

# Toward Outcome Based Education (OBE): An Impact of Active Learning Approach for 'Computer Organization' Course

Snehal S. Patil<sup>1</sup>, Sushma S. Kulkarni<sup>2</sup>, Sachin K. Patil<sup>3</sup>

<sup>1</sup>Assistant Professor, Rajarambapu Institute of Technology, Sakharale, 415408, India.

<sup>2</sup>Director, Rajarambapu Institute of Technology, Sakharale, 415408, India

<sup>3</sup>Associate Professor, Rajarambapu Institute of Technology, Sakharale, 415408, India.

<sup>1</sup>archana.jakhale@ritindia.edu

<sup>2</sup>director@ritindia.edu

<sup>3</sup>sachink.patil@ritindia.edu

**Abstract:** In recent years, there is an incredible development in technology, which brought innovative changes in the educational sector. Active learning approaches are vital in teaching learning process such as content delivery, assessment, monitoring, etc. This paper discussed about active learning activities as simulation tool, buzz activity through animated video, and poster presentation. In addition to this, we checked students' performance and impact to gain knowledge by considering result analysis and course outcome attainment of two consecutive years for "computer organization" course. Individual students learning performance and learning interest increased due to implementation of different active learning tools during classes.

**Keywords:** Outcome Based Education (OBE), Buzz Activity, Computer Organization, Poster Presentation, Simulation Tool.

## 1. Introduction:

Emphasis on OBE in the current era enhances the education quality (Bonwell and Eison, 1991; Doyle,2008; Ugale and Shingan,2018). OBE is a student centered learning approach. Student's involvement while learning is an important part in OBE. Active learning tools have a vital role in student

involvement in classrooms (Jakhale and Attar, 2015; Lokare et al. 2018). The course "Computer Organization" is a fundamental course in computer science and engineering stream. It contains basics of architecture of computer and arithmetic operation at machine level. In addition, this course has high weightage in GATE competitive exam and understanding this course content is a prerequisite for many courses like "Operation System", "System Programming" etc. Students find difficulty to understand such a course. Therefore, use of active learning tools help students in deep understanding of the course .

In this paper, we share our classroom experiences and present different active learning tools used for computer organization course for students involvement in the classroom. Also, we have checked the performance of students by comparing course result and course outcome attainment for two consecutive years.

Section 2 focuses on literature review of different active learning tools used for teaching learning process. Section 3 emphasizes on methodologies used to understand the systemic way to conduct different activities for computer organization course. Section 4 presents the effect of activity-based learning on students to retain knowledge. In the 5th section, we also compared the students performance in ISE-I and ISE- II tests conducted in the academic year 2019-20 and attainment of course to show impact of activities on students. Finally, section 6 offers concluding remarks of the activity.

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**Snehal S. Patil**

Assistant Professor,

Rajarambapu Institute of Technology, Sakharale, 415408, India.

archana.jakhale@ritindia.edu

## 2. Literature Review:

Computer organization course is an essential part of the computer science stream (HalaElAarag,2012). Teaching such a course is difficult; students having trouble to understand concepts by traditional teaching (Xuejun Liang, 2008). Therefore, there should be use of active learning tools that will positively help students to understand the courses and to engage in their learning interest.

The National Survey of Student Engagement (NSSE, 2003) says that student engagement is not one of the single course of a student's academic career, but it's a pattern of his or her involvement in a variety of activities to understand concepts. His principle speaks directly that student engagement, is good practice with active learning tools like use of simulation tools, animated videos, gaming and poster presentation.

There are several lists of processor simulators available on the Internet (Binkert et al.,2011; Djordjevic et al.,2005; Magnusson et al.,2002; Mulia et al., 2013; Nikolic et al.,2009; Skrien et al,2001; Vollmar et al.,2006 ). There are many cache simulators to allow students to play with cache memory and memory hierarchy. The usage of visual simulators can improve both the teaching and learning processes. EDU-Cache simulator enable a visual environment to explain the basic cache memory concepts (Sasko et al, 2013). Educational games have made learners more motivated and interested learning (Ahmed et al.,2015).A poster presentation is a way to communicate research or understanding of a topic in a short and concise format (Aung and wi,2019). Gaming and poster presentation allow learners to learn this subject in a fun and interesting way. Therefore, this will be an encouraging student-faculty interaction, cooperation among students (Smith et al., 2005). It also increase the student's willingness and ability to learn the material.

