Reflective Teaching for Undergraduate Courses: An Experience

Saroja V. Siddamal[1], Suneeta V. Budihal[2], Ujwala B. Patil[3]
Department of Electronics and Communication
B. V. Bhoomaraddi College of Engg. and Tech., Hubli-31
sarojavs@bvb.edu

Abstract: The paper presents a reflective approach for the undergraduate's courses to improve the effectiveness of teaching. The objective of the proposed practice is to enhance the course learning, beyond the traditional mode. In the traditional method of teaching the course instructor would not have checked the effectiveness of the teaching till the completion of the course. The student also would not have measured the level of understanding. This creates a gap between teaching and learning. The reflective teaching breaks this vicious circle and promotes better teaching and learning. To meet the objective different activities such as cyclic test and concept visualization are designed and practiced in the identified courses. The proposed approach provides opportunities to refine course delivery and improve learning.

Keywords: Reflective teaching, cyclic test, concept visualization.

1. Introduction

Reflective teaching is a kind of self assessment strategy. It is a technique of improving teaching by means of meta cognitive awareness. Through this one can make conscious efforts to evaluate and analyze their current teaching, and continuously use the reflections, observations to create their own conclusions to test future situation.

He educator John Dewey in 1993 wrote "the process of reflection for teachers begins when they experience difficulty that cannot be resolved immediately. Reflection commences when one enquires into their experience and relevant knowledge to find meaning in their beliefs. It has the potential to enable the teacher to direct their activities with foresight and to plan according to ends in views". Reflective teaching practices are used to teach many courses [1].

Corresponding Author

Saroja V. Siddamal
Department of Electronics and Communication
B. V. Bhoomaraddi College of Engg. and Tech., Hubli-31
sarojavs@bvb.edu

Various reflective practices facilitates students to learn according the their learning styles. In the process of exploring the methods of effective and engaging ways to engineering courses, reflective teaching was found more relevant.

Writing uses a different part of our brain than talking does. Many people think better when they are physically active [3]. A broader analysis of reflective teaching is presented [4] and in [5]. Abstraction plays a central role in this lesson as the ability to abstract is critical in software development processes. However, the ability to abstract it is not trivial cognitive process. Furthermore, the teaching of abstraction is not a simple challenge [6]. The survey reveals that reflective teaching is a effective tool for self assessment in course delivery. In order to enable the effective learning reflective teaching acts as a tool.

The rest of the paper is organized as follows. In section 2 effective teaching framework is discussed, section 3 demonstrates the proposed framework of reflective teaching in identified courses. Section 4 deals with methodology and its effectiveness, conclusions are derived in section 5.

2. The effective teaching framework

The main idea of the frame work shown in Figure 1 is that, effective teaching and learning techniques lead to student satisfaction and motivation to learn when properly supported by a positive learning environment. The proposed framework consists of four main components:

1. **Strategies**: Use of different student-centered techniques like reflective teaching/learning to support and enhance learning.
2. **Roles**: Assigning roles and responsibilities to all the stakeholders to ensure their active participation and collaboration.
3. **Assessment**: Assessment and evaluation methods to measure monitor and promote learning.

4. **Environment**: Effective learning environment both inside and outside the classroom.

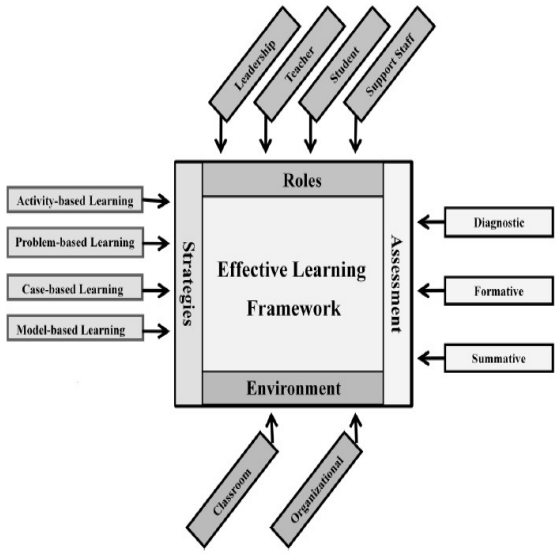

Fig. 1: The Student-centered Effective Learning Framework

(Source 2013 ISSN: 2309-3951, 2014)

3. Proposed Framework of Reflective Teaching

The primary benefit of reflective teaching practice is a deeper understanding of their own teaching style and ultimately greater effectiveness as a teacher. Figure 2 shows the proposed framework for reflective teaching.

