Innovative Teaching Approach:To transfer focus from teachers to learners

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Abstract— In a modern view of learning students are expected to be active in the learning process by participating collaborative activities. There is big question in front of many faculty members how can we personalize and customize learning and yet make it efficient and effective. There are many technologies available for teaching and learning. However abstract thinking is a vital skill when learning Object oriented & Architecture oriented technology in computer science Engineering and Electronic Engineering. According to our study students in the classroom as well as in industry encounter difficulties in thinking in abstract terms while practicing object oriented development. The blackboard teaching is not that much effective to involve them into the learning process [6]. This work is basically conducted to explore the present modern resources. This generation students are becoming intelligence rich, they are interested to gain knowledge not just through the conventional methods of teaching but also through new teaching methodologies.

The aim of this work is to explore the opinion of students about teaching methodologies they found as the most interesting and best to learn these types of subjects. Some group based activities Jigsaw(Write-Break & Make), Simulation, Top-Down approach, Activity based Teaching are presented here to make teaching learning process more efficient and knowledge sharing and make focus transfer from teachers to the learners.

Keywords— **OOP, Jigsaw (Write-Break & Make), Simulation, Top-Down approach, Activity based Teaching, Animated PPTs.**

Introduction

The primary purpose of this exploratory study is to improve the level of students understanding in the programming & architectural oriented subjects by using effective, group based teaching methods. The traditional passive view of learning involves situations where material is delivered to students using a one way lecture method. In contrast, a more modern view of learning is not abstract, and where students are expected to be active in the learning process by participating in discussion and/or collaborative activities [1]. Overall, the results of recent studies concerning the effectiveness of teaching methods favor constructivist, active learning methods. Students are the most qualified sources to report on the extent to which the learning experience was satisfying, informative productive, worthwhile. While opinions on these matters are not direct measures of instructor or effectiveness of course, they are indirect indicators of student satisfaction, and there is considerable research linking of student satisfaction to effective teaching. There are many teaching techniques that can make engineering and technology instruction more effective, more interesting, and more enjoyable for both the instructor and the students; some of these are variations from the traditional lecture method. These techniques include many aspects of active and cooperative learning, which get the students involved in the classroom experience. As now a day's students are not only marks oriented they are becoming knowledge rich, they are eager to gain practical knowledge not just through the conventional methods of teaching but also through new teaching methodologies, so they now need to explore and experience the real-world; through which they can acquire, demonstrate and authentic skills.

Teaching the Programming Subjects in computer science and complicated circuit based subject in Electronics is challenge for the educators due to the complexity of the subjects.

We made an attempt to overcome the problems, so as to transform the students understanding in this subject and also make joyful classroom learning active participation by using Jigsaw (Write-Break-Make), activity play, Top-Down method etc. Further section I, deals with the detail problem statement, section II discusses literature survey III discusses the implementation, section IV discusses the Result and observations.

I. PROBLEM STATEMENT

As a result, with the current lecture based approach, students may learn to solve logical problems and follow preset rules for a well-defined problem but lack the ability to transfer that learning into additional conditions. In particular, they may fail to see the connection between solving a problem logically and real-world engineering application.

It is challenge to teach programming and circuit based subject in CSE & ETC respectively for engineering faculty due to the logical nature. Students are not taking self interest to learn the programming and circuit based subjects [4]. These two objectives in common are impossible to achieve by using one way Lecture-based method as now students are more interested to learn concepts with real time scenario. As

programming subjects are more important in engineering education we need to use more practical approach while teaching this subject. As above mentioned and a part of Best practice method, rating method used as a tool to identify students feedback on different teaching methods in learning programming and circuit based subjects which are toughest, logical, and structural in nature.

Table-1 Rating for Different Method

Sr. No.	Method	CSE Students Feedback	ETC Students Feedback	Number of Students
1	Lecture	54%	45%	80
2	Group Discussion	37%	27%	80
3	Assignment	31%	20%	80
4	Individual Preparation	20%	67%	80
5	Seminar	31%	27%	80

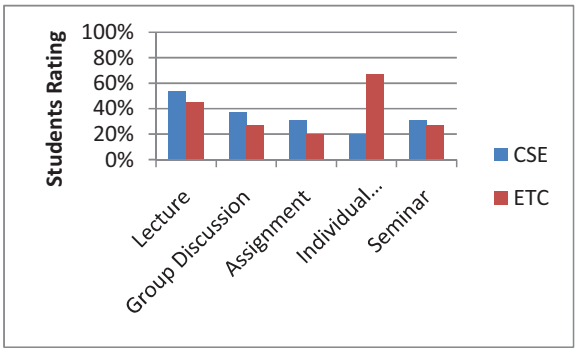

Figure 1: Bar Chart for showing rating in Table-1.