Instead of traditional delivery in classroom like prompt lecture delivery, syllabus completion and preparing students for examinations; OBE focuses on enhancing learners' abilities, multi-intelligence, lifelong learning and ultimately meeting the expectations of the workplace (Aziz et al, 2005;Srimathi H, Krishnamoorthy A,2019).

## 3. Methodology

### 3.1 Active Learning Approach:

The concepts related to computer organization course are taught mainly by using different active learning approaches.

Learning Objectives for use of Active Learning Tools:

- Engage: To engage students by capturing their interest.
- Explore: To give opportunity to students in exploring their Skills.
- Explain/ Elaborate: Allow to explain concept, explanation follows experience.
- Evaluate: Review and reflect their learning to develop new understanding/skills.

### 3.2 Classroom Implementation:

During this study, tools like buzz activity and simulation were used in second year class(2017-18 batch) of computer science and engineering department of Rajarambapu Institute of Technology, Sakharale. This implementation was done for “Computer Organization” course. Total 79 students were selected/participated for/in the activity. Out of which 44 were girls and remaining were boys. We have formed groups of 3-4 students and conducted activity in each group. Activity is conducted throughout the semester.

Activity 1: Buzz Activity: It is a collaborative technique. In this activity faculty role is equally important as role of the students. Overview of buzz activity is described in Fig1.

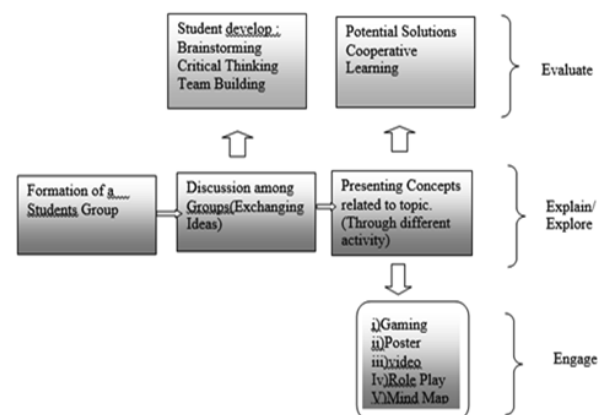


Fig. 1: Overview of Buzz Activity

BUZZ ACTIVITY : COMPUTER ORGANIZATION			
Group formation and Topic Assignment			
r.NO	Roll No	Student Name	Topic
1	1403030		
	1503001	DEVALE CHAITANYA	
	1503006	KARNE SHUBHAM R	
	1503020	Dhanashree Ghadage	Basic Operational concepts
	1503032	Rushakesh Rajendra Kha	
2	1503038	Indrayani Patil	
	1503044	Shamal Bansode	
	1503050	MAMADGE PRIYA N	Number Arithmetic operation
	1503057	Rohan D. Kekare	
	1503060	Rajab P Navaf	
3	1603001	KADAM PRANALI SU	
	1603002	PATIL SOURABH ASH	Execution of complete instruction using Sgile bus Arch.
	1603003	MORE RUTURAJ PRA	
	1603004	PATIL SHUBHAM BH	
	1603005	KADAM OMKAR AN	
4	1603006	PARGAONKAR SAUR	Multiple Bus organization

Fig 2:Group Formation and Assignment of Topic

### Procedure:

- 1) Group Formation: Buzz groups are teams of three to four students that are formed to respond to course-related concepts (Topic). Fig 2 shows group formation and Topic assignment to students.
- 2) Discussion within the Group: Each group can discuss informally and exchange ideas. This discussion is effective for generating information and ideas in the given span of time.
- 3) Discussion with Faculty: The course teacher of computer organization is responsible to check their ideas and to give suggestions for the conduction of the activity.
- 4) Presentation: Students need to present their work/ideas in front of a classroom (through activities like Poster Presentation, Animated Videos, Gaming, etc.). Students can choose these activities as per their interest to demonstrate the concepts.

