Peer Interaction Teaching-Learning Approaches for Effective Engagement of Students in Virtual Classroom

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Abstract: The virtual classroom teaching-learning, online meetings, and discussions are becoming most popular throughout the world due to the COVID-19 pandemic event. There is a need to enhance the engagement and thinking ability of the students during a virtual classroom using suitable tools. This study explores the perspective of engineering students and staff members towards virtual classroom teaching-learning in India and Ghana-West Africa. This study also proposes teaching-learning approaches to motivate students for effective engagement and thinking. As an outcome, problem-solving skills and necessary graduate attributes of the students will be developed and accomplished. The participants involved in the survey include 194 students and staff members from engineering colleges and universities in India and Ghana-West Africa. The questionnaire-based research method is used to collect the perspective of students and staff. The disciplines in engineering such as Electrical and Electronics Engineering, Mechanical Engineering, Civil Engineering, and Computer Engineering are considered for analysis. The survey gives the challenges and benefits of virtual learning faced by the students and staff members. It also gives the expectation of the students and staff doing a virtual meeting. The research findings show that peer interaction teaching-learning methodologies such as brainstorming, role plays, group discussion, case studies, animated videos, games, and activities are best suitable in a virtual classroom to overcome the challenges addressed by the students and staff members. Based on the analysis of the survey, ICT-based tools, and applications for incorporating interactive teaching-learning methodologies have been listed with strategies and approaches to motivate and engage the students effectively in a virtual classroom environment.

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1. Introduction

The peer to peer interaction is one of the best ways to make students learn and gain knowledge. The traditional classroom makes the students involve much in the learning process, similarly, it is important in the virtual classroom to make students involved, committed, and engaged by the instructors. The virtual classroom is a digital learning environment in real-time that allows both students and educators to connect online. The peer interaction makes the student effectively engage in teaching-learning activities and enhance their thinking ability.

According to the World Health Organization (WHO) [1], COVID-19 is an infectious disease caused by a coronavirus that may spread through droplets from an infected person when he coughs, sneezes, or exhales. It may even develop severe illness and leads to the death of the infected person. After many awareness programs to prevent the spread of disease, it has spread to almost all the countries and territories around the world. Throughout the world, 45.61 million cases were recorded and 1.19 million people have died. In Ghana, the confirmed cases are 48,055 and 320 people were died because of this virus. In India, the confirmed cases are 8.09 million and 121,000 people were died because of this virus [2]. This creates a mandatory need for social distancing and to avoid gatherings. This led to the shutdown of schools, colleges, universities, and other related institutions. This closure of the educational institutions makes way for a virtual mode of teaching and learning activities. Thus, the conventional face to face teaching methodology has been replaced by virtual/online e-learning methodology. The countries like India are facing some challenges in the transition and implementation of virtual learning and for countries like Ghana, it is even worst. The most common challenges are instructor centric, poor internet connectivity, inadequate knowledge and skills in the usage of virtual learning methodology, Inadequate availability of ICT tools for both educators and the students [3-4]. These challenges raise the question, whether the learners and educators are ready for virtual teaching and learning process, and what guarantees the success of

virtual/ online e-learning. Several studies have been performed by various researchers associated with virtual/ online e-learning. Online learning is ineffective because of poor interaction, poor content development, and lack of preparedness towards e-learning [5-7]. In addition to this, adapting from the existing pedagogies to innovative virtual learning creates a negative impact on students due to poor motivation [8]. The growth of e-learning is growing approximately 15.4% yearly in educational institutes around the world [9]. The COVID-19 pandemic has pushed the educational institutions to provide online services including lectures and student assessment. In this transition, it is very important to record the perspective and attitude of the students towards virtual learning [10].

To get the perspective of the students and staff members, a survey has been conducted in various colleges and universities. The main purpose of this survey is to identify the perspective of the students towards the adaptation of virtual learning, the challenges, and benefits faced during the virtual classroom. This study is performed on the students who are doing engineering in various colleges and universities in Ghana and India. This study helps to get more information from the students about the ongoing virtual learning and their expectation for the upcoming learning methodologies.

