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# Enhancing Real-World Applications Learning In Industrial Engineering: Integrating Out-of-Classroom Experiences for Optimal Skill Development

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***Abstract*— The paper describes an effort to improve the industrial engineering course knowledge of a group of mechanical engineering students who are in 4th semester. The purpose of the research was to evaluate the efficacy of the "out of classroom" teaching strategy in the context of skill sets appropriate for the business and industry domains. The main emphasis is given on "Value Engineering" and "Value Analysis" techniques. The students were divided into group of clusters and they have been assigned in various projects by subject faculty which contains deferent levels to complete. The results show that the learning strategy can improve management, business, and engineering abilities, and that it has the capacity to do so in a single semester of study.**

***Keywords*— Value Engineering; Value Analysis; S.W.O.T. Analysis**

## I. INTRODUCTION

The ultimate objective of the institute is to prepare students for life beyond college. Self-awareness and more specialized talents are in higher demand in today's culture. Incorporating learning activities exterior to the classroom is one of the simplest methods to help students improve. Taking classroom learning exterior to the classroom can serve to expand a student's educational experience by demonstrating real-life applications of theories that they are studying in their respective areas.

### *A. What is learning outside the classroom?*

The use of venues other than the classroom for teaching and learning is known as outside-the-classroom learning. It is the act of getting pupils out of the house and giving them new, challenging, and interesting experiences to help them learn. Places can refer to a venue, activity, or workshop, but the goal is the same regardless of where learning takes place outside of the classroom. Give students a hands-on learning experience that will prepare them for success in life after college. Learning experiences outside of the classroom differ from those obtained through traditional teaching techniques because students may be encouraged to engage in a more diversified set of soft skills such as cooperation, leadership, and compromise in their learning environment. Traditional education relies on repetition and memory to educate pupils and is useful for imparting new information and educating children who learn best by listening.

Traditional teaching, on the other hand, does not inspire pupils to acquire critical thinking, problem-solving, and decision-making abilities, as studying outside the classroom may. Outside of the classroom, understanding can not only lead to a better understanding of difficult subjects, but it can also provide a foundation for learning in a range of domains. Outside of the classroom, understanding can not only lead to a better understanding of difficult subjects, but it can also provide a foundation for learning in a range of domains.

### *B. Direct benefits of learning outside the classroom*

Learning outside the classroom may help teachers foster a love of learning, provide students real-world perspective, and introduce them to a range of stem careers. Students who participate in learning activities outside of the classroom are more interested in their academics and have greater self-esteem. Evidence demonstrates that studying outside of the classroom can assist enhance achievement, improve classroom conduct, and increase student engagement, even in kids who are difficult to engage in the classroom setting. According to an exhaustive investigation released by Ofsted, learning outside the classroom contributed greatly to boosting standards and improving pupils' personal development. Colleges and universities aim to educate their students for careers after graduation.

### *C. Aim and Objective*

The aim of this study is to explore and discuss the current opinions of engineering degrees, particularly in terms of the following themes:

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1. By demonstrating to students the practical implementations of the topics they are studying in school or in the engineering sector, you may enhance their educational experience.
2. To development of self-awareness and more specialised skills for students.
3. The cultivation of skill set that is suitable for industry or business domains.
4. Making subject less boring and more interesting.

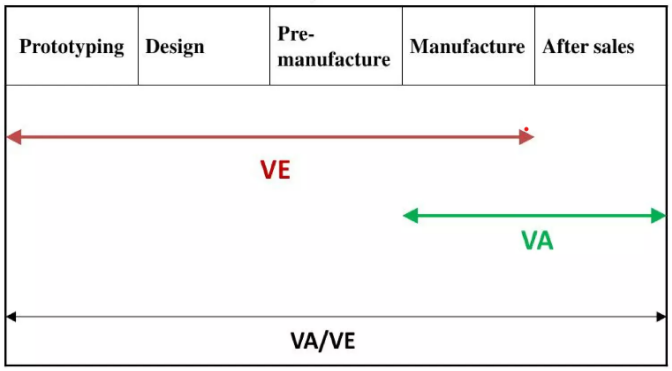


Fig. 1. Graphical View of the VA and VE Terminology

## II. Methodology Followed for Out of Class Room Teaching Strategy

The subject that will be covered outside of the classroom first chose a specific theme. The same topic was separated into activities for the second stage. The same activities will then be further divided into different levels, which will be completed by various groups of student clusters. A group of students had to interviewed businesspeople for a survey and then fill out several survey forms and an analysis table that the subject matter expert had given. Students must create one case study and one PowerPoint presentation using the materials they have already prepared, and they must turn them in by the end of the predetermined time period. Faculty and students are regularly coordinate with one another during the whole process.