4.1 Poster Presentation: A poster presentation is a way to communicate your understanding of a topic in a short and concise form. It usually includes two elements - a poster and a brief (usually not more than 2 minutes) explanation. Students need to analyse and evaluate information, synthesize ideas and creatively demonstrate their understanding of the topic. Students can seek help from the faculty regarding it. Poster presentations develop their ability to communicate perceptively.

4.2 Animation Tools: It can be a valuable resource in the classroom. Students will demonstrate their understanding of concepts while they are creating the animations and the finished product can be uploaded to an online learning space. It will give them clear understanding of concepts.

4.3 Gaming: To deliver the concept games is used. For example Collecting information: In the game, the learner can use his/her game character to collect different items (like coins, key, etc.). Each one of these items gives the learner information regarding the computer architecture subject.

5) Comment and summarization: Faculty summarizes the concept and gives feedback.

6) Evaluation is done by faculty. The parameters (rubrics) are considered for evaluations are "Content and Explanation", "Depth of Knowledge" and "Delivery" (Fig 3).

<u>Rubrics for Buzz Activity Evaluation</u>				
<b>Course Details:</b>				
CLASS: Second Year, B. Tech			SEMESTER:IV YEAR: 2017-18	
COURSE TITLE: Computer Organization			COURSE CODE: (CS2041)	
PROGRAM/DEPT.: Computer Science and Engineering			FACULTY: Mrs.S.S.Patil	
Criteria	Value			
	0	1-2	3-4	5
Content and Explanation	Not attempting answer	Explanation is not existing, unclear	Explanation is basic	Demonstrate thinking with clear, sequential explanation
Depth of Knowledge	Not attempting answer	Attempt but manual understanding a concept	Understand a concept	Excellent understanding and solve more problem.
Delivery	Unable to solve problem	Begin but fail to solve problem	Solved but incorrect logic	Clear organized method and solve problem for complete and correct solution
Gate	No evidences for computation	Include basic computations some incorrect	Include correct computation	Correct computation with multiple approaches

Fig. 3: Rubrics for Buzz Activity Evaluation.

Fig 4. highlights example of conduction of buzz activity. Group no.18 implemented buzz activity using poster presentation. The group has used poster presentation to explain hierarchy of memory concept. After students' presentations question/answer session was conducted. At the last faculty summarised the topic. In such an activity, students involvement is more than traditional teaching.

### Activity 2:

Simulation Tool: A common use of simulation is for experimentation in a low-cost, low-risk environment. Through simulation tool, theoretical concepts are connected with actual implementation. Learning of the students is done by

**Table 1: Rubrics to evaluate PBL**

Criteria	Dimensions				Total
	Poor (Marks: 0 to1)	Fair (Marks: 2 to5)	Good (Marks: 6 to7)	Excellent (Marks: 8 to 10)	
Code validity, code readability, cleanliness of folder structure.	The submission's coding (and code presented in the style guide) is not human readable, nor valid HTML5 and CSS3 with up to 4 major errors (things we have taught you directly) and up to 8 minor errors. There are some major concerns with the cleanliness of the file and folder structure.	The submission's coding (and code presented in the style guide) is human readable valid HTML5 and CSS3 with 1 major error (things we have taught you directly) and up to 4 minor errors. There are some minor concerns with the cleanliness of the file and folder structure.	The submission's coding (and code presented in the style guide) is human readable, semantic and valid HTML5 and CSS3 with up to 4 minor errors (things we have not taught you). File and folder structure is clean.	The submission's coding (and code presented in the style guide) is human readable, semantic and valid HTML5 and CSS3 with absolutely no errors. CSS uses a meaningful naming convention, and file/folder structure is clean.	
Design: Consistency, interface and interaction elements.	The style guide presents an inconsistent aesthetic with unclear interface and interaction cues that respond poorly to user interactions. Little to no connections are built in the final sketches/wireframes, hindering our understanding of navigability significantly.	The style guide presents fairly consistent aesthetic with some unclear interface and interaction cues that respond somewhat effectively to user interactions. The final sketches/wireframes show how navigation will occur, though the structure of the site and navigation is unclear at times.	The style guide presents a consistent aesthetic with clear interface and interaction elements that effectively respond to user interactions. The final sketches/wireframes demonstrate an understandable model of the site's structure.	Effectively leverages principles of 'atomic design' to construct combinations of elements (i.e. navigation, product/service listing) that effectively respond to different devices. The final sketches/wireframes help demonstrate how the site will effectively direct the user to move deeper into the site.	
Deliverables, weekly checks, quantity and quality of exploration.	Numerous weekly deliverables are missing.	Some of the required weekly deliverables are missing.	Deliverables meet the expected amount of process exploration outlined in the brief.	Deliverables demonstrate more exploration both in quantity and quality than outlined in the brief.	
Website Feedback survey by the end user	End user Dissatisfied	End user neutral	End user satisfied	End user very satisfied	
					Total ---/40

