

# Experiential Learning Framework for Signals and Systems: An Attempt Towards Reaching Higher Levels of Cognition.

Ujwala Patil<sup>1</sup>, Preeti S Pillai<sup>2</sup>, Shraddha B Hiremath<sup>3</sup>, Raghavendra M Sher<sup>4</sup>, Rohit K<sup>5</sup>, Nalini C Iyer<sup>6</sup>

<sup>1,2,3,4,5,6</sup>K.J.Somaiya Institute of Technology, Vidyapeeth, Vidya Nagar, Hubballi-580031, India

<sup>1</sup>ujwalapatil@kjetec.ac.in

**Abstract:** In this paper, we propose an experiential learning module for the course Signals and Systems (SNS). This course is designed in the second year of the Electronics and Communication Engineering stream and challenging course as it demands a higher level of cognition skills. Experiential learning is a series of activities that allow students to be actively involved in ensuring learning. The experiential learning module enhances the problem-solving skills towards reaching higher levels of cognition, moving from the lower levels of remembering, understanding. Typically, the conventional modes are teacher-centric, visual learners and sequential learners find challenges in stimulating their cognition skills. Towards this, we design an experiential learning framework with two techniques: Concept inventory and SNS with Python to facilitate sequential learners and visual learners respectively. The challenges associated with the deployment of our framework are time and resource management. The proposed framework facilitates achieving a higher level of cognitive skills; also the introduction of the simulating tool ensures the conceptual learning of the course beyond classroom learning.

**Keywords:** Cognition skills, Concept inventory, Python, Sequential learners, Visual learners

## 1. Introduction

Facilitation of the course content using traditional methods, i.e. chalk and talk method initiate only knowledge transfer of 100% for the creamy layer of students. The statistics reveal that 65% of the students are visual learners and the rest are sequential learners. It is the responsibility of a tutor to discover and implement different pedagogy methods to be inculcated with traditional teaching [1], [4]. Signals and Systems is one of the basic courses in the Electronics and Communication curriculum and the concepts in this course are closely associated with mathematics. This course is a prerequisite course for different core courses like DSP, Communication, VLSI, Wireless communication, etc. As a mathematically oriented subject, students found it challenging to link mathematics and Signals and Systems course concepts to solve given signal processing applications due to a lack of a higher level of cognition skills and visualization of the concepts. To improve their cognition skills Concept inventories were floated to build the competency among the learners to address problems of the course Signals and Systems. Typically, the problems are designed at different levels of Bloom's taxonomy, and

students are allowed to carry out this activity as a part of their continuous evaluation [2], [3]. The performance at different complexity levels is used to reframe the structure of the further synchronous sessions. To enhance their visualization skills of signals and systems concepts a programming language called Python was introduced. This approach develops a constructive framework in students' minds to represent the concepts behind mathematics logically. This approach provides the benefits of visualization of signals and its operations to the learners along with enhancing their coding skills. We consider the employer's feedback and choose Python as a supporting language for the course Signals and Systems. Implementation assignments including signal generation and its operations are designed and evaluated as part of their continuous evaluation. Experiential learning is appreciated by experts and also by students. Authors in [10], [11] discuss "Learning by doing" activity to ensure the learning beyond the classroom teaching.

For many years K.J.Somaiya Institute of Technology has placed prior emphasis on achieving almost all the educational outcomes demonstrated by the OBE framework. The activities introduced in the signals and systems course play a very significant role in programmatic accreditation and better assessment of learning outcomes for continual improvement. Major efforts as a facilitator are to provide a better assessment tool for enhancing the learning capability of the pupil as well as to extend the learning outcome assessment. To improve the overall assessment strategy of the course signals and systems an additional pedagogy method is introduced in this paper.

The content that is being covered fairly distributes from introducing the concept of signals, systems, and their analysis for continuous-time and discrete-time signals, its interaction with continuous-time and discrete-time systems, and related properties. Also, the students experience frequency domain existence for every time-domain representation that provides a lower level of abstraction in the form of trigonometric and exponential Fourier series, Fourier transforms, Z transforms and their applications. All these concepts are pretty challenging for a facilitator to convince the students because the course is more bent towards the conceptual analysis, contains a higher level of abstraction and a student needs to have a strong fundamental base in mathematical solving skills as well as comprehension of the meaning behind the mathematics as the students are being exposed to the frequency domain as well [7], [8]. A necessity to create a contemporary method

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