Use of Active Learning Techniques and ICT Tools to Inspire Online and Blended Teaching-Learning Process

WIN-WIN situation for both faculty and students !!!

Mr. Kartik Ramesh Patel
Assistant Professor, EXTC Department
K.J. Somaiya College of Engineering
Vidyavihar, Mumbai-77, India
kartik@somaiya.edu

***Abstract*— To develop Higher Order Thinking Skills (HOTs) and hence the quality of education imparted on students, it is necessary for a teacher to go beyond traditional methods of teaching such as classroom lectures, assignments etc. By using interactive methods of teaching-learning described in this paper along with different Information and Communication Technology (ICT) tools the teaching-learning process can be made more student-centric. In the 21st century with the development of different ICT tools the course content (resources) can be floated using online platform such as Google drive, Learning Management System Moodle, Wordpress sites etc. which enables sharing of resources among students along with traditional way of classroom lectures which gives inspiration for online and blended teaching-learning process. This paper is the implementation of different active learning techniques and ICT tools used for students to engage actively in the course and hence better attainment of Learning Objectives (LO's). Results revealed that student's attendance at the lecture is increased to 84% along with the performance of students increased to 85%. To complete the loop, feedback from students was taken and analysis shows that 56 % of students are in favor of this online and blended teaching-learning process.**

Keywords—Higher Order Thinking Skills, Learning objectives, Blended learning, Learning Management System, Information and Communication Technology

I. INTRODUCTION

In the 21st Century, our society needs young people who are flexible, creative, and proactive-young people who can solve problems, make decisions, think critically, communication ideas effectively and work efficiently within teams and group. The 'knowing of knowledge' is no longer enough to succeed in the increasingly complex, fluid, and the rapidly evolving world in which we live. In order to optimize life-long learning and potential success, it is now widely accepted that young people need to have opportunities to develop personal capabilities and effective thinking skills as part of their well-rounded education. These skills should be an integral part of the revised curriculum of universities and autonomous institutes.

In traditional teaching methods, students learn within a classroom by listening lectures, preparing notes, assignments and referring textbooks. Current education technology research reveals that such type of a passive environment is not effective and results in limited knowledge retention by students. [1]. Active learning shifts the focus from the teacher and delivery of course content by using different techniques to the learner and active engagement with the course contents.

Active learning involves providing opportunities for students to meaningfully talk and listen, write, read and reflect on the content, ideas, issues, and concerns of an academic course [10]. It is a student-centric approach which makes student working in collaboration with classmates. In active learning teachers are not "deliverers of knowledge" but rather "facilitators". The importance is put on the discussion, problem-solving, cooperative learning, and writing exercise. Active learning engages students in two aspects – learning by doing the activity and thinking about the activity they are

doing [3]. Active learning techniques include role-playing, group projects, think-pair-share, flipped classroom activity, five-minute paper, concept mapping, peer teaching, debate, group discussions etc. Active learning consists of students being engaged in learning through participating in knowledge (cognitive process), resulting in a deeper knowledge.

Use of Information technology becomes more significant from year to year. Today it is difficult to imagine any discipline of human activity without Information and Communication Technologies (ICT). The term "technology" has come to us from the Greek language and translated as "science". The modern understanding of the word includes the application of engineering and scientific knowledge to solve real-time practical problems. The ICT refers to the processes and methods of interaction with information, which implemented with the use of devices, computers, and telecommunication. [4]. ICT tools are used to prepare students at all levels: primary, secondary and higher education. Combining traditional classroom training with computer-based or online training with different ICT tools is reaping the benefits of blended learning.

The manuscript is organized into five sections. Section II contains current trends and issues of blended learning. Section III highlights framework and continuums of active learning. Section IV is about the implementation of different active learning techniques in the course. Section V includes results and feedback analysis.

II. BLENDED LEARNING

The term 'blended learning' has various definitions. Blended learning incorporates both face-to-face interaction and distance learning, making the best use of both delivery modes. It can also be termed as a combination of classroom and online learning which is called 'hybrid learning' [5]. In blended learning online component is 'natural extension' of classroom learning. The aim of blended learning is not to replace traditional classroom teaching but to complement it to form a blended or hybrid approach. This blended model of teaching-learning also requires specific pedagogical aspects while implementing in the classroom. The influence of the blended learning depends significantly on the facilitator's skills in designing activity and imparting on the learner. The role of the faculty administration in supporting online infrastructure is important along with the dedication of students to learn new skills in a different way so that they can work competently for expansion of knowledge. Nowadays, higher education systems prefer blended learning in order to provide an alternative channel to their learners in understanding courses. Main components to support the implementation of blended learning are Learning Management System (LMS), Student Management Systems (SMS) and Content Management Systems (CMS).