2. Methodology

The study is conducted based on a quantitative methodology. The questionnaire is developed to collect data from the students. The questionnaire is made up of three sections with 40 questions. The first section of the questionnaires collects the information about the participant, who took part in the survey. The second section collects the information required for virtual learning. The third section collects the data for the analysis of virtual learning including challenges faced and perspectives of the student. Google form is applied to collect the data through online mode. The usage of google form helps to collect data from students from different colleges and universities by saving cost and time. 194 samples are collected based on the stratified sampling method with the age groups of 18-22, 23-27, 28-33, and above 33. The survey took place during September 2020 and October 2020. Students pursuing engineering from tertiary institutions in Ghana and colleges in India are considered for analysis. The details of respondents from different types of engineering specialization are shown in figure 1. The participants from the institutions are recently transitioned from conventional to virtual learning and are new to these virtual learning technologies.

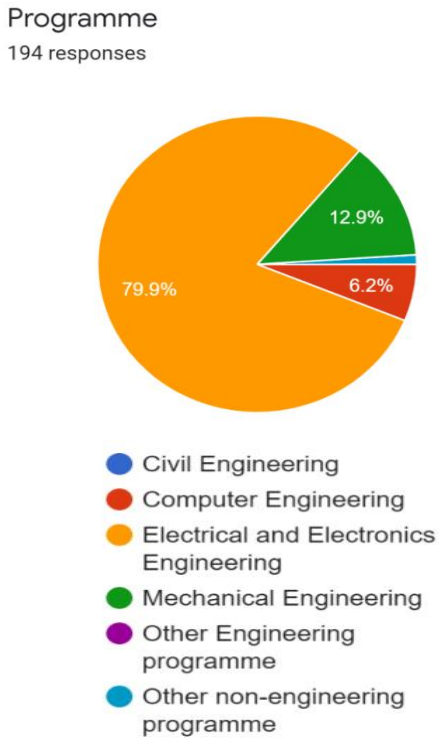

Fig. 1 Details of respondents from different engineering programmes

3. Analysis

From section one of the questionnaire, the information about the participants is collected and analyzed. Among the 194 respondents, 173 are male and 21 are female. 112 respondents belong to the age group of 18-22, 74 respondents belong to the age group of 23-27 and 7 respondents belong to the age group of 28-33. The gender details of respondents involved in this survey are shown in figure 2. The age group of students and staff involved in this investigation are shown in figure 3.

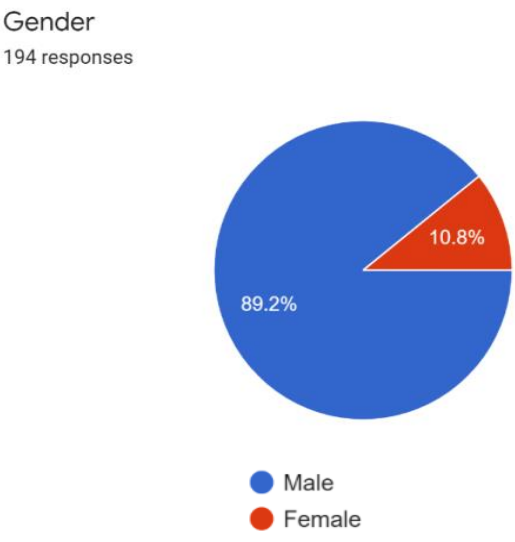

Fig. 2 Gender details of respondents involved in this survey

Table 1. Questions and responses for virtual learning requirements

S.No	Questions	Yes	No
1.	I am comfortable using computers	150	44
2.	I am able to access the Internet from my computer.	140	54
3.	I am comfortable with spending several hours at a time on a computer.	117	77
4.	I enjoy reading and have good reading skills.	168	26
5.	I am familiar with using E-mail and a web browser.	168	26
6.	I am self-motivated and able to work independently.	172	22
7.	I am a procrastinator when it comes to schoolwork and deadlines.	109	85
8.	I think it would be exciting to attend classes with people across the state/region, around the country, and even in other countries.	182	12
9.	I believe that high-quality learning can take place without face-to-face interaction.	125	69
10.	Do you like new technologies which may require new approaches to learning and problem-solving?	184	10