**Table 2: PBL evaluation based on Rubrics sheet**

Criteria	Dimensions				
	Poor (0 to 1)	Fair (2to5)	Good (6 to7)	Excellent (8 to10)	Total
Code validity, code readability, cleanliness of folder structure .			✓		7
Design: Consistency, interface and interaction elements.			✓		7
Deliverables, weekly checks, quantity and quality of exploration.		✓			5
Website Feedback survey by the end user			✓		7
<b>Total</b>					26/ 40

**Table3: Commercial Website Project details**

Group No.	Roll No.	Name of Client	Name of company/Organiz ation	Website Specifications
1	1403060, 1503002, 1503014, 1503055	Sanjay Bhosale	Hotel Maharaja	Creative Design, All the Menu card details, Photos of hotels, dishes, chefs, Customer feedback form
2	1501056, 1503009, 1503013	R.R.Jadhav	Gandhi Vidhyalaya	Creative Design, Profile with Photo, Photos and information is in good manner. Customer feedback form
3	1503008, 1504014, 1503017, 1503018	Sanket unune	Shreemant hotel	Creative Design, Menu card details, Photos of hotels, chefs, Customer table form
4	1504040, 1504048, 1504063, 1505053	Aniruddha Manolikar	Sarthi	Creative interface for both mobile and web, Booking for E-rickshaw, Uber facility in rural and urban areas
5	1653003, 1653008, 1553010, 1403038	Manish Bhat	Shree Institute	Creative design and Effective User Interface. Portal to post event information and posters. Gallery includes pictures of already happened events. Facilities: Online registration, login and application.
6	1504027, 1504029, 1504031, 1653005	Sai Patil	Sai Rentals	Effective User Interface. Gallery with car photos and price. Online registration. Login Page
7	1653012, 1653011, 1503042, 1504045	Mr. Vishal Jadhav	Angnipankh	Effective User Interface. Gallery with children photos and Donate Page Online registration. Login Page
8	1503027, 1503028, 1503022, 1503015	Mrs. Rekha Bhosale	balkrishna sangle vidyamandir ichalkamji	User Interface, Online registration, Login Page, student data adding and deleting
9	1503031, 1503053, 1503056, 1503059	Mrs. Dinesh Jadhav	Bhagyashree Cards	Effective user interface, Order page, gallery with wedding card photos, Menu bar with different religion cards
10	1503051, 1403057, 1504049, 1503043	Shri. Krishanji Jadhav	Jadhav Enterprises	Register, User to system, Login/logout features, Filter out cars according to user, requirement, Show details of each car