Blended learning can increase access and flexibility for learners, increase the level of active learning, and achieve better student experiences and outcomes. For faculty, blended learning can improve the better way of content delivering and class management practice. A blend might include [6].

- Face-to-face and online learning activities
- Well established technologies such as lecture capture, with social media and emerging technologies.
- Group activities, simulations, problem-based learning, site-based learning, practical's, case studies etc.
- Traditional timetabled classes with different variations such as weekend, trimester

A. Past, Present and Future

Blended learning is part of the ongoing convergence of two learning environments. On one hand, we have the traditional face-to-face learning environment for centuries. On the other hand, we have online learning environment that has begun to grow and expand with rapid development in new technologies [10]. In the past, these two learning environments have remained largely separate because of fewer technological developments for creating and sharing resources (Fig.1). The rapid development of technological innovations over the past half-century (digital technologies) had a huge impact on the possibilities for learning in the computer-mediated environment. There will be a more increased focus on facilitating human interaction in the form of computer-supported collaboration, sharing of resources, making virtual communities, instant messaging, and blogging [10].

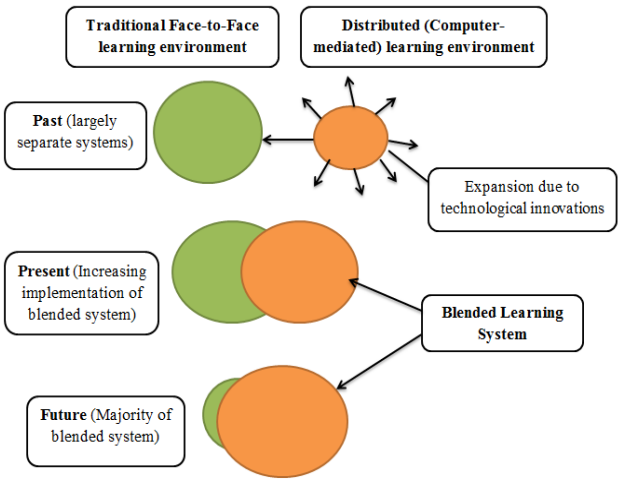

Fig. 1. Progressive convergence of traditional face-to-face and online blended environments [10]

B. *Current Trends and Issues*

There are many reasons that a facilitator or learner might pick blended learning over other learning options. Six reasons that one might choose to design or use blended learning system mentioned in [7].

- Pedagogical fruitfulness
- Access to information
- Community interaction
- Individual agency
- Cost-effectiveness, and
- Ease of modification/revision

The most commonly cited a reason for blending is more effective pedagogical practices. Currently, teaching learning process in higher education is still focused on information transmission rather than interactive strategies. Blended learning approaches increase the level of active learning, peer-to-peer learning, and learner-centered strategies.

As a learner access to information and resources to is one of the key factors influencing the growth of blended learning environment. With the development of LMS, it is possible for a teacher to float online resources to all learners simultaneously which can be accessed by them anytime anywhere. Flexibility and convenience of learner are also important to motivate online and blended teaching-learning process.

As on today, there are many information sharing platforms such as Google drive, WordPress site, Padlets, Wikis, Moodle etc. are available which provided cost-effectiveness with ease of modification and revision to the entire process.

The issues for implementing blended learning might be the technology challenge of building infrastructure within an educational institution or particular in the classroom. Obtaining software technology and hardware for blended learning can be costly. The other issue is IT literacy, which may be a substantial barricade for teachers rather than learners. For developing blended learning environment the availability of solid tech support and trainers is an absolute must. For implementing such learning techniques there's a significant amount of extra teacher's work involved in the primary developing stage. A facilitator adopting blended learning has to pick the right course content, the right ratio between the classroom and online learning, and best of my knowledge.

