

Exploring Interest Factor in Mathematics Teaching Learning in Engineering Education



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Abstract: Mathematics Education is considered to be non-avoidable and away from real life situation for practicing Outcome Based Education (OBE). Mere completion of steps either by mugging up or just following up like standard, had left mathematics education to least interesting. Due to this students drop outs are high and failing to the effectiveness of inclusion of mathematics in engineering education. In this paper, an attempt is made to explore and create SOP (Standard Operating Procedure), the interest factor, necessary to drive the cause of inclusion of mathematics in professional education. This research work is useful to reflect in professional competency in their respective domain.

Keywords: Mathematics Education, Interest, Competency, Proficiency, Efficacy

I. INTRODUCTION

The report published by UNCTAD, technology and innovation report [1] acknowledges India’s global leadership in students graduating in the field of Mathematics. On the contrary, only 25% of first year students are able to clear mathematics subject in 2019 in Tamil Nadu [2]. In this respect, a maximum stretchable 40% only, is true in first attempt across professional education with high score in mathematics. Even students scoring more than 90% in pre engineering are not able to clear engineering mathematics respectably in first attempt [2]. Schukajlow [2016] indicated that student’s interest affects the performance and proficiency in mathematics education [3]. A survey of 60 students is therefore taken to understand, as to why students drop interest during mathematics teaching learning process Table 1 Indicates, this survey result.

Table 1: Major cause of losing interest in mathematics

Sr. No.	Cause of Losing Interest	% of students
1.	Failed to understand how equations are framed	92
2.	Too many laborious steps	40
3.	Can’t relate with real time applications	55
4.	Consumes time in preparations	32

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This assessment further verified with one to one interaction and assessment. It is therein confirmed that students failing to understand how equations are framed is the major cause of losing interest in mathematics.

During this interaction, a case study was presented by student. In mathematics class, question shown in fig 1 is taken up by teacher to solve it.

For what value of ‘x’, the eigen values of the given matrix A are real.

$$A = \begin{pmatrix} 10 & 5+i & 4 \\ x & 20 & 2 \\ 4 & 2 & -10 \end{pmatrix}$$

Fig 1: Eigen Value question in examination

Students find it difficult to solve it, due to following reasons.

1) Students fail to understand, what is the importance of finding Eigen value and its relevance in practical field application

2) How the matrix A is formulated.

Also to the extent of surprise, students confessed that, they didn’t asked above two questions to their teachers, or teachers tried to disseminate these questions at least by pre class approach.

As a result, students solve it routinely with mugged up steps and forget it after examination, without any assimilation of their practical knowledge.

This leads to detrimental effects like

1. Students leave many important topics, treating them optional to attempt as they find them non-interesting and difficult to understand

2. Devote very less time on study of mathematics subject

3. Delay mathematics learning as much as possible

4. Study just for sake of exam in last minute

5. Instead of actual solving, students try to read mathematics directly from books or notes.

6. Never try to correlate and having big narrative question mark in them as, why I am studying this, instead

7. Mug it up, solve it and forget approach is followed

8. Can’t formulate mathematical model, which hampers their prospects in projects, formulation of concepts etc.

This creates detrimental impact on proficiency, competency of students and will create adverse effect on students learning.

An attempt is made in this paper to explore interest in mathematics teaching learning and evaluation process.

II. OBJECTIVES

Objectives of this research work are:

- A. Explore possibilities of creating interest in mathematics education to address 1 to 8 in introduction section mentioned above
- B. Create Standard Operating Procedure for teaching mathematics equations to students with interest of students as pivotal point.

III. LITERATURE REVIEW

Number of standard research papers were reviewed to explore the findings of, “infusing interest” in mathematics education. Specific Findings are listed in Table 2

Table 2: Literature Review

Sr. No.	Author	Factors which creates interest in students	Reference Number
1	Schukajlow	Path Analysis on multiple applications	3
2	MarjaKristiina Lerkkanen	Learner Centric Method creates interest and not teacher directed method	4
3	Johan Korhonen	Students Aspirations and quick achievements	5
4	Nuutila	Task performance in domain field	6
5	Ekstam	Teachers efficacy beliefs impacts students interest	7
6	Cantley	Collaborative Cognitive Action Strategies improve interest	8
7	Tosto	Perceptions in classroom environment creates interest	9
8	Renninger	Scaffolding by peer learning of differently abled students create interest	10
9	Kozlowski	Creativity Based Mathematics Instructions creates environment	11
10	Research Gap	Sustaining after initial success is to be retained to maintain generated interest	Strategy

Therefore it is evident that, blended pedagogical approach needs to be implemented for the propose work.

IV. METHOD

Blended Pedagogical approach consisting of following components needs to be incorporated while demonstrating problem mentioned in figure 1.1

Following are the suggested components that need to be attributed to explain to students.

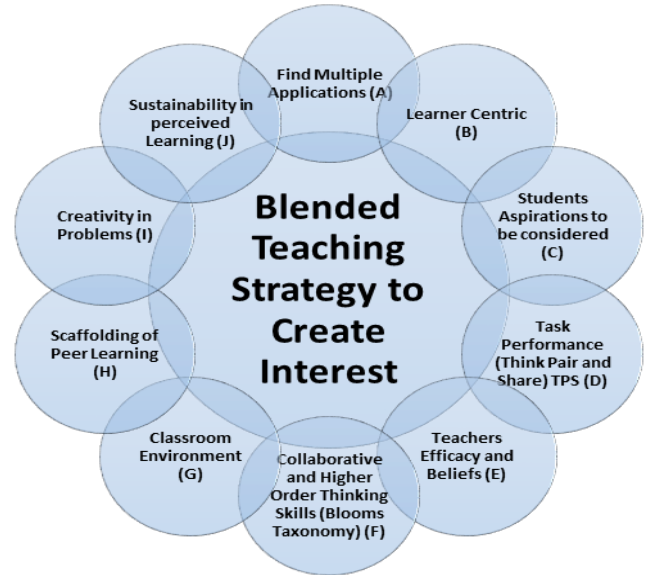


Fig 2: Blended Teaching Strategy to create interest

For Eigen value problem indicated in 1.1 following are the interest factor noted and fig2 is applied.