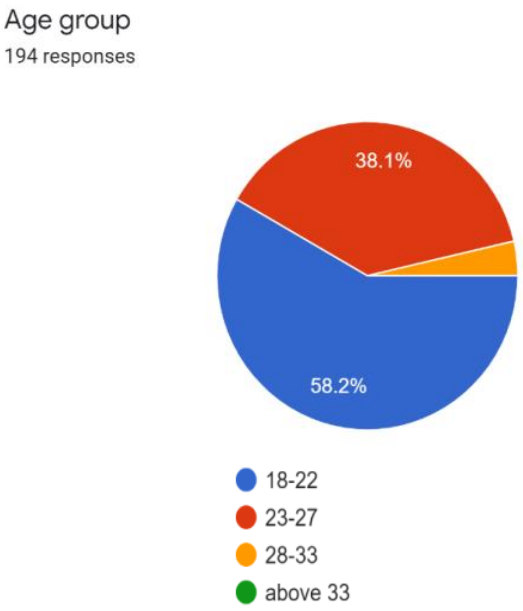

Fig. 3 Age group of students and staffs involved in this investigation

Section two of the questionnaire collects the data concerning the readiness of the students towards virtual learning. The question and its responses to the virtual learning requirements are as shown in table 1.

All the questions are positive (yes) type questions except the procrastination question which is a negative type question. The survey shows that participants like new technologies and approaches to learn and solve problems. They are also interested to attend and interact with people across the countries and regions.

$$\text{Average} = \frac{150+140+117+168+168+172+85+182+125+184}{194\times10}$$

$$\text{Average} = 76.8\%$$

The analysis shows that an average of 76.8% of the students is ready for virtual learning. Among 194 respondents, 135 respondents use smartphones as the primary virtual learning gadget, 47 respondents use the laptop as the primary virtual learning gadget. Hence the usage of the smartphone plays a significant role in the virtual learning process.

Section three of the questionnaire collects the information about the experience of the respondents in the virtual/online e-learning during the COVID-19 pandemic situation and their perspectives towards the upcoming learning methodologies. The survey is recorded on a five-point scale (Strongly Disagree - 1, Disagree - 2, Neutral - 3, Agree - 4, Strongly Agree - 5). The questionnaire and its responses for analyzing virtual learning are shown in table 2.

The analysis shows that all the respondents are stressed during this COVID-19 teaching and learning process. The response shows that the respondents faced challenges in effective learning, peer interaction, technical connectivity, and class engagement. The survey also reveals that the benefit of virtual learning such as flexibility, easy availability of learning material, and cost-effective learning methods. The respondents understand that virtual learning

is a part of technological advancement in the educational sector which cannot be neglected. From the survey, it is to be noted that the educator/instructor needs the necessary training to adapt to virtual learning.

Table 2. Questionnaire and its responses for analyzing virtual learning

S. No	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	**2**	**3**	**4**	**5**
1.	Virtual learning is stressful for me during the COVID-19 pandemic?	0	0	57	37	53
2.	I could manage time well while learning remotely?	0	32	74	34	27
3.	Virtual learning is effective than traditional classroom learning	96	35	32	13	18
4.	Technical difficulty is common in virtual learning	20	24	34	31	85
5.	Virtual learning is interesting than traditional classroom learning	87	32	41	14	20
6.	Virtual learning is easy to adapt	54	33	54	24	29
7.	Virtual learning makes me more engaged and to think better than in the classroom.	65	37	39	26	27
8.	Virtual learning is part of technological advancement/revolution and is mandatory from the year 2021	43	22	48	32	49
9.	Virtual learning is distractive	40	31	49	26	48
10.	Virtual learning makes me to feel isolated	20	19	64	26	65
11.	Virtual learning is flexible to learn (No fixed schedule)	39	29	58	24	44
12.	Virtual learning is cost effective	25	14	48	32	75
13.	Virtual learning provides an opportunity to network with peers across nations or even different continents.	22	20	57	33	62
14.	Availability of learning material and documentation is easy in virtual/online learning	31	25	49	33	56
15.	The instructor is good enough to engage and make me think about virtual/online learning.	37	41	61	27	28

The survey has been done to analyze the support given to students from schools, colleges, universities, parents, guardians, and educators. Suitable questions are included in the survey to analyze the support received by students from schools, colleges, universities, parents, guardians, and educators as shown in table 3.

Average students received no help = $\frac{58+42+60}{194\times3}$ = 27.5%

Average students received extreme help = $\frac{13+22+35}{194\times3}$ = 12%

An average of 27.5% of the respondents felt helpless in this transition to virtual learning. The survey also reveals that only 12% of students got necessary help from universities, teachers, and their parents towards virtual learning. Thus, it is to be noted that the help from the school, university, teachers, lecturers, parents, and caretakers need to be improved towards the implementation of virtual learning.

The challenges are listed as a dropdown menu for the participants to choose from. The challenges listed are Computer and digital literacy, Time management, Ability to engage and think, Technical issues, Home environment and disturbances, Multimodality, Motivation, Adaptability challenges, Gadgets shortage, and Assignment burdens. The response from the participants is shown in table 4.