Shortcomings of blended learning exist but are not unsurpassable. The negative impact can be minimized or even channeled into productive activity if the instructor keeps an eye on student feedback, improves technology skills and delivers quality course material.

III. ACTIVE LEARNING

Students learn by many methods such as seeing, hearing, logical reasoning, memorizing, building mathematical models etc. [9]. The process of having students engages in some activity that forces them to reflect upon ideas and how they are using those ideas. In active learning students regularly assess their own degree of understanding and skill at handling concepts of problems in particular discipline. It is the process of keeping students mentally and physically active in their learning through activities that involve gathering information, thinking and problem-solving [8].

A. *Active Learning Framework*

Advocates for active learning in the middle grades agree that the most lasting learning comes through direct experience and interaction with the intellectual, social, and physical environments (Fig.2.) [8].

- *Intellectual:* Primary goal of the facilitator should work to get students intellectually engaged with the content. We want students to be active rather than just passively receiving information and accepting teacher's delivery of content or through

textbooks. Active learning requires students to engage with the course content using critical thinking or higher order thinking such as creating, analysis and synthesis. Enquiry based learning, problem-solving, concept maps, the study of research papers, presentations, puzzles interdisciplinary projects are intellectual active learning methods.

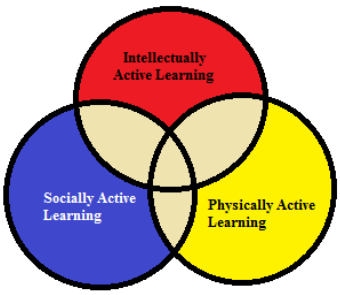

Fig.2. Frame Work of Active Learning [8]

- *Social:* At the age of 10-15, youngsters are peer-oriented and allowing students to work collaboratively is a significant aspect of active learning. A small group activity, projects sharing of resources among peers, having partners, discuss a question about the content is part of social active learning. Small groups and whole class discussions are also methods for getting students socially active in their learning.
- *Physical:* Youngsters are typically energetic and active, and physical movement in the classroom is important as well. Active learning strategies such as site seeing, building models, hands-on projects, and experiential learning are some of the physical active learning strategies.

B. *Active Learning Continuums*

One of the methods of selecting appropriate activities is to categorize them using a series of continuums. Detail use of four continuums to measure variables associated with the process of selecting an appropriate activity. The continuums are 1) Task Complexity Continuum 2) Course Objectives Continuum 3) Classroom Interaction Continuum 4) Continuum of Student Experiences [9].

- *Task Complexity Continuum:* The task complexity continuum examines a particular active learning strategy to determine its complexity. This continuum ranges from simple to complex.
- *Course Objective Continuum:* This continuum places knowledge and skills/attitude at opposite ends of the continuum. Whether the outcome required is for the student to gain knowledge, ability, attitude, or some combination, to be the most important question that must be answered before the selection of an active learning strategy.
- *Classroom Interaction Continuum:* This reflects the overall level of interaction that an instructor prefers or is comfortable with. The two extremes are limited interaction on the left side and extensive interaction on the right side of the continuum.
- *Student Experience Continuum:* It measures learners experience with the teaching style, content or skill needed to successfully participate in the active learning strategy.

IV. Using Active Learning Techniques with ICT Tools in Course

Active learning techniques are implemented for two courses in third-year electronics and telecommunication engineering.1) Communication System (number of students 74) and 2) wireless communication (number of students 14) with traditional classroom teaching and ICT tools to inspire online and blended teaching-learning process. Results for attendance in lecture, the performance of students for communication systems course is shown. Also to complete the implementation loop, feedback from the student is taken and its analysis is shown.

A. *Flipped Classroom Activity*

This activity was conducted as one of internal assessment test of the course for 10 marks. The topic was multiplexing and multiple access techniques used in the communication system. In flipped classroom activity information transmission

happens outside classroom and assimilation happens inside the classroom. In the month of October 2017, this activity was conducted. Flipped classroom activity has two segment-In-class segment and out-of-class segment.

- *Out-of-class segment*: Three animated videos from YouTube clarifying basic concepts of multiplexing and multiple access was shared with students by using ICT tool Google drive. Students are expected to watch the video and before coming for next lecture. This is equivalent to the teacher giving the lecture in the traditional classroom.