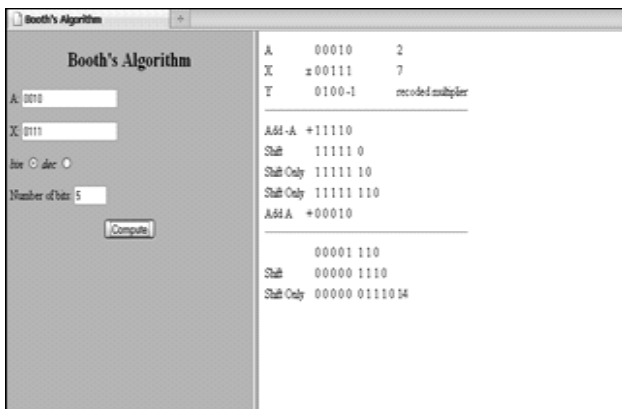
**Fig. 4 : Poster Presentation for Buzz activity**

experiencing it on their own. Some concepts like arithmetic operation at machine level, Booths algorithm, etc. are taught by using the Isrelkoren simulation tool. (Fig 5)

(<http://www.ecs.umass.edu/ece/koren/arith/simulator/>)

Procedure:

- 1) Installation of Tool
- 2) Experiencing tool with the help of manual.



**Fig. 5: Simulator used for “Booth's Algorithm” concept**

#### 4. Findings/Outcomes of Overall Activities

By using above mentioned active learning techniques, it is found that, both students and faculty are getting benefited.

Confidence level of students goes high. Student generates a large number of ideas for potential solutions. They develop team building and cooperative learning skills among them. Also, they become able to summarize, apply or integrate new information. They engage in their own learning activities. Deep understanding of the core concepts in the course is possible with such an activity. Students can apply the basic knowledge of architecture of computer in different applications. Also, they can practice on multiple-choice questions for competitive exams.

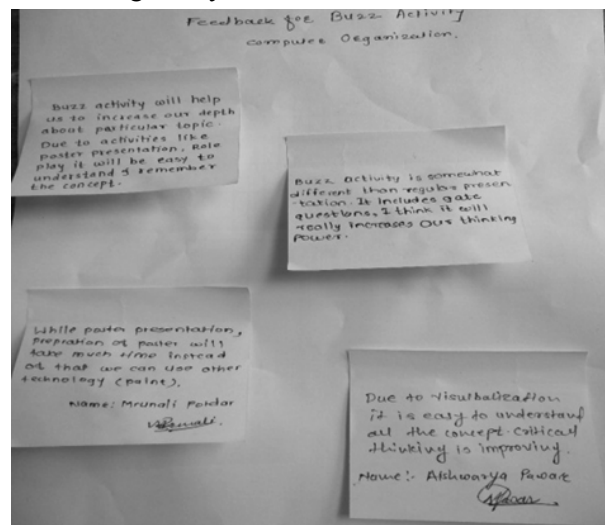
Implementation of activities create a positive teaching environment with well-organized lectures. Direct interaction between faculty and students, which hardly do in normal lectures. Therefore, it motivate both sides faculty and students with joyful teaching learning.

Some hurdles like class control, time consumption and assurance of all student involvement are found while implementation of activities.

Informal Feedback from the students using yellow paper concept (Fig.6) has been taken. Students have given positive feedback about active learning techniques.

Major points in the feedback activity from students:

- Increased depth of a particular topic.
- GATE questions get solved.
- Thinking ability is increased.



**Fig. 6: Feedback for activity(Yellow Paper concept)**

- In case of Poster presentation, preparation of poster requires time. Here some other technique can be used.
- Visualization gives better understanding of concepts.

## 5. Result and Discussion

The course, Computer Organization is difficult for the students. All these activities work efficiently and effectively on the course. The main goal to conduct this activity is students' better understanding of the concepts of the course. The activities are tested on 79 students of Second Year B. Tech Computer Science and Engineering.