This were taken as basis for development of a solution and with a thought process was seen for best solution as Jigsaw(Write-Break & Make), Simulation, Top-Down approach, Activity based Teaching.

I. LITERATURE SURVEY

It is been surveyed that, students are the most qualified source to report on the extent to which the learning experience was productive, informative, satisfying or worthwhile. This indicates the student's satisfaction and links with the different teaching methods. In recent engineering education it is difficult to make concept understandable to every student due to large classrooms size. The major factors that affect learning are teaching innovation & understanding the classroom dynamics. The main factors affecting to teach programming and architectural subjects are logical concepts, student interest in the subject other than a student's personal factors, factors such as teachers & mode of conduction, courses and learning environment, participation, assessment etc. all may have an impact on students learning. To improve teaching means using new teaching ideas, techniques and tools, while creative teaching is the development and the use of noble or inventive teaching methods. This will make students active participation in the classroom.

The literature survey lead to innovative methods of teaching learning adopted in engineering education. Some of the case studies and key observations mentioned below illustrate the importance of Innovative methods of teaching learning.

A. Lecture Method:

A lecture based approach is an oral presentation intended to present information or teaches student about a particular subject. Lecture based teaching creates new ideas and used to convey critical information. Lectures are much criticized as teaching strategy. It is point out that lecturing is mainly a one way method of participation that does not involve every student into teaching learning process. Therefore, lecturing is often contrasted to understand programming and architecture based subjects.

B. Group Discussion:

Exchange of ideas between several people is the best process of learning and teaching one another. In the classroom environment, group discussion is the best way of promoting conductive learning and convenient teaching situation. It gives opportunity to students to express their views or opinions orally on certain concepts. It is very convenient to students to learn different things in groups. However students who are weak in programming subjects will have trouble to understanding what they should remember from discussion also some students may not feel comfortable being put on the spot during a whole group discussion.

C. Assignment Method:

This is most common method of teaching especially in teaching learning process. It is an educative technique consist of guided information, self learning, writing skill and report preparation .But if the students are not that much familiar with the concepts on which we are giving assignments then we need to reduce the complexity of the assignment and it will degrade the learning quality.

D. Individual Preparation:

Students are expected to update themselves with self-study. This is a method in which content and peace of learning are based upon the abilities and interest of each individual student. The individual preparation method is effective in understanding the concept. The students need to take extra efforts to understand the concept. Also it is not possible for all the students due to the logical and architectural nature in subject. So this method is also not that much effective to learn the concepts.

E. Seminar:

The seminar method is the most modern and advanced method of teaching which is usually used in engineering education. It is used to realize the higher objective of cognitive affective domains [3]. As the method is effective to understand the concepts but some students are not having good presentation skills they will only mugging up the things and remember only for the presentation time and forgot after

the presentation. So to learn programming concepts seminars are not that much helpful. Programming subjects are logical and it needs practical.

DEVELOPMENT OF SOLUTION

Root causes were identified in analysis phase of best practice method for involving students into learning process and creating joyful environment while learning programming and architectural subjects. This was taken as basis for development of a solution and we identified the best solution as -

"Making joyful and active teaching of Programming and Architectural subjects in the class room and Practical's"

To implement the solution, we have found group of use cases which makes students an active and lifelong learners.

Use cases:

1. Jigsaw: (write -break & make):

This is the very effective to involve students into the teaching learning process. As we want to create joyful environment while teaching architecture, Electronic Formulas this method is very useful method and will generate interest in students to learn the concept [2]. We conducted this activity at the end of every chapter in tutorial sessions. This method involved grouping the students into team of 2 students with each member being given responsibility for reading/learning a portion of the chapter.

Material Required: White sheets, Marker, Envelop etc.

Process to conduct ac:

Step 1: Make team of 2 students.

Step 2: Distribute questions team wise.

Step 3: Instructions should be given to students prior to start of activity.

Steps Involved:

Step 1- Distribute chits group wise which includes different questions like write equations, draw diagrams & steps required to draw any plot.

Step 2- Instructor should collect sheets and check answers. If the answers are correct instructor should assign marks to respective team & if wrong then instructor should correct it.