- *In-class segment*: In initial 10 minutes of lecture, we had the small discussion on all three videos and I have highlighted some the important points related to multiplexing. In the later part of lecture questions related to videos are displayed on LCD projector. 15 Minutes are given to write the answer to these questions on paper. The advantage of this activity is that when students are coming to the lecture, they are already familiar with the topic on which discussion is going to happen in class which brings an eagerness to attend the lecture. This is the example of blended learning in which traditional classroom teaching is blended with online learning (videos and other resources). Following are the continuums associated with this activity.

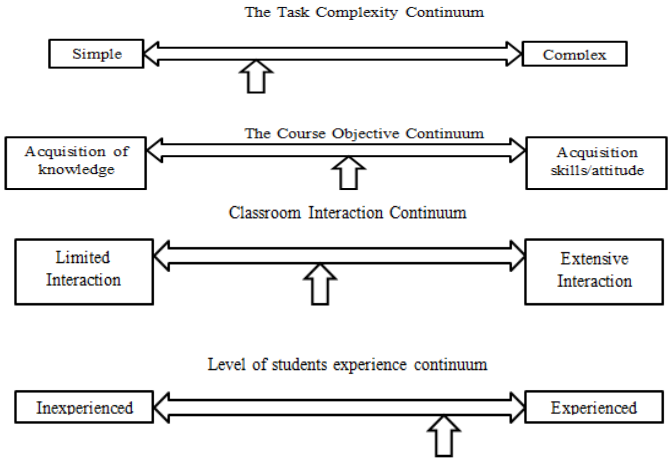

Fig.3. Continuums of flipped classroom activity

B. *Five Minute Paper*

This was second activity conducted for internal assessment for 10 marks. In this activity, students are expected to write the summary of entire lecture within five minutes. In a group of two, students will the summary of the lecture. To make assessment standard some of the common points on which summary has to be written were displayed on LCD projector. With this activity student will acquire skills like the presence of mind, collaboration with the peer, critical thinking, written communication, adaptability. Following are the continuums associated with this activity.

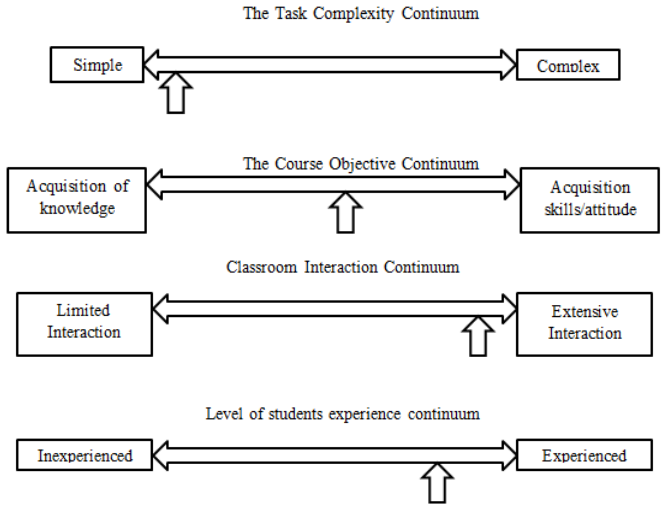

Fig.4. Continuums of five minute paper activity

C. *Crossword Puzzle*

The activity was conducted for wireless communication course as a part of the graded activity in the internal assessment test. Students were given ten clues in the form of crossword puzzle across and down with each clue carries one mark. The questions in the puzzle were asked from the lecture power point presentations which were shared with them by using ICT tool Google sites. The time duration of 15 minutes was given to complete the puzzle. Since perfect word match is required to complete the puzzle this activity requires curiosity and imagination power in students. Accessing and analyzing information is also skills acquired through activity. Following are the continuums associated with this activity.

