

Inculcation of Life Philosophy through DSP Concepts



B. Hema Kumar, M. Florance Mary

Abstract: Engineering education is a training that encompass learning the theoretical knowledge of concepts, and real time application domains. The role of engineering is also bound by ethical values and the understanding of social and cultural values. In this context a new approach has been designed to facilitate learning of life philosophies through Digital Signal Processing (DSP) concepts. To facilitate learning process, skits based on core DSP concepts were developed using simple day to day tools and performed with learners. The concept was introduced with simple analogies. Then students were made to participate in skits corresponding to key concepts. After the skits, learners were educated about the correlation with Life philosophies. Three case studies were taken up for this study. We found that the inculcation of life philosophies through simple skits, helped learners better to understand the concepts as well the moral values of life.

Keywords: DSP, Skits, Life philosophy, flipped classroom.

I. INTRODUCTION

A Flipped classroom activity [5] to increase active listening among students was employed for handling the subject DSP. In a conventional class room, transmission of information takes place inside the class. Students do assignments to reinforce what they learned in class. In the flipped classroom the process is reversed. Information transmission takes place outside the class whereas concept reinforcement takes place inside the class. This type of strategy helps students better to clarify their doubts and increase the creativity level of students [4]. For concept reinforcement a variety of activities can be performed like peer instruction, think pair share activity etc. We have used analogies with technical skits [1], [3] as in-class activity for concept reinforcement. Analogies based on life philosophies were chosen for explaining the DSP concepts. Three case studies were considered for this study.

II. CASE STUDIES

A. Case Study 1: Even and Odd Signals

Author (s) can send paper in the given email address of the journal. There are two email address. It is compulsory to send paper in both email address.

Revised Manuscript Received on May 30, 2020.

* Correspondence Author

B. Hema Kumar*, Department of Electronics & Instrumentation Engineering, Pondicherry Engineering College, Puducherry, India. Email: hemakumarb@pec.edu

M. Florance Mary, Department of Electronics & Instrumentation Engineering, Pondicherry Engineering College, Puducherry, India. Email: florcemary@pec.edu

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an [open access](http://creativecommons.org/licenses/by-nc-nd/4.0/) article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Technical Concept

In Digital Signal Processing the concept of even and odd signals are used for signal analysis. A signal is referred to as an even, if it is identical to its time-reversed counterparts. Mathematically even signals are represented as $x(t) = x(-t)$ and odd signals as $x(t) = -x(-t)$

Even signals are symmetric around vertical axis, and odd signals are symmetric about origin. These particular characteristics of signal symmetry will be useful for signal analysis. Any arbitrary signal is made of even and odd parts. Even and odd signals can be extracted from the given signal [9].

Even part (x_e) of a signal is expressed as given below; (1)

$$x_e(t) = \frac{x(t) + x(-t)}{2} \quad (1)$$

Similarly, Odd part (x_o) of a signal can be expressed as (2)

$$x_o(t) = \frac{x(t) - x(-t)}{2} \quad (2)$$

Philosophical Concept

Any human being has good thoughts as well as bad thoughts. These bad thoughts can be considered similar to impurities. This gives the difference between Humans and God.

Mathematically, this can be expressed as **God = Human – impurities**

Correlation

We are representing a signal $x(t)$ as good thoughts and the signal $x(-t)$ as bad thoughts. If we implement the equation (1), as per this concept;

The human being (H) is EVEN if he has good and bad thoughts given by (3)

$$H_e(t) = \frac{\text{Good} + \text{Bad}}{2} \quad (3)$$

EVEN represents, each individual is very normal having good and bad thoughts. Consider a human being Unique or ODD, if he eliminates bad thoughts and retains good thoughts as given by (4)

$$H_o(t) = \frac{\text{Good} - \text{Bad}}{2} \quad (4)$$

Odd represents, each individual is very UNIQUE, and if bad thoughts or impurities are eliminated and thus purifying thy self, which helps in salvation.

B. Case Study 2: Fourier analysis of signals

Technical Concept

A signal is any physical quantity whose magnitude changes with time. A signal can be basically analysed in time domain. One can calculate the amplitude and time period, can be checked for periodicity.

Signal can be either convoluted or correlated with other signal or itself to extract useful information.

But if the signal contains more than one frequency components, then it will be difficult to analyse the signal in time domain alone. Hence for this purpose we will be using frequency domain analysis to identify multiple frequency components, bandwidth and various other parameters of interests. In DSP Fourier transforms is used to convert a Time domain signal to frequency domain signal [9].