Step 3- After correction it should be return back to respective teams & tell them to cut it in different pieces & place them in envelop provided.

Step 4- Exchange envelops within teams and tell each team has to arrange those correctly & stick on other sheets provided to them within 60 seconds (for one equation or diagram or steps).

Step 5- Instructor again collect the sheets and check the answers. At the end of activity we should declare the winner & appreciate them.

As per feedback taken from students the activity were very interesting and makes concepts clear.

Table 2- Students Feedback for jigsaw

Method	Rating				
	5	4	3	2	1
Up to what extent you like this activity?	95%	5%	0%	0%	0%
Give your rating about usefulness of this activity	98%	2%	0%	0%	0%
Level of enjoyment.	93%	3%	2%	2%	0%
Would you like to continue this activity for joy of learning?	98%	2%	0%	0%	0%
How this activity helped you in learning difficult concepts? 1-Activity is useful for Joyful Learning. 2- Beneficial for memories the things. 3-Best way to prepare for exam.					

Table 2-Students Feedback for Jigsaw (Write-Break & Make)

2. Simulation:

This technique is more interactive and effective as compared to other methods to explain the difficult concepts with visualization so it can be more understandable to students. Simulation software's utilizes mathematical models to replicate the behavior of an actual electronic device or circuit. Proteus Design Suite is a powerful yet affordable circuit simulation and PCB design software package for inspect, scheming, and real time testing of analog, digital, MCU, and mixed electronic circuits and their PCB layouts.

Proteus Increasing Engagement of second year ETC students in Digital Design; the authors observed that results of study show that, majority of students experienced good visualization of concepts in digital design because of simulation.

As students unable to understand & visualize the working of concepts in digital design in classroom by blackboard teaching .So we adopted this simulation tool & used in classroom to explain the concept & show the working of different circuits. This helps students to understand & visualize the concept in better way.

What our students did using this tool?

Students are given instructions about basic steps to use tool and instructed to explore more about tool by themselves.

Students are asked to perform each experiment of lab work on simulator & then implement on hardware.

Though students understood the concept through simulation, it becomes too easy for them to implement on hardware. Authors observed that students are implementing or performing experiment with much better results & in less time.

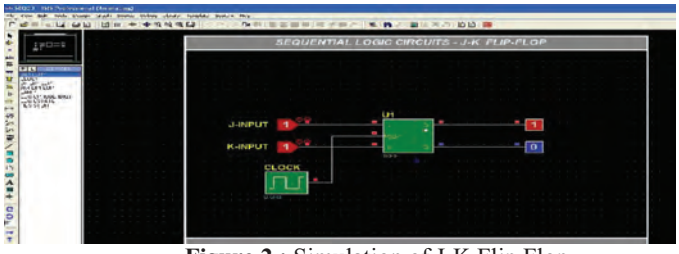

Figure 2 : Simulation of J-K Flip Flop

Proteus is very effective simulation tool to create the visual presentation of electronic circuits. It includes different functionalities like flow of electrons or transferring signals from one constituent to another constituent. So students are getting clear idea about the circuit. As per feedback taken from the students for the different methods we had already discussed and the innovative simulation method and calculated the percentage of understanding is calculated.

Table 3- Students Feedback for Simulation

Sr. No.	Method	CSE	ETC	No. of Students
1	Lecture	54%	45%	80
2	Seminar	31%	27%	80
3	Simulation	85%	89%	80

From above feedback it is clear that simulation is effective method which we can use at the time of classroom teaching to express the concepts in more detail.

3. Top-Down Method:

Most of the students are getting problems while learning Object Oriented programming language. Only theory knowledge is not sufficient to learn Object Oriented programming. As we are writing many complex programs we need to follow some steps. Abstract thinking is a mechanism that allows student to represent a complex reality in terms of a simplified model so that irrelevant details can be suppressed in order to enhance understanding [9]. However rather than focusing on the design problem bigger picture students focus immediately on the code when writing or reading Object Oriented Program. This tendency of students focus only on single function or module this will degrades code quality and large possibility of missing some details.

.Steps for Activity:

Step 1- Understand-in this step we explain the problem to students.

Step 2 – Identify-In this step we will identify the different terms.

Step 3- Design- We will design different UML diagrams to represent the above terms and relationship among them

Step 4- Writing-From above details we will write code

Step 5- Review- We will check the details given in step-1.