We have analysed the activity by considering two ways

- Comparison of Internal Semester Exam (ISE-I) marks (before conduction of activity) and ISE-II marks (after conduction of activity)

**Table1:Passing Percentage and Average Marks in UT-II is improved than UT-I**

	ISE-I(before Activity)	ISE-II (After Activity)
Passing Percentage	75.90%	82%
Avg Marks(out of 25)	13	14.7

**Table2:Questions attempted (on concepts covered in the activity)is increased**

Total Students	No. of Questions related to activity in ISE-II	No of Students attempted Questions on Activity (out of 79)	Avg Marks(out of 12)
79	2	73	8.6

**Table 3 : Course Outcome with Attainment for computer Organization Course**

Course Outcome	Activity used	The Points covered through activity	Outcomes	Attainment	
				Year 2016-17	Year 2017-18
To conceptualize basics of organizational and architectural issue ,functional unit of processor in digital computer and apply in computer organization	Animated Video	Basic Architecture of Computer	-Visualization through animation, remember concept for a long time	46	66
Construct the ability to perform computer arithmetic operations such as binary, signed, decimal, hexadecimal, floating point numbers.	Simulation Tool	Arithmetic Operations	Theoretical concepts connect with actual implementation -Students learning by experiencing how to use a simulator model.	48	65

- CO Attainment of the Computer Organization course for two consecutive batches.

Initially, we have conducted ISE-I (before conduction of activity). It has been observed that students get lower grades. Further, we have analyzed scores in ISE-I and ISE-II (after conduction of activity).The average score in ISE-I is 13 out of 25. However, in ISE-II, It has been increased to 15.5 out of 25 (Table). In addition to this , no of questions attempted by students related to activity in ISE-II is more. (Table)

Each program defines a program outcomes (POs) which are accessed, and evaluated at the end of four years of graduation. These attributes are acquired through course outcome (CO's) defined at every course and evaluated at every semester. Based on how well these two parts are defined and evaluated, OBE attainment is measured. Every internal assessment is considered for attainment. Hence, the attainment of CO's is the focus of teaching learning. With the active learning teaching process attainment of CO's is increased. Table 3. Shows course outcomes for "computer organization "Course with active learning tools used for respective CO's. It also contains points covered through activity with their outcome. As active learning tools have been adopted for batch of the year, 2017-18, significant impact in attainment is observed. From the graph (Fig.7) we analyze that attainment is increased for the batch 2017-18. So, active learning tools play an important role in increasing attainment. Table 4. Shows overall result analysis of computer organization course for two consecutive years. Fig. 8 shows a graph which indicates noticeable impact in the year 2018 by using active learning tools and improvement in grade of students as well.

Interpreting memory organization that uses banks for different word size operations and cache mapping techniques including translation, allocation.	Buzz Activity: Gaming, Poster Presentation	Memory Management	-Engage their own learning	54	64
Ability to understand the input/output organization, data transfer techniques for computer.	Buzz Activity: Animated Video,	Data Transfer Techniques	-Visualization through animation, remember concept for a long time	42	68
To analyze processor performance improvement -using instruction level parallelism in digital a computer.	Buzz Activity: Video, Gaming	Parallelism	-Engage their own learning	43	71