### *A. Methodology Steps*

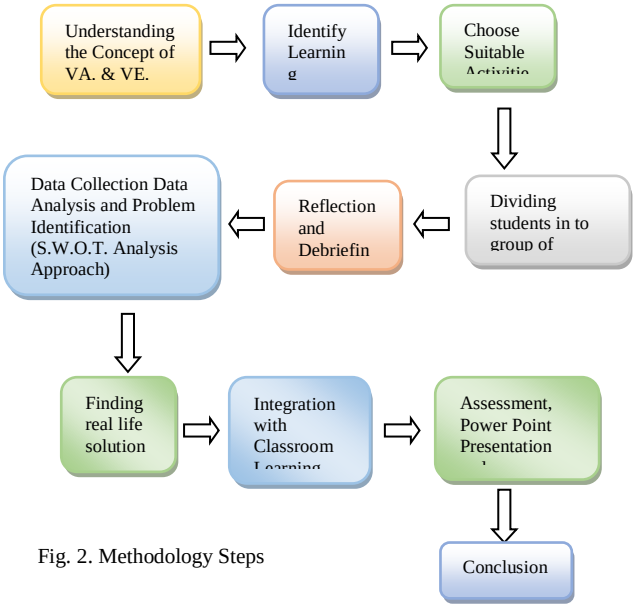


Fig. 2. Methodology Steps

## III. Observations and Discussions

**Phase-I:** The observation start from the subject topic which can be co- relate with practical implementations. For example: The VA and VE studies are about reducing costs in any ongoing business or project in the manufacturing industry. The topic teacher begins by discussing practical applications in the actual world.

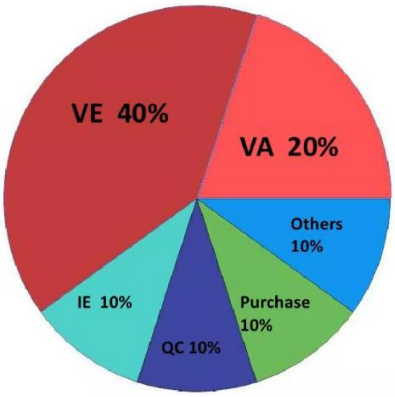


Fig. 3. Cost Cutting Approach

Teams have to be formed by the students. Four students, including a team leader, made up each squad. This course's prerequisites stated that the student should be familiar with industrial engineering.

The team leaders were then told to approach the professors with every member of their team, one at a time. In order to prevent this interaction with instructors in the classroom, teams must only approach when they have time. This makes students feel more open to learning when they are part of a four-student team as opposed to an all-student class. A sample cluster of student group sites and associated activities are shown in Table 1.

TABLE I
DETAIL OF STUDENTS GROUPS

| Group | Enrollment No | Activity Place |
|---|---|---|
| 1. | 21SOEME11002 | N.P. Food Zone & Cake Shop |
| | 21SOEME11001 | |
| | 21SOEME11003 | |
| | 21SOEME11603 | |
| 2. | 21SOEME11007 | Shree Ram Fast Food Center |
| | 21SOEME11605 | |
| | 21SOEME11004 | |
| | 21SOEME11607 | |
| 3. | 22SOEME13002 | Khodal Nasta House |
| | 22SOEME13601 | |
| | 21SOEME11604 | |
| | 21SOEME13007 | |
| 4. | 22SOEME13005 | Amul Parlor |
| | 22SOEME13006 | |
| | 22SOEME13008 | |
| | 22SOEME13009 | |

The students were asked to carry out this activity in either particular place i.e. for this topic we have chosen the different shops, some are available in the college campus and other shops were outside the campus of college. Each group has assigned the particular business place for survey only after discussion and brain storming activity with subject teacher.

Fig. 4. Photograph of Area and Customers Gathering

**Phase –II:** In next phase , students needs to approach the relative business owner and ask them to particular questions about their ongoing business with reference to that students will aware of various attributes of that business like : particular business fundamentals , how that owner had stated that business, how much time required to do that particular business, what are the difficulties currently they are facing, pros and cones of that business, monthly spending and revenue generated in currant scenario. By asking these particular questions students need to prepare data sheet and photographs if needed. The survey sheet was prepared by faculty and if needed team can add more questions if required. The sample of Amul parlor and Shree Ram Fast Food Center questionnaire hierarchy is mentioned in following table 2 and table 3. It may vary from activity to activity.

| INVESTMENT | COST |
|---|---|
| FRENCHAISEE | Rs.3,00,000 |
| EQUIPMENT | Rs.1,50,000 |
| RENOVATION | Rs.30,000 |
| OTHERS | Rs.1,00,000 |
| TOTAL INVESTMENT | Rs.5,80,000 |

| PROFIT PER MONTH | PROFIT |
|---|---|
| MILK PRODUCT | Rs.10,000 |
| ICE-CREAM PRODUCT | Rs.30,000 |
| OTHERS PRODUCT | Rs.20,000 |
| TOTAL PROFIT PER MONTH | Rs.60,000 |

| PROFIT PER YEAR | PROFIT |
|---|---|
| MILK PRODUCT | Rs.1,20,000 |
| ICE-CREAM PRODUCT | Rs.3,60,000 |
| OTHER PRODUCT | Rs.2,40,000 |
| TOTAL PROFIT PER YEAR | Rs.7,20,000 |