Table 3. Support received by students in virtual learning

S. No	Question	Not at all helpful	Slightly helpful	Moderately helpful	Extremely helpful
1.	How helpful your [School or University] has been in offering you the resources to learn from home?	58	75	48	13
2.	How helpful are your teachers/Lecturers while studying online?	42	67	63	22
3.	How helpful are your parents/caretaker while learning online?	60	47	52	35

Table 4. Challenges in virtual learning

S. No	Question	Number of respondents	Percentage
1.	Technical issues	50	25.7
2.	Home environment and disturbances	41	21.1
3.	Computer and digital literacy	30	15.5
4.	Time management	22	11.3
5.	Gadgets shortage	14	6.7
6.	Inability to engage and think	13	6.7
7.	Assignment burdens	8	4.1
8.	Lack of Motivation	7	3.6
9.	Adaptability challenges	7	3.6
10.	multimodality	2	1.0

Table 5. Benefits in virtual learning

S. No	Question	Number of respondents	Percentage
1.	Access to coursework from anywhere at any time.	74	38.1
2.	Improved technical skills	27	13.9
3.	Effective time management	23	11.8
4.	Sharpened digital skills	22	11.3
5.	Immediate feedback on tests/exam	19	9.7
6.	Expanded world view	14	7.2
7.	Low cost	7	3.6
8.	One-on-One Attention	5	2.5
9.	Asynchronous discussions with classmates	2	1.0
10.	Community and relationship building	1	0.5

Among the various challenges, the technical issues are commonly followed by home environment and disturbances. The benefits of virtual learning are also listed as a drop-down menu in the survey for the analysis as shown in table 5. Among the various benefits, access to coursework from anywhere at any time is considered the biggest benefit of virtual learning.

4. Discussion

An average of 76.8% of students gave a positive response in section two of the questionnaire. The usage of smartphones and laptops makes the student ready to adapt to the virtual learning methodology. This reveals the possibility of effective implementation of virtual learning in developing countries like India and Ghana. Also, the focus should be made for the remaining 23.2% of the participants to perform intensive analysis for the reason behind the lack of adaptability.

The virtual learning during this COVID-19 is stressful since all the stakeholders faced an unexpected transition. This could be one of the reasons for the stress, which not only affects the students but also affects the instructors, educators, and universities. Necessary arrangements should be taken to reduce the stress level of all the participants in the educational sector.

The challenges in virtual learning experienced by the participants are shown in figure 4. Among the various challenges faced by the respondents, 25.8% of technical issues, 21.1% of home environment disturbances, and 15.5% of digital literacy are considered as the notable challenges that should be resolved for the adaptability of virtual learning.

The benefits of virtual learning experienced by the participants are shown in figure 5. Among the various benefits of virtual learning, access to coursework from anywhere and at any time (38.1 %) is considered the best benefit in virtual/online e-learning methodologies.

This virtual learning creates a huge network so that the skill can be shared and developed from any end of the world with less cost and stress. Sharing, reading, and recording of materials are easier with virtual and online e-learning technologies.