Responses are indicated in table 3.

Table 3: Attributes of Teaching Learning

Sr. No.	Strategy to be implemented for effective approach	Attribute applicable to eigen value problem
A	Find Multiple Applications	Control theory, vibration analysis, electric circuits, advanced dynamics and quantum mechanics uses eigen values
B	Learner Centric	Eigen values gives the factors by which compression will occur.
C	Students aspirations to be considered	In Engineering, Students aspirations is placement and employability. Teachers must explain, what is the scope of employability, if they are able to clearly calculate eigen value and apply in real world situation. Teachers should explain its scope in GATE examination, IES etc.
D	Task Performance (Think Pair and Share)	Students should not be given direct answer. Instead they should be made to explore by using research paper or google it or go through Wikipedia. At start of class, each student should explain other student, about what they learned or alternatively, they can record their responses in Moodle. Teacher will wait till student attempt it and students get their mistake to clarify.

Sr. No.	Strategy to be implemented for effective approach	Attribute applicable to eigen value problem
E	Teachers Efficacy and Beliefs	What strategy teacher will adopt or take responsibility that 1) They will help students to learn. 2) Motivate students to overcome constraints 3) Reward students who can achieve tasks and acknowledge their quick win 4) How to motivate slow learners to increase their learning pace and reflect on their learning.
F	Infusing Collaborative and Higher Order Thinking Skills	Students should be asked with interesting HOT questions as homework or assignment which will create interest. e.g. You are working in Indian Railways after passing through IES exam. Where you will apply knowledge of Eigen Value that you learned today. Record responses in MOODLE.
G	Classroom Environment	Blended, Active Engagement Approach. PPT, Chalk and Board, Activities, Peer Learning, MOODLE, Access to Google whenever required. Especially, advanced learners responses should be made available to all students as reference. Slow learners are then thus promote to advanced learners.
H	Scaffolding of Peer Learning	Peer Learning plays vital role. Group Strategy must be promoted with Outcome defined within specific and stipulated period of time. Teachers learning can more be reinforced with advanced learners, experience sharing etc. Advanced learners should be promoted to help slow learners or those who are not taking initiative to complete.
I	Creativity in Problems	Make the problem creative and apply interest factor in it from employability perspective. e.g. You are working on Data Sciences platform in software industry. How will you use Eigen value to compress data based on which decisions can be taken up?
J	Sustainability in Perceived Learning	A topic wise knowledge pool of students, who gives maximum response should be generated. These students will then help other learners, as an when required. Such students can be awarded Teaching Assistant Certificate for sustaining these efforts.

This model is applied to teaching learning and evaluation process of Eigen value in the class. Pre class (Pre Reading like Wikipedia), during class (Active Learning) and post class (Assimilation through homework) is followed.

Total 58 students participated in this activity out of which 54 students completed within stipulated time of 24 hours. Their responses are recorded, analyzed and contemplated for further enhancement and improvement. Following chart indicates the responses students feel were most important in exploring interest in solving Eigen value problem.

Table 4: Students Responses in %

Strategy No.	Students Responses in %		
	Priority 1	Priority 2	Priority 3
A.	45	40	15
B.	85	10	5
C.	70	22	8
D.	94	4	2
E.	91	4	5

Strategy No.	Students Responses in %		
	Priority 1	Priority 2	Priority 3
F.	47	42	11
G.	88	4	8
H.	89	4	7
I.	93	5	2
J.	83	8	9

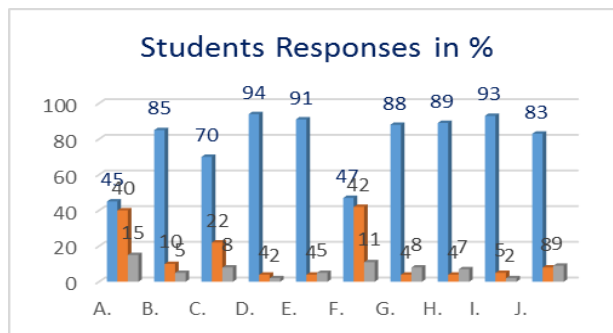


Fig 3: Students responses to prioritize strategies

V. RESULT AND DISCUSSION

Student's responses shown in Table 3 and Fig 3 are analyzed. From responses graph it is evident that, students felt three important strategies, teacher should always cover are, 1) Task Performance, 2) Creativity in Problems and 3) Teachers efficacy and beliefs. Students believed in Learning by doing, opportunities created by understanding of the importance of subjects with respect to its employment opportunities and teachers commitment for students learning and not just mere completion of syllabus.

VI. CONCLUSION

In this research paper, SOP is created (Standard Operating Procedure) by developing A to J Strategies, which yields greater learning for mathematics. As a result students could infuse interest in mathematics studies. Results shown that advanced learners were increased from 12 to 48 (Four times) and recommended to be implemented for better results. Similar strategies were framed for teaching derivatives, integration, vectors etc and found very interesting responses from students.

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