Philosophical Concept

As per Thirukural Human beings attain success in life based on the altitude of their thoughts. This is given by the couplet 595, English translation [7] of the same is provided below;

The explanation of this Thirukural couplet is “The stalks of water-flowers are proportionate to the depth of water; so is human's greatness proportionate to their minds”.

Understanding of our fellow human beings is very much needed for a peaceful environment. Understanding a person from outward appearance alone will not reflect the true nature of a person. Analyzing the thoughts will give a better understanding of fellow individuals [6]. Even for an individual, for personal upliftment it is required to analyze his own thoughts, identify their state and enrich them with good ones is required.

Correlation

Each thought is a frequency [8]. Analyzing a signal in time domain is equivalent to looking and judging a person from the outward appearance. But to understand the real person it is required to analyze the thoughts. Based on which a person may be considered as good or bad. If one has bad thoughts, the person has to transform himself by analyzing the thoughts and enriching himself with good thoughts. Analyzing the thoughts of person is equivalent to frequency domain analysis. and the transformation one attains due to analysis of thoughts is equivalent to different transforms used in DSP.

C. Case Study 3: Autocorrelation

Technical concept

Correlation is a bivariate analysis that measures the strength of association between two variables and the direction of the relationship. A signal can be correlated with another signal or itself. Based on the correlation many useful inferences can be derived. When a signal is correlated with other signal it is called cross correlation and if it's done with the same signal it is called auto correlation [9].

Auto correlation is used to extract radar signals to improve sensitivity. Auto correlation of a signal is given as in (5)

$$\sum_{m=-\infty}^{\infty} x(m)x(m - k) \tag{5}$$

Where the parameter k is any integer. When k = 0, the autocorrelation function represents the total signal energy.

Philosophical Concept

Often human beings compare themselves with others as a measure of growth. But the real growth is one needs to compare himself with his past and present. Since each human being is unique in this universe, comparing ourselves with others will not be a correct measure. When a person compares himself with his past and present situation, he knows what his real stand is, which will help the person in his or her progress [6].

Correlation

The act of comparing oneself with others is equivalent to cross correlation; whereas comparing oneself with his or her own past and present is equivalent to auto correlation. Moreover, Auto correlation gives the energy content of a signal which is equivalent to the person identifying his or her true stand in life.

Hence autocorrelation in life gives a true measure of one own capability and his ability to correct from his past mistakes and glow like a phoenix bird, which comes out of its ashes in mythology.

III. EVALUATION METHODOLOGY & RESULTS

The methodology for implementation was carried out in Two different terms of 2017 & 2018.

- 1) First term extends from Jan 2017 to June 2017. The students under this term where referred as group FTQ (Flipped classroom with Questions for reinforcement).
- 2) Second term extends from Jan 2018 to June 2018. The students under this term where referred as group FTSA (Flipped classroom with Skits and analogies for reinforcement).

To evaluate the effectiveness of the proposed method, two strategies were followed

- 1) Unit wise test
- 2) Final end semester examination

After completing each unit in the syllabus, a test was conducted to the students. The test mainly focused on the student's ability to learn the basic concepts. This test was taken as the first measure. At the end of the semester Final examination results were considered as the second measure. Additionally, a special questionnaire was provided to students to enquire about their personal likes and dislikes about the usage of skits and analogies. This questionnaire was submitted through an anonymous messaging platform. The results of the unit test and end semester examination is illustrated in Fig 1 & 2.

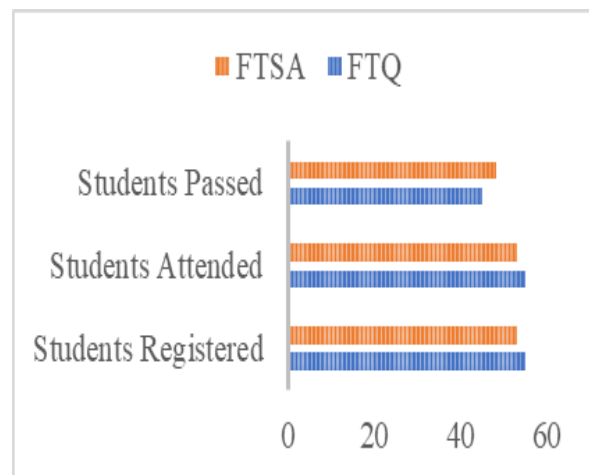


Fig 1. Results of Unit Test

For unit test 50 out of 55 number of students attended the exam. Out of which 35 passed the test in the case of FTQ group. Whereas in FTSA group 51 out of 53 students took the test, out of which 40 passed. Hence from Fig 1 it is evident that the group FTSA performed 12% better compared to FTQ group.

