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Analysis of Improved Pedagogy Applied for Teaching courses related to Computer Programming for First Year Engineering Programs

Dr. Manojkumar Vilasrao Deshpande, SVKM's NMIMS, Shirpur, MS, India

Dr.Manojkumar Deshpande started career as an entrepreneur and then as faculty in 1991. He joined Mumbai University in 1999 and further designated as Head of Computer Engineering Department at SVKM's D.J.Sanghvi College of Engineering, Mumbai. After awarding Ph.D., In Oct 2011, he joined as Professor & Associate Dean at MPSTME, SVKM's NMIMS (deemed to be university) at Shirpur Campus. He is the Member of Board of Studies and contributes in curriculum development for engineering education programs. He has developed the research interest in application of AI and Multimedia technologies in the field of Software Engineering, Big Data Analysis, Education Technologies, Watershed Development and Renewable Energy. He has excellent track record of publication and contributed effort in organizing conferences. He is Ph.D. supervisor and undertook various consultancy assignments to serve the society.

Dr. Pradeep Kashinath Waychal, Innovation Centre
Mr. Prashant Pralhadrao Udawant P.E., SVKM's NMIMS, MPSTME Shirpur Campus

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Manojkumar Deshpande
MPSTME, SVKM's NMIMS
Shirpur, MS, India
manojkumar.deshpande@nmims.edu

Pradeep Waychal
SVKM's NMIMS
Shirpur, MS, India
pradeep.waychal@nmims.edu

Prashant Udawant
MPSTME, SVKM's NMIMS
Shirpur, MS, India
prashant.udawant@nmims.edu

Abstract

This study revealed that proposed pedagogy for courses related to Computer Programming in the curriculum of First Year B. Tech and MBA Tech. Program. This pedagogy resulted in better understanding of content by students. It was evident that students performed better in trimester-end examinations. The performances of two batches with and without proposed pedagogy are analyzed statistically.

The proposed pedagogy incorporated hands on practice in laboratories tailored with short theory sessions replacing conventional way of conducting theory sessions in classroom and practical sessions in laboratory separately.

The faculty conducting these courses appreciated proposed pedagogy for comfort in session delivery. This proposed pedagogy also enabled faculty to complete portion in the stipulated duration.

1. Introduction

Traditional education system has emphasized conveying a lot of information and facts but has not properly modeled the learning process. Current teaching pedagogy is lacking in subject wise requirement and delivery, which must be innovated and reengineered [1]. Another observation is that students are struggling while learning the programming subjects. It can be found that during last decade there is dramatic drop in number of students enrolling in IT and Computer science courses. Also attrition ratio is also continues to be significant [2]. After a keen survey by Teague has found that students are facing problems while learning programming, such as, difficult content, lack of enjoyment, inability to see relevance to "real world" application of the unit content, lack of motivation to learn, lack of inability to learn, reluctance to approach academic instructor for help, especially outside class times, getting stuck on programming concepts and being unable to resolve them without help[3][4]. Newly graduates are with opinion that many new teachers are still failing to make connections between theory and practice [5].

This study is related to performance of undergraduate engineering school under study. This schools offers B. Tech. and MBA Tech. programs in five disciplines i.e. Civil Engineering, Computer Engineering, Electronics and Telecommunication Engineering and Mechanical Engineering. All these programs were following trimester pattern. In the first year for each trimester of each program, student need to take course related programming language. These courses are offered to student with further objectives: (1) Student must acquire fundamentals of programming languages (2) Student should have ability to learn software tools related to their discipline.(3) Student should have adequate skills of analyzing requirement and developing engineering application of respective discipline. (4)Student should be able to aware about MNC Coding standards.

Course Objectives are in line with Program Educational Objectives. Trimester end examination score is one of the tool to measure course outcomes and contribute to measure program outcomes. Courses related to computer programming, offered to First Year students of different program such as B. Tech. and MBA Tech. are listed in Table 1.