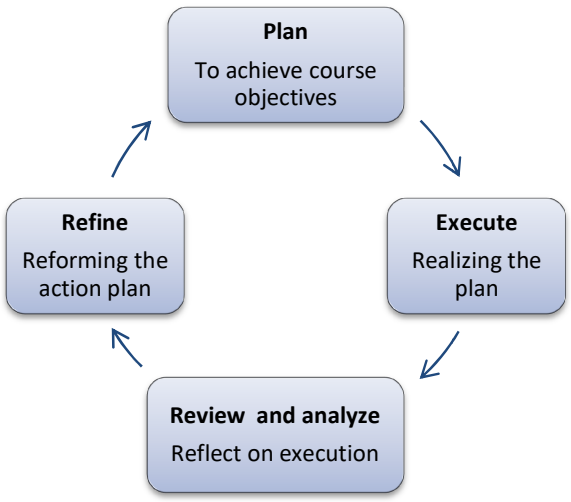

Fig. 2. Proposed framework for reflective teaching

i. **Plan:** In reflective teaching the course instructor uses the concrete experience to plan the course delivery in order to achieve objectives for the course.
ii. **Execute:** During the course delivery the instructor focuses on the implementation of the plan. At some stage in the execution the reflections are considered.
iii. **Review and analyze**: The collected reflections are reviewed and analyzed for their implications on classroom delivery.
iv. **Refine**: The analyzed reflected data is used by the course instructor to refine the strategy and reframe the plan of course delivery.

4. Methodology

The proposed framework is practiced to teach the undergraduate courses of III and VI semester in the department of Electronics and Communication Engineering. Cyclic tests are designed for Signals and Systems course of III semester and concept visualization are framed for Digital communication course of VI semester.

4.1 Cyclic Test

Cyclic test are the repetitive exams conducted to ensure the proper understanding the topic. The activity is planned according to the proposed frame work of reflective teaching for Signals and Systems course of III semester.

Plan: Topic learning objectives are planned to achieve the course objectives. Course instructor uses experience to design mode of delivery and assessment.

Execute: Course delivery is carried as per the plan.

Review and analyze: Based on the course delivery the level of learning is assessed through continuous internal examinations. The scores revealed the poor understanding of few concepts by majority of students.

In our curriculum framework Continuous Internal Examinations (CIE) is conducted for 50 marks, out of which first and second CIE is evaluated to 20 marks each and remaining 10 marks is assigned for activities like quiz, implementation assignment, course project etc.
The student has to score 8 marks in each of these CIE to get eligibility to write semester end examination. In class strength of 75 more than 40% of students were not eligible. This motivated to restructure the course delivery.

Refine: These reflections are used to refine the conceptual mode of course delivery. Cyclic tests are designed and conducted to know the effect of teaching and their learning regularly rather waiting till next CIE.

Post cyclic test class delivery is reframed based on the performance in cyclic test. Course delivery is reformulated using supportive multimodal material like video lectures form renowned IIT Professors.
Improved performance in the next CIE ensured the effectiveness of cyclic test.

4.1.1 Effectiveness of the activity

The cyclic test is practiced and the effectiveness is measured using academic performance of the students as well as using the student's feedback. The Figure 3 shows the influence of the activity on the student performance. The cyclic test activity for third semester students is practiced after CIE-1. In CIE-1 the student performance was very poor. As a remedial strategic planning cyclic test

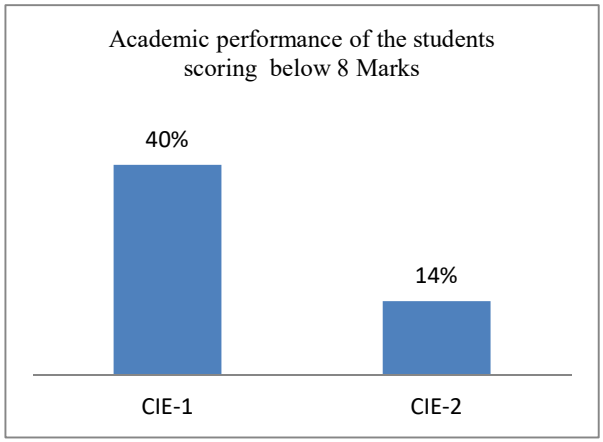

Fig. 3: Academic Performance in signals and systems course

was designed and practiced. The performance in CIE-2 is improved considerably.

The effectiveness is analysed using the student's feedback also. The feedback questions framed by the instructor are:

1. Activity motivates to apply theoretical knowledge to solve given problem?
2. Activity is relevant in particular course/concept?
3. Is cyclic test a burden?