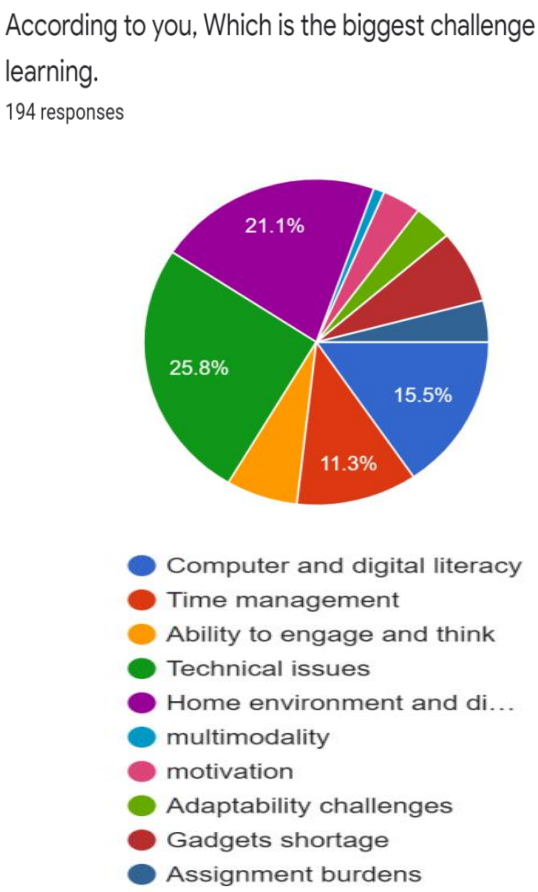

Fig. 4 Challenges in virtual learning

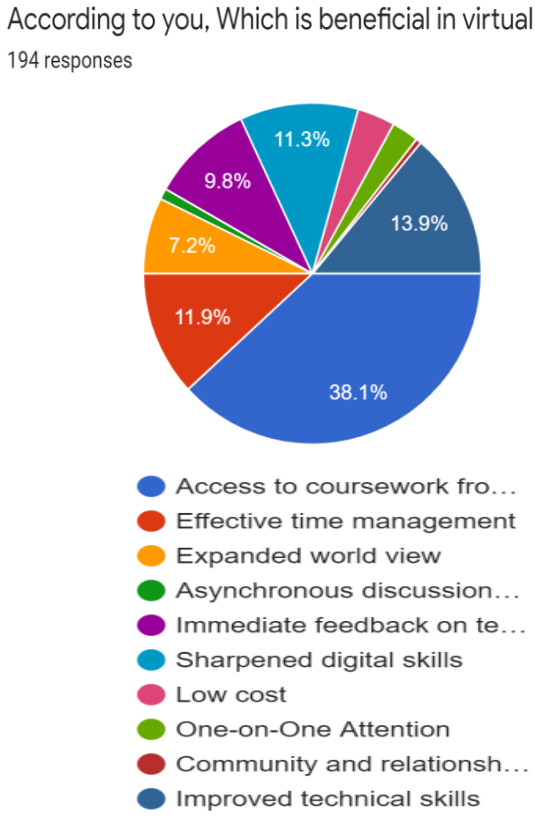

Fig. 5 Benefits of virtual learning

The survey shows the virtual learning is not effective during this COVID-19 pandemic but shall be effectively implemented with few improvements. The technical difficulty is one of the major concerns which affects the effectiveness of virtual learning. A technical difficulty for the short interval of time will affect the continuity of class. Hence suitable precautionary and remedial measures should be taken at both ends. Supply of recorded videos and materials shall be one of the remedial measures in this scenario.

The other major concern which affects the effectiveness of virtual learning is correlated with poor student engagement. The survey shows that suitable training is needed for instructors towards virtual learning for effective engagement in a virtual classroom. Virtual learning will not be effective if the instructor is not adapted and trained in virtual learning. The instructors are good enough to engage students in traditional face to face learning. The transition from traditional to virtual face to face learning should be performed as early as possible. The peer to peer interaction holds the key to make virtual learning effective. Effective student engagement and development of thinking ability is the key parameter in learning.

4.1 Teaching and learning strategies for effective engagement

According to Robert Marzano, "Positive relationships between teachers and students are among the most commonly cited variables associated with effective instruction. If the relationship is strong, instructional strategies seem to be more effective" [11-13] Some of the strategies for increasing student motivation and engagement in a virtual classroom are shown in figure 6.

Fig. 6 Strategies for effective engagement of students in a virtual classroom

At the beginning of the virtual class, ask the students to introduce themselves in a chat box or using a microphone whereas, in the continuing virtual class, suitable review questions may be posted to bring their attention and involvement.

Proper usage of a discussion forum or chatbox helps to keep track of the students in the virtual classroom. It is important to provide video lectures, necessary materials, assignments, and sample assessment questions for the students to boost their attention and interest in the course. Follow the deadlines to complete the task assigned at the right time since virtual learning is time-bounded. The inclusion of project-based learning, problem-based learning, and task-based learning [14-16] makes the learning more engaged. The continuous and routine feedback keeps the student highly motivated and committed.

The content development and session plan play a key role in this accomplishment of effective engagement in virtual learning [17]. The content shall be developed using the Session plan, participant manual, trainer manual, Activity sheet, audio, and video clips. The session plan should include course/program/module title, Session objective, Methodology, Duration, and Breaks. It is very important to include activities to make the participants engage and think[18-20]. Some of the suggested activities by the participants to make the virtual learning interesting and effective are:

1. Ask questions/opinions periodically
2. Conduct technical quiz appropriately
3. Explain Case studies
4. Conduct individual activity
5. Tell relevant stories
6. Organize role plays
7. Use animation
8. Conduct group discussion
9. Organize short games
10. Play a video demonstration

Learner-centered teaching techniques [21] should be included. This shall be accomplished by suitable virtual learning tools. The most commonly used application tools in the virtual learning process are Zoom, Google classroom, Google meet, GoToMeeting, YouTube live, Microsoft team. Among the various tool used for virtual learning, Zoom is widely used because of its features and simplicity. This helps to conduct face to face learning through a virtual classroom.