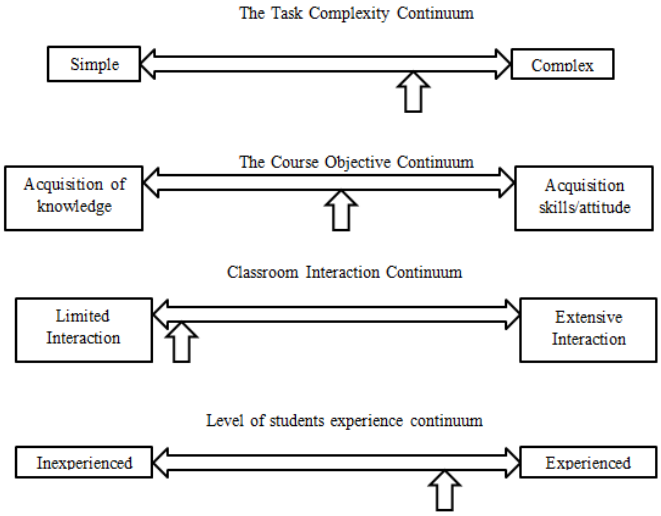

Fig.5. Continuums of crossword puzzle activity

D. *Picture Prompt*

Second activity conducted for wireless communication course was picture prompt. In this activity, students have been shown images/pictures with no explanation, and students had been asked to identify/explain it and justify their answers. Also, they have been asked to write about it using terms from the lecture or to name the processes and concepts shown in the image. This was complete online activity and it was designed using Google Slides. The activity was shared on Google drive folder, and each student had to answer the question in the same folder online only. The assessment was also done online and marks were shared with students. This activity also requires critical thinking, HOT's and imagination power. Following are the continuums associated with this activity.

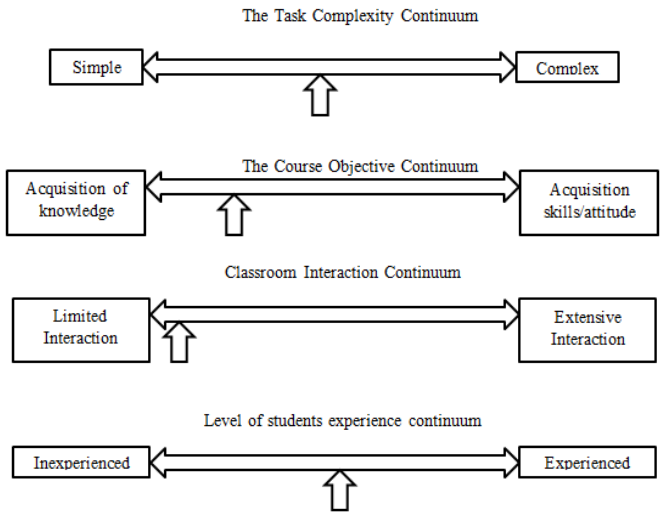

Fig.6. Continuums of picture prompt activity

V. Results and Feedback

A. *Student's Attendance in lecture*

Odd semester of the academic year in our institute started from July 2017. The active learning techniques are implemented in the month of September and October 2017. With the proper description of the activity given to students, it was observed that student's attendance in lecture is increased to 84% in September and 71% in October 2017 as compared to 66% in July 2017 and 31% in August 2017 month. The increased attendance in the lecture shows student's eagerness for the activity and the knowledge they will acquire by doing it.

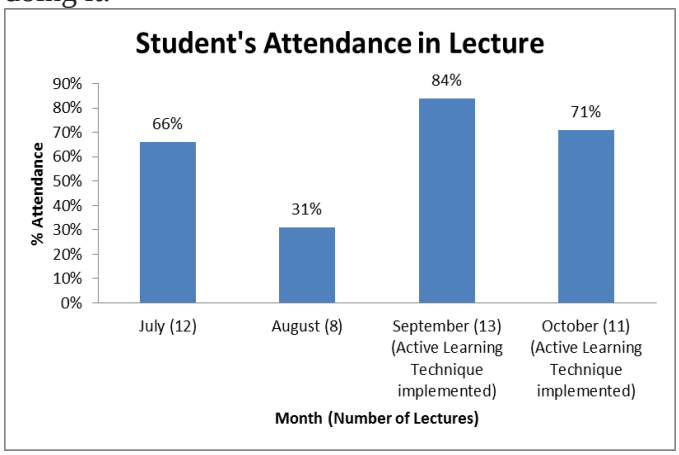

Fig.7. Percentage of Student's Attendance

B. *Student's Peformance*

The performance of the student is a very critical parameter for satisfying learning objective of course and overall result of the institute. It was observed that performance of students increased by implementing active learning technique such as flipped classroom activity and five-minute paper as compared to traditional activities of quiz, assignment and surprise test.

