taking place during the pandemic. The study done paves the way for educators to understand the effectiveness of online teaching. It is important to redesign the course delivery in an online mode to make students engaged and the outcome of the survey supports these aforementioned observations.

The outcome of the survey is given below:

1. A small group of 5 students would help students to have digital collaboration and engage personally in digital learning.
2. Animations are found to be the best digital approach for effective learning.
3. Online learning helps students to learn at their own pace comfortably.
4. Students prefer to learn from video lectures delivered by his/her faculty handling the subject.
5. Online quiz having multiple-choice questions (MCQ) preferred by students.
6. Student version software is useful for learning.
7. Online classes are more effective because they provide PPTs in front of every student, lectures are heard by all students at the sound level of their choice, and walking/travel to reach classes is eliminated.
8. Students do not have any disturbances or distractions which make learning more effective.
9. But for a few students, most of the students have no or limited responsibilities at home which provides a good ambiance and a nice environment for effective online learning.
10. Students can get their doubts clarified during lectures, by posting queries in discussion forums and by referring to online materials provided by the faculty.

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