The Figure 4 reflects the student feedback for this activity. The analysis is done on 1 to 3 scale, 3 being the strongly agree, 2 being the moderately agree and 1 indicates disagree. 85% of the students strongly agreed that they could apply theoretical knowledge to solve given problem. 79% of the students agreed that the design of the cyclic test was relevant. 49% of the students found the cyclic was a burden. Cyclic test are the effective tools to enhance the student learning

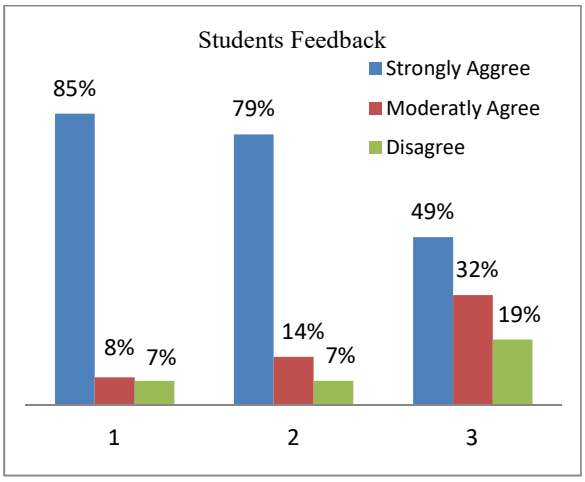

Fig. 4: Students Feedback

4.2 Concept Visualization

To teach the complex concepts of design and analysis to undergraduate students additional tutorial classes or further explanations with visualizations [10] is required. Concepts visualization cannot be achieved using a traditional teaching and through textbook [11]. We need to integrate advanced technology tools in education such as simulations and visualizations.
The activity is planned according to the proposed frame work of reflective teaching for Digital Communication course of VI semester.

Plan: Before the commencement of semester the course instructor designs the course to meet the objectives. Few complex concepts need to be delivered through special teaching technique such as simulations using Simulink. Concepts of modulation technique such as ASK, BFSK, PSF, QPSK etc. are discussed with modular approach using Simulink as shown in Figure 5.

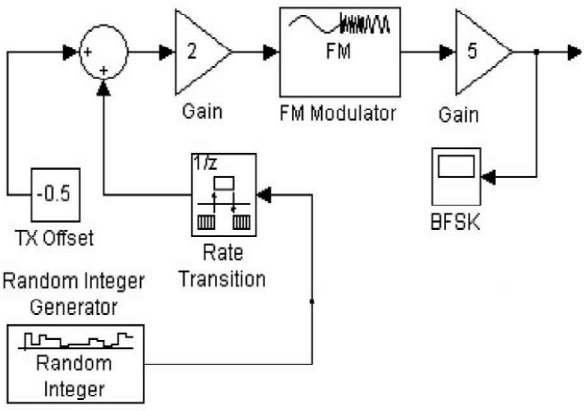

Fig. 5. Implementation of BFSK using simulimk tool

Execute: Course delivery is carried as per the plan.

Review and analyze: Based on the course delivery the level of learning is assessed through continuous internal examinations. The oral feedback and scores revealed the poor understanding of few concepts by students.

The modular approach of Simulink limited the students from exploring the concepts. This resulted in poor performance in CIE of year-I as shown in Figure 6. This motivated to reframe the special teaching technique used in course delivery.

Refine: These reflections are used to refine the visual mode of course delivery. There is a need to explore the concepts beyond the modular approach. The EDA tools like Scilab, pSpice, Matlab etc facilities, parametric level concept visualisation. The course delivery is redesigned using Matlab as concept visualisation tool. Improved performance in the CIE of year II ensured the effectiveness of redesigned concept visualisation.

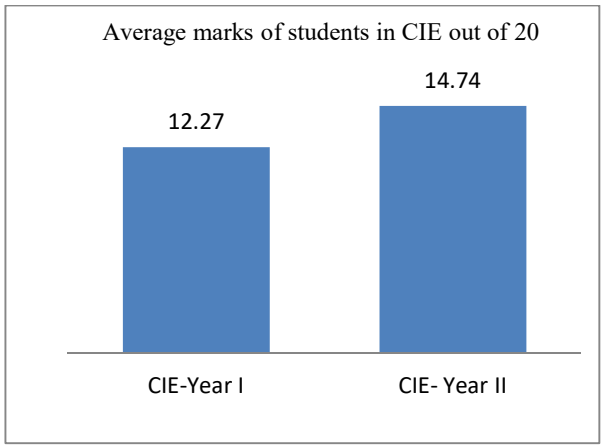

Fig. 6: Academic Performance in digital communication course

4.2.1 Effectiveness of the activity

The concept visualization is practiced and the effectiveness is measured using academic performance of the students as well as using the student's feedback. The Figure 6 shows the influence of the activity on the student performance. The effectiveness is analyzed using the student's feedback also. The feedback questions framed by the instructor are:

1. Concept visualization enhanced the learning compared chalk and talk.
2. Learning from the activity can be applied beyond the course.