The main reason behind this was active engagement of students during lecture, peer discussion, and collaboration, interesting way of learning from online resources, sharing of resources, critical thinking and dynamic participation in the activity. The results are shown below (Fig. 8) are the comparison of three activity conducted as a part of the internal assessment in communication system course and two activity conducted for wireless communication course (Fig.9).

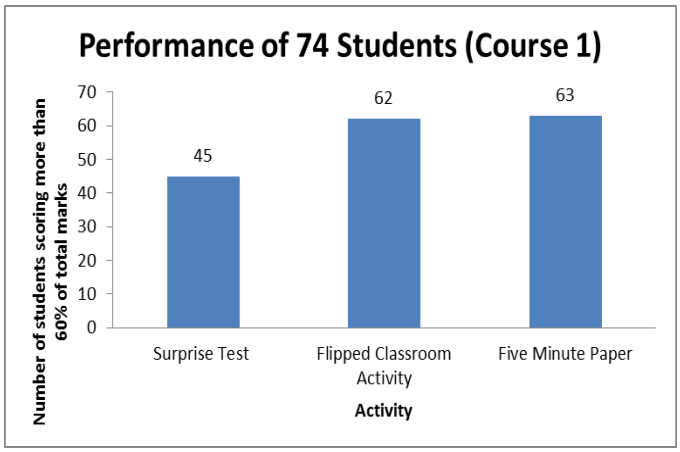

Fig.8. Performance of 74 Students of Communication Systems course

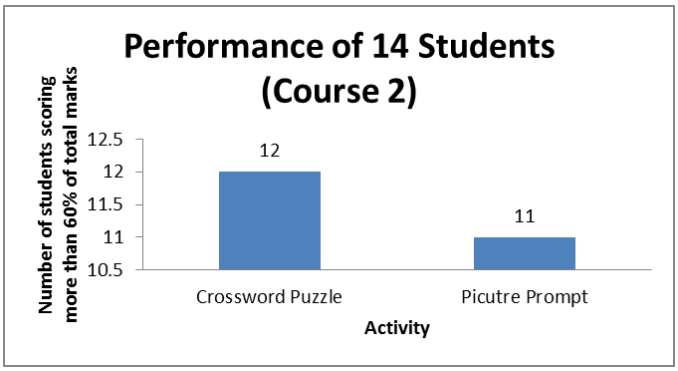

Fig.9. Performance of 14 Students of Wireless Communication course

C. *Feedback analysis*

At the end of activities, feedbacks from the participating students were collected to know their opinions about the activity. The feedback results are visualized in Fig. 10 below.Out of 74 students in class 66 students has responded to the feedback form. 56% of students say in high amount, the active learning technique five-minute paper was helpful for reviewing material presented in class. 57% of students say flipped classroom activity was very helpful for them to identify their preparedness for the upcoming exam.

There was one open ended question floated in the feedback form saying, Give your suggestions in general about the active learning techniques implemented in classroom. Also suggest any other active learning techniques which you know. Students say there should more weightage given to active learning because it gives sense of learning methodologically rather mugging up. It also helps them to learn things more curiously.

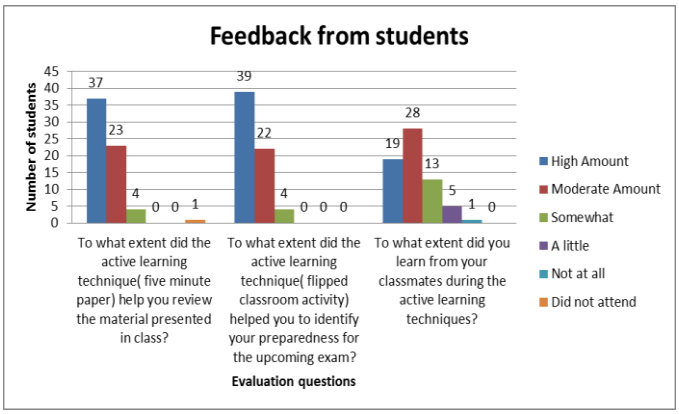

Fig.10. Student's Feedback about active learning techniques

To inspire online and blended teaching-learning process in future, one additional question was asked in the feedback, response of which can be visualized in Fig. 11.