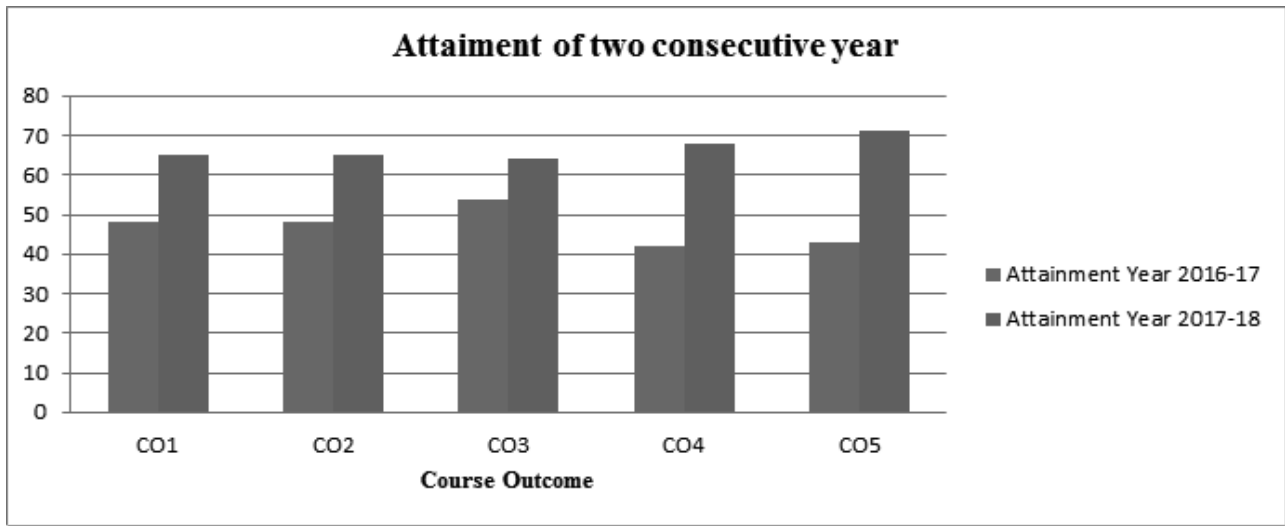


Fig 7: Attainment of two consecutive Years

Table 2. Result Analysis for Computer Organization Course

Year	Passing %	Grade and Range of Marks						
		AA (91-100)	AB (81-90)	BB (71-80)	BC (61-70)	CC (51-60)	CD (41-50)	DD (31-40)
2017	92.20	-	1	8	14	31	14	1
2018	97.29	-	5	23	23	9	10	1

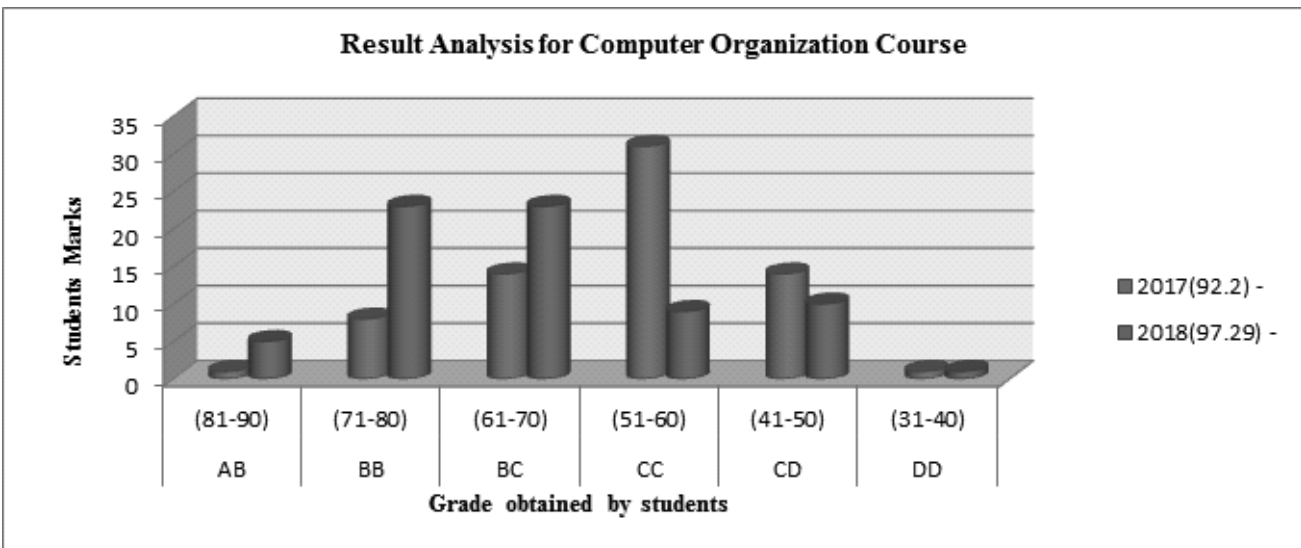


Fig 8: Result Analysis for Computer Organization Course

## 6. Conclusion

Student engagement in learning is a very challenging task. As active learning tools like buzz activity through poster presentation, gaming, animated videos and simulation tools are applied to computer organization it creates a significant impact on overall performance of the students. The feedback revealed common agreement that “activity based learning” helped students to generate interest, better understanding & promotes self-directed subject learning.

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