Fig. 5. Questionnaire Hierarchy

TABLE II
DETAILED QUESTIONNAIRE HIERARCHY

| Daily Expenses (Rs) | QTY | Total (Rs) |
|---|---|---|
| Potatoes | 30 kgs | 750 |
| Daal | 50 ltrs | 300 |
| Maida | 5kgs | 100 |
| Oil | 1.5kgs | 150 |
| Miscellaneous items | | 500 |
| LPG gas | 5kgs | 340 |
| Water | 3 jars | 60 |
| Transportation | | 100 |
| Other items | | 200 |
| Total | | **2500** |

| Revenue Generated | Rs (in INR) |
|---|---|
| Daily Expenses | 2500 |
| Daily income | 8050 |
| Profit (Daily) | **5550** |
| Profit (Monthly) | **111000** |
| Profit (Yearly) | **1110000** |

**Phase III:** This phase is dedicated to problem identification i.e. scope of improvement to gain more amount in existing business cycle or identification where they are spending unnecessary money. Here, student needs to observe this thing by themselves or they can discuss the same with subject faculty.

**Phase IV:** Here all the gathered data are discussed with subject faculty, team by team individually and linked them with VA and VE approach also applied the S.W.O.T. analysis so that ideal solution may be found together with strengths, weaknesses, opportunities, and threats analysis. During this step, students will decide whether or not the real-world solution is feasible. Following that, these solutions will be provided to business owners, who will be able to increase the profitability of their operations or decrease unneeded costs.


Fig. 6. Basics of S.W.O.T. Analysis

**Phase V:** In this phase all activities done by students will be integrated and evaluated in classroom and accordingly the rubrics marks will be given to the students. The classroom activity divided into various attributes as students has to prepare power point presentation along with case study and they have to present it as a classroom activity.

Tables 3 and 4 show the assessment criteria for this activity. The facts of students' ongoing internal evaluation are shown in table 3. And table 4 denotes sample details of continuous internal evaluation of four students respectively.

TABLE III
DETAIL RUBRIC FOR THE ASSESSMENT

| Detailed Activity | Marks | Details |
|---|---|---|
| Questionnaire Hierarchy Along with Activity | 10 | Preparation of data sheet and collection of information |
| PowerPoint Presentation | 15 | Detailed activity in brief |
| Case study | 10 | About the company history to current market trends |
| Attendance | 05 | Full attendance regards to 5 marks |
| Total | 40 (Reduced to 20 marks) | |

TABLE IV
DETAILS OF CONTINUOUS INTERNAL EVALUATION OF FOUR STUDENTS

| Enroll. No | QH (10) | PPT (15) | CS (10) | Attendance (05) | Total (40) |
|---|---|---|---|---|---|
| 21SOEME11001 | 08 | 12 | 07 | 05 | 32 |
| 21SOEME11605 | 07 | 10 | 06 | 05 | 28 |
| 21SOEME11604 | 08 | 09 | 04 | 05 | 26 |
| 21SOEME13007 | 06 | 11 | 08 | 05 | 30 |

Fig. 7. Students Undergoing Individual Activity

Student feedback is integral to the success of integrating out-of-classroom experiences for optimal skill development. It provides crucial insights into the effectiveness and relevance of experiential learning activities, enabling educators to align these experiences with desired learning outcomes. Constructive feedback helps refine the selection and design of such activities while also identifying and overcoming integration challenges, creating a seamless connection between theoretical knowledge and practical application. Moreover, feedback acknowledges the motivational impact of real-world experiences on skill enhancement, encouraging active student engagement. Student input, in essence, serves as a guiding force for educators, impacting the design and refining of out-of-classroom events as well as their function in supporting key skill development. The review was conducted through goggle documents and table 5 and table 6 shows the overall feedback in forms of numbers and graphical representation respectively.

TABLE V
STUDENT'S FEEDBACK ON VA&VE ACTIVITY

| Sr. No | Question asked | Poor | Average | Good | Very Good | Excellent |
|---|---|---|---|---|---|---|
| 1 | The problem was interesting? | 0 | 0 | 12 | 18 | 10 |
| 2 | The learning experience was fruitful? | 0 | 0 | 10 | 16 | 14 |
| 3 | The problem relevant to your subject? | 0 | 0 | 2 | 11 | 27 |
| 4 | Active Learning was better than conventional class? | 0 | 1 | 4 | 13 | 22 |
| 5 | Lectures are clear and organized with active learning. | 0 | 0 | 3 | 8 | 29 |
| 6 | The faculty gave adequate extra help when needed. | 0 | 4 | 15 | 10 | 11 |
| 7 | Is this active learning will help you to develop Entrepreneurship and Leadership skills? | 0 | 0 | 2 | 17 | 21 |
| 8 | Compare to regular classroom teaching wheatear it was confidence booster? | 0 | 0 | 6 | 9 | 25 |