From the visualization below, 56.06 % of students believe that there should be active learning mixed with lectures (blended learning). 40.09 % of students agree there should be more active learning with fewer lectures. 43.93 % of the student says video lectures should be provided on a CD, with active learning strategies used during class time (Flipped classroom activity). From the above analysis, it is proved that students are more interested in blended learning using ICT tools and active learning techniques due to more visualization effects in online learning. Students are also interested in flipped classroom activity wherein video lectures should be provided to them to study as a part of out of class segment and information assimilation, discussion, question-answer, and understanding should be done as a part of the in-class segment.

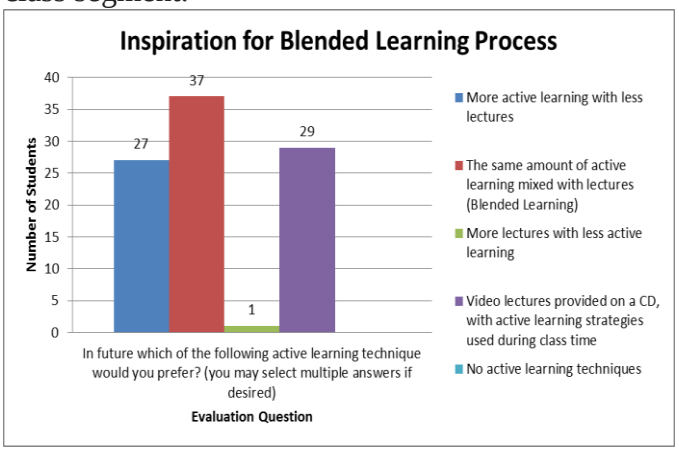

Fig.11. Inspiration for Blended Learning process

VI. Conclusion

With the development of technology, changing pedagogical tools is the challenge for the future education system in the world. Nowadays we have many different ICT tools which make the teaching-learning process more effective. The major idea of the approach described in this manuscript is to include online learning (active learning and ICT tools) with traditional classroom teaching to encourage the blended teaching-learning process. By implementing blended learning method the created environment is favorable for both faculty and student. Students will be actively engaged in course, and develop skills such as critical thinking, problem-solving, collaboration with peers, effective oral and written presentation, Initiative, entrepreneurialism, curiosity, and imagination etc. and they will perform better in the exam. Faculty will have a higher percentage of learning outcome attainment for the course. Hence the blended learning environment is the win-win situation for both faculties as well as students. The active learning techniques are implemented for two courses and feedback from students reveal that 56 % students agree that learning in blended mode will be more supportive of them.

VII. Acknowledgement

The author would like to acknowledge and thank principal, head of electronics and telecommunication department and subject board, to give flexibility in the curriculum for implementing active learning techniques.

References

[1] B.L. Tembe, S.K. Kamble, "Implementation of active learning methods in mechanical engineering education to enhance students' performance",2016 IEEE 40th Annual computer software and applications conference.

[2] Magdalena Bogacka, Krzysztos Pikon, "Work in progress: combining active learning methods in engineering education", 2017 IEEE Global Engineering Education Conference (EDUCON),pp.1863-1867.

[3] Lavrinenko S.V., Ikonnikova P.K., "The effectiveness of information and communication technologies in the educational process", IFOST-2016:Humanitarian and Economical Aspects of Engineering Sciences, pp.465-468.

[4] Mohd Fadzli Ali, Gordon Joyes, and Linda Ellison, "Using blended learning to enhance students' cognitive presence", 2013 International Conference on Informatics and Creative Multimedia", pp. 202-208.

[5] Gina Saliba, Lynnae Rankine, and Hermy Cortez, "Fundamentals of blended learning", Blended learning team, learning and teaching unit University of Western Sydney.

[6] Curtis J. Bonk, Charles R. Graham, "The handbook of blended learning, global perspectives, local designs", Pfeiffer, essential resource for training and HR professionals.

[7] Susan Edwards, "Active learning in the middle grades", Middle School Journal May 2015, pp.26-32.

[8] Daniel Bell and Jahna Kahroff, "Active learning handbook" (2006), Faculty development center, Webster university.

[9] W.M. Ruvini M. Weerasinghe, Ryoju Hamada, "Usage of active learning strategies in engineering education", The 2016 Biomedical Emgineering International Conference (BMEiCON-2016).

[10] Instruction at FSU Handbook 2011, pp.75-102.