Example:

"Rajarambapu Institute of Technology" is an autonomous institute located at Islampur. College management wants their online portal system with following assumptions

- A college contains many departments
- Each department can offer number of courses
- In single department there will be many instructors
- An instructor can relate to only in one department
- Only one head for each department.
- Instructor can be head of only single department
- Each instructor can take many courses
- A instructor can take only one course
- A student can enroll for any number of course
- Each course can have many students

Solution:

Q1 - Identify the classes, variables, methods.

Q2 - Draw class diagram from above information with all the relationship details.

Q3 - Write Java code from above information.

Q4 – Compare your code with other students.

4. Activity Based Learning:

As we are involving students more into the teaching learning process we need to take some group activity so they can learn with fun. Activity based learning is a new technique played by students to explore in depth concepts to be understood by slow learners. State transitions are gestured by students; hence even slow learners could grasp the concepts. We can use this activity for first year students to teach basic computer fundamentals. The ABL method is appearing to be a system where the teacher needs to take fewer efforts to teach.

Steps Involved:

Step 1-We call some students to volunteer this activity.

Step 2- Decide the different Roles.

Step 3-Tell them to prepare some statements related to that particular concept.

Example:

Roles Required:

Learner 1-User
Learner 2-Input Device
Learner 3-Control Devices
Learner 4-Memory
Learner 5-ALU
Learner6-Output Device

User-I am giving you the instruction and data. Input device please collect it.

Input Device- I am collecting data and instruction which you are giving.

Control Unit-Input device, store the instruction the data in the memory unit.

Memory unit-I am collecting the information from the input device.

Control Unit- Memory; send the data to the ALU

Memory Unit- I am sending the data to the ALU for processing. ALU collects the data from me

ALU- I am accessing the data from memory and starts processing the data.

Control Unit- ALU, If you finished processing the data, give the result to memory. Memory, collect the result coming from memory unit

Memory Unit- I am ready to store the result from ALU.

Control Unit-Output Unit; Be ready to display the data on the monitor.

Output Unit- Ya… I am ready to display the result

Memory- Ok. I am sending the result to output unit. Output unit, Please collect it

Output Unit- I am displaying the result in the screen.

Animated PPTs:

Students learn best and most when they enjoy what they are doing. Animation is a tool to encourage and develop students learning is not only fun but effective. By using animation students develop skills competencies.

This activity is used for microprocessor subject .As this is a basic subject in Electronic Engineering there is need to understand the whole instruction set & working of it. It is difficult for students to visualize the working of instructions. So students can't use instructions properly in program as they couldn't understand working of instructions. As animation is best tool to visualize the concept, we used this tool as activity.

Steps Involved:

- All students of SY are given demo of Microsoft Office Animation -how to prepare the animation for instruction working & asked them to explore more about it.
- One Instruction per student is assigned to prepare animation for given instruction as a assignment.
- Students understand the working of instructions with animation.
- Students can visualize the working of instruction so they can use those properly in program.

Total 65 students have submitted assignment so we create recourse of 65 instructions. Later this whole set is distributed to all students.

II. RESULT AND OBSERVATIONS

The main aim is to make active participation of students in the class room, efficient and lifelong learns for programming and architecture oriented subjects. As per the feedback taken from students regarding the above methods we found that the methods are very effective to learn programming subjects. The main aim is to make active participation of students in the class room, efficient and lifelong learns.

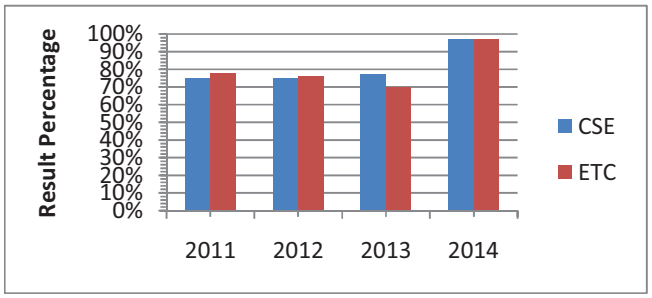

Figure 3: Result Analysis

Conclusion:

Based on the feedback results, all teaching methods presented here are appeared to positively affect students' grasp of the material. Students' scores improved most under these methods, and least in the lecture, lecture/discussion, and case study methods. This finding suggests that moderately-active learning methods are more effective than the other traditional methods to teach programming and architecture oriented subject. Adopting the practical approach of teaching makes students to understand the concepts and relate to the real time applications easily. Activity based and animation based teaching learning was attempted in the classroom and tutorial sessions, which lead to the engage large classroom dynamic and active participation of the students.

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