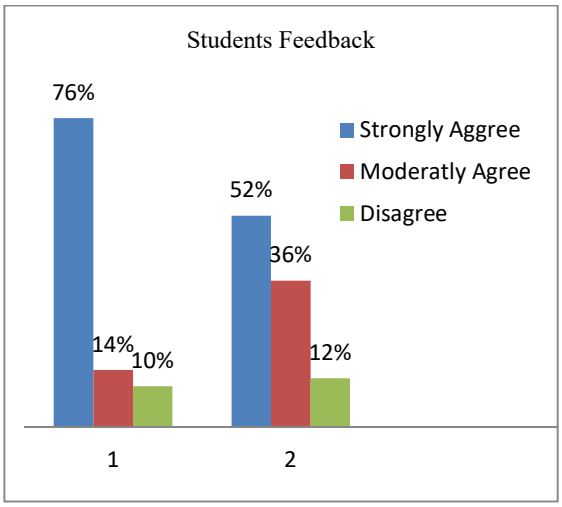

Fig. 7: Feedback from Students

The Figure 7 reflects the student feedback for this activity. The analysis is done on 1 to 3 scale, 3 being the strongly agree, 2 being the moderately agree and 1 indicates disagree. 76% of the students strongly agreed that learning is enhanced through concept visualisation. 52% of the students agreed that the learning from concept visualisation can be applied beyond the course.

5. Conclusion

The paper demonstrated a reflective approach for the undergraduate's courses to improve the effectiveness of teaching. The reflective teaching bridges the gap and promotes better teaching and learning. The activities such as cyclic test and concept visualization are designed and practiced in the identified courses. These activities enabled the course instructor to continuously refine the course delivery and improve student learning. Though reflective teaching improves the student learning it demands additional time and effort from course instructor.

Reference

[1] Durward K. Sobek II. "Use of Journals to Evaluate Student Design", Processes In Proc. American Society for Engineering Education (ASEE).
[2] David Keirsey. "Please Understand Me II". Prometheus Nemesis Book Co., 1998.
[3] Annual Conference and Exposition, 2002. Thompson 2002 Kenneth L. Thompson, "Learning as a Biological Process. Pegasus Communications", Inc., http://www.pegasuscom.com/levpoints/learnbio.html, 2002.
[4] Hazzan, O., "The reflective practitioner perspective in software engineering education", The Journal of Systems and Software 63 (3), pp. 161-171.

[5] Hazzan, O. and Tomayko, J., "The reflective practitioner perspective in eXtreme Programming", Proceedings of the XP Agile Universe 2003, New Orleans, Louisiana, USA, pp. 51-61.

[6] Kramer, J. Keynote: Abstraction – "Is it teachable? The devil is in the detail", The 16 th Conference of Software Engineering and Training , Madrid, Spain 2003.

[7] Brooks, D. W., Nolan, D. E., & Gallagher, S. M. Web-teaching: "A guide to designing interactive teaching for the World Wide Web", (Vol. 9). Springer, 2001.

[8] Keengwe, J., Onchwari, G., & OnChwari, J.. "Technology and student learning: Towards a learner-centered teaching model". AACE Journal, 17(1), 11-22,2009

Felder, R.M., and R. Brent. 1994. "Cooperative learning in technical courses: Procedures, pitfalls, and payoffs. ERIC Document Reproduction Service", ED 377038. Available on-line at http://www.ncsu.edu/felder-public/

Papers/Coopreport.html_, accessed September 28, 2002.CL Strategies(JCCCT). pdf, accessed September 28, 2002.

[9] Proceedings of the World Congress on Engineering and Computer Science 2009 Vol IWCECS 2009, October 20-22, 2009, San Francisco, USA "Learning and Teaching Engineering Courses with Visualizations", Tang-Hung Nguyen1, and I-Hung Khoo.

[10] Atkins, D., et al. "Revolutionizing science and engineering through cyber infrastructure", Report of the National Science Foundation, Blue-Ribbon Advisory Panel on cyber infrastructure. Washington, DC: National Science Foundation. 2003.