Some of the techniques to motivate students in the virtual classroom

1. Allow students to show what they value most.
2. Make better decisions by collecting clear data on your students.
3. Ask students what they expect from you and make sure you meet their expectations.
4. Let students choose what they want to learn.
5. Give students options for how they want to learn something.
6. Let students choose their assessments.
7. Leverage social media.
8. Create authentic learning experiences instead of abstract challenges.
9. Integrate pop culture into your lessons using song lyrics, memes, and clips from movies and television shows.
10. Publicize goals to help students to stay accountable.
11. Give effective and objective feedback.
12. Give meaningful praise that will help students to know what they are doing right.

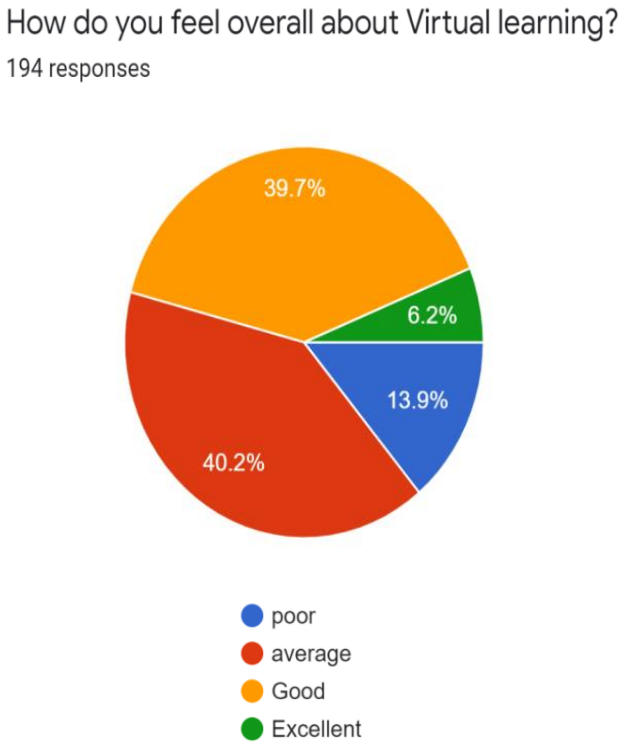

Fig. 8 perspective of virtual learning among students

The finding of the study is based on the collection of data which shows that the respondents are ready to adapt the virtual learning methodologies. 40.2% of the respondents felt average towards virtual learning as shown in figure 8. Considerable efforts shall be made to adapt virtual learning by enhancing peer to peer interaction and by eliminating technical issues. The face to face learning shall be implemented using virtual learning application tools like Zoom, Google classroom, Google meet, GoToMeeting, YouTube live, Microsoft team. Virtual classroom learning shall be an unavoidable option in tertiary or higher education. Hence the universities, instructors, and parents should be prepared for the transition. peer to peer interaction is the most important factor to motivate and to engage the students to make virtual learning more effective. These findings lead to the suggestion of teaching and learning strategies that can be implemented using

applications like Zoom, Google classroom, Google meet, GoToMeeting, YouTube live, Microsoft team.

5. Conclusion

The perspective of engineering students and staff members towards virtual classroom teaching-learning in India and Ghana-West Africa are explored in this study. The questionnaire-based research method is used in this research. The proposed approaches are supportive to motivate students for effective engagement and thinking. The problem-solving skills and graduate attributes of the students are recognized. The challenges faced by the students and staff members and also the expectation of the students and staff in the virtual classroom are investigated. The peer interaction teaching-learning methodologies such as brainstorming, role plays, group discussion, case studies, animated videos, games, and activities are best suitable in a virtual classroom to overcome the challenges addressed by the students and staff members. The ICT based applications such as Zoom, Google classroom, Google meet, GoToMeeting, YouTube live, Microsoft team are extremely useful for implementing peer to peer interaction and methodologies. The teaching-learning approaches and strategies are optimum to motivate and engage the students effectively in a virtual classroom environment.

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