Table 1: Computer Programming courses offered to trimesters of First Year different programs

Program : B. Tech. (First Year)	
Trimester I	Computer Programming- I
Trimester II	Computer Programming-II
Trimester III	Computer Application
Program : MBA Tech (First Year)	
Trimester I	Programming Concept using C
Trimester II	Object Oriented Programming using C++
Trimester III	Core Java

2. Conventional Pedagogy

As per curriculum, weekly workload of course for each division was two hours of theory in classroom and two turns of two hours practical in Laboratory. Usually batch size of practical is decided looking at size of laboratory. In undergraduate engineering school under study, Laboratory size is sufficient to accommodate 60 students at a time. Workload for Teacher of this subject for one division of 60 students was

2 Hours Theory + 2 Turns X 2 Hours Practical = 6 Hours

In Academic Year 2011-12, theory sessions were conducted in class room and practical sessions were conducted in computer laboratory. Theory and practical session were conducted for 60 students of division. While doing survey it was observed that students were not able to connect theory with practical session as practical were scheduled at different time slot on any other day as per availability of laboratory. They could not assimilate practical knowledge hence performance of student in examination was poor which is evident from Table 2. Compared to B.Tech. program, MBA Tech. program result were impressive. This was due to selection process of students opting for MBA Tech. program which is high in demand than B.Tech. Program, students having higher ranking in Entrance test, prefer MBA Tech. Program. The Faculties were also facing the problems to synchronize practical with pre-requisite to be covered in theory session.

Table 2 : Result of batch 2011-12 of B.Tech. and MBA Tech. programs for Computer Programming related courses

Class	Trim I	Trim II	Trim III
B.Tech. CE	61.40	52.63	45.61
B.Tech. EXTC	62.71	45.76	72.41
B.Tech. Mech.	58.33	47.46	72.41
MBA Tech. CE	95.00	80.00	90.00
MBA Tech. EXTC	80.49	90.24	90.24
MBA Tech. Mech	58.97	66.67	82.05

3. Improved Pedagogy

In the academic year 2012-13 the curriculum was similar to previous year i.e. for one division of 60 students needed to attend two hours of theory session and two hours of two Practical sessions in a week. Labs gives an surrounding to a student for experimentation. Closed-lab activities helps the amalgamation of theory and practical, and lighten the tension between learning and evaluation [6].

With improved pedagogy all theory sessions were converted to practical sessions. In a week student needed to attend three practical sessions of two hours. Workload of teacher increased by two faculty hours and curriculum requirement was also fulfilled.

Following are salient features of improved pedagogy.

1. All students needed to attend practical sessions
2. Each practical session of two hours was divided into eight slots of fifteen minutes.
3. Starting with first slots of fifteen Minutes theory sessions, in next slot of fifteen minutes students were instructed to use computer system for practice and to complete mini assignment given in theory session. Alternate slots were used for theory and practical session.
4. Each laboratory session of two hours was conducted by two faculty, called lead faculty and support faculty.

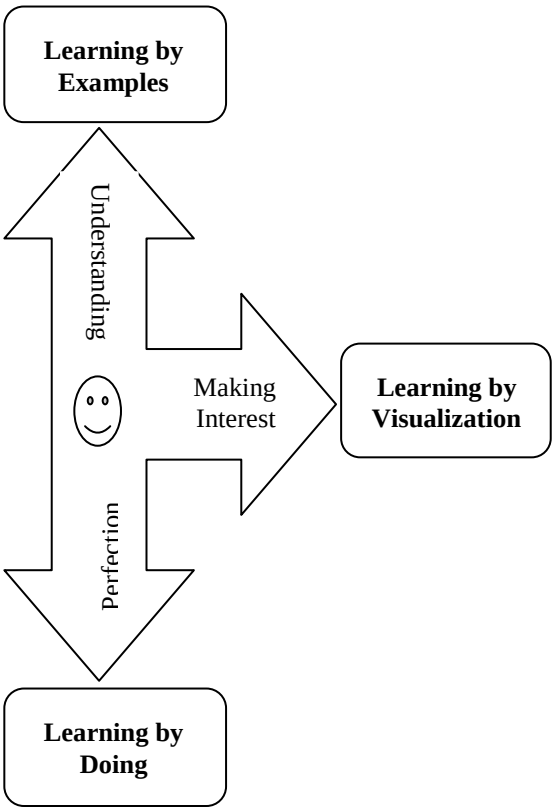

Figure 1: Way of Learning the Programming Subjects

5. In case of unavailability of support faculty, two Teaching Assistants were deployed. These teaching assistants were students of post graduate students of M.Tech. Computer Engineering program.
6. Laboratory utilization increased by 33% as compared to previous pedagogy.

As shown in Figure 1, creating interest and understanding of the programming subjects is possible by the three different methods [7], (1) Learning by Examples (2) Learning by Doing and (3) Program Visualization.

Learning by Examples: This technique is followed while faculty is teaching in theory slot. The additional thing which we have adopted in new Pedagogy is that we have focused more on practical as well as real life examples.

Learning by Doing: The students could write correct be perfect in writing the program by this method. By knowing more examples during their practical slot students could write program in lesser time

Learning by Visualization: It is very important to explain and show the students about line by line execution of the program code. It helps to make the interest in learning programming subjects. We have used Screen-Leap software to accomplish this task. As every students will be having individual PC's for learning, with this software the screen of instructor's PC is shared by each student through their individual systems. So that instructor could explain the line by line execution of the program code to each student. Also lot of programming animations can be shown to students.

This has been innovative attempt to improve student's programming performance. Faculty as well as students appreciated this pedagogy. Faculty felt more comfortable to conduct alternate sessions of theory and practical. Students were practicing with hands on, just after short session of theory. Hence understanding and performance in trimester end examination of student was improved.

Results of computer programming courses were analyzed statistically which are depicted further.

Table 3 : Result of batch 2012-13 of B.Tech. and MBA Tech. programs for the Computer Programming related courses

Class	Trim I	Trim II	Trim III
B.Tech. CE	75.00	86.67	73.33
B.Tech. EXTC	59.65	70.91	67.27
B.Tech. Mech.	70.00	77.59	75.86
MBA Tech. CE	97.56	97.56	92.50
MBA Tech. EXTC	92.50	94.87	97.44
MBA Tech. Mech	85.00	80.00	92.50

4. Analysis of Result

Term End Examination result indicating performance of students in respective divisions were analyzed.

4.1 Average Grade Data Analysis :

By comparing the students average grade values of Table 2 and Table 3, It has been revealed that improved pedagogy has made dramatic increase in performance of students in term end examination score of programming courses. The red and blue traces are indicators of program-wise, trimester-wise class percentage of computer programming related courses. Red indicates traces for Academic Year 2012-13 and Blue indicates traces for academic year 2011-12.

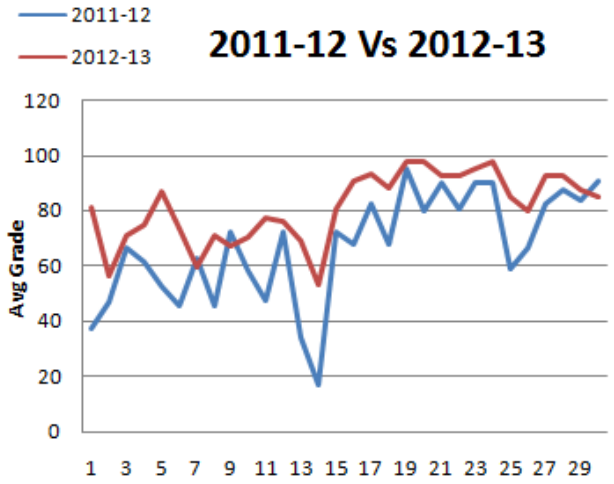

Figure 2 : Average grade data analysis for student performance in 2011-12 and 2012-13

T-Test has been conducted on two data sets. Summary of is depicted below:

Table 4: T- test for average grade data analysis

T-Test Two Sample for Means		
Year	***2011-12***	***2012-13***
Mean	66.83	81.07
Standard Deviation	19.55	12.55
Observations	30.00	30.00
95% upper bound for mean difference	-10.17	
Hypothesized Mean Difference	0.00	
T - Value	-5.95	
P- Value	0.00	

4.2 Qualitative Analysis :

In qualitative result analysis, we have considered the random 30 students grades from each class. We have compared the grades of each class for the academic year 2011-12 with academic year 2012-13. In graphs, red and blue traces are indications of grades of different students for the academic year 2011-12 and 2012-13 respectively. t-test is performed for qualitative analysis also with the help of mini tab 17 software.

Level of significance considered is as 0.05.

5. Conclusion

Average grade data analysis and Qualitative analysis of the consolidated scores of student in Term End Examination, It is concluded that modified pedagogy resulted in better understanding of course content by students. The student could write program accurately with error-free code spending less time.

Student performed better in Term End Examination and Course objectives are fulfilled partially. Few Course Outcomes were measurable and depicted in this paper. Students enjoyed the learning and received personal attention of the faculty.

Faculty appreciated this way of teaching because of equal balance of theory and practical sessions, relieved them from continuous one hour sessions. Interaction with students increased and helped student to understand the course content. Faculty expressed satisfaction after their teaching and felt comfortable during session delivery.

Authorities appreciated effort put by faculty and pleased by improved performance of student in term end examination in programming course.

But this pedagogy required additional number of faculty for same number of students division and batches.

6. Future Scope

Effect of this pedagogy on placement percentage in ITES Companies yet to be verified due to lack of sufficient data. There is future scope for analysis of effect of this pedagogy on student performance in recruitment process or Entrepreneurial Skill development.

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