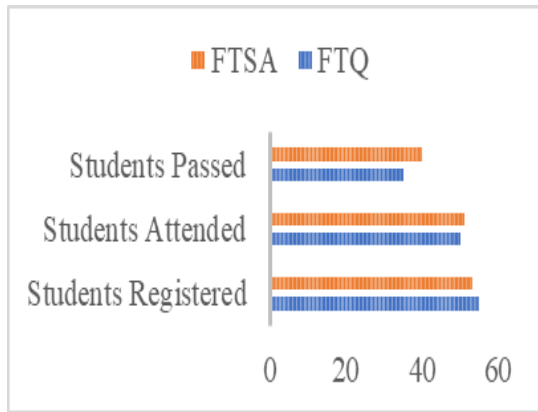


Fig 2. Results of End semester Examination

For Final end semester examination 45 out of 55 number of students passed the test in the case of FTQ group. Whereas in FTSA group 48 out of 53 students passed. This is evident from Fig 2. Thus, the group FTSA performed 11% better compared to FTQ group.

A. Implications from anonymous messaging platform

The understanding of concepts was better in FTSA compared FTQ. Students told that the philosophical concepts were quite interesting and it simplified remembering of technical concepts. Also, in some cases the students were able to remember the philosophies better than actual engineering concepts.

IV. CONCLUSION

From the results depicted in Fig 1 and Fig 2, it clearly indicates the effectiveness of the group FTSA over FTQ group. Moreover, the comments from anonymous messaging platform also add to this. Hence usage of skits and analogies as a reinforcement methodology has better effects compared to normal questions and answers asked. These type of flipped classroom activities help the students to better understand the concepts. Furthermore, since the analogies are related to life philosophies it helps students to understand ethical principles along with engineering concepts. Thus, a two in approach is attained by inculcation of life philosophies through DSP concepts

REFERENCES

1. Dr B Hemakumar, "Teaching Digital Signal Processing using skits - A Case Study", International Journal of Current Engineering and Scientific Research (IJCESR), Volume-5, Issue-1, ISSN (Online): 2394-0697, ISSN (Print): 2393-8374, pp 35-40, Jan 2018.
2. Hemakumar B, "Interactive DSP teaching using skits and Audiovisual aids", Asian Conference on Education (ACE 2017), held at Art Center Kobe, Kobe, Japan from 19th to 24th Oct 2016
3. Hemakumar, B., and Dr.Anandanatarajan, R, "Technical Skills for Teaching Engineering Concepts - A Case Study", Proceedings - International Conference on Teaching and Learning, organized by Dept. of Education, University of Malaya, Kuala Lumpur, Malaysia on 5th Oct 2016 pp 251 - 260
4. Dr. Xiaobin Le P.E., Testing the flipped classroom approach in engineering dynamics class", Proceedings of 122nd ASEE annual conference, June 15th to 17th, 2015.
5. Carl Reidsema, et.al., "The Flipped Classroom Practice and Practices in Higher Education", Springer Publications, 2017.
6. Vedhathiri Maharishi, "Yoga for Modern Age", Vedhathiri Publication, 16th Edition, 2014.
7. G.U.Pope, "Thirukural", Giri Trading Agency 2016.
8. Rhonda Bryne, "The Secret", Simon & Schuster; UK ed. Edition, 2009
9. P.Ramesh Babu, "Digital Signal Processing", Scitech Publications Pvt Ltd., 2014

AUTHORS PROFILE



B. Hema Kumar is an Assistant Professor, from Department of Electronics and Instrumentation Engineering, Pondicherry Engineering College. He has a total teaching experience of 15 years. He obtained his PhD in Biomedical Image Processing from Pondicherry University in 2017. He has published papers in 30 International journals and conferences. He has visited Japan and Malaysia for paper presentations.



M. Florance Mary is an Assistant Professor, from Department of Electronics and Instrumentation Engineering, Pondicherry Engineering College. She has a total teaching experience of 14 years. She obtained his PhD in Process Control & Instrumentation from Pondicherry University in 2016. He has published papers in 15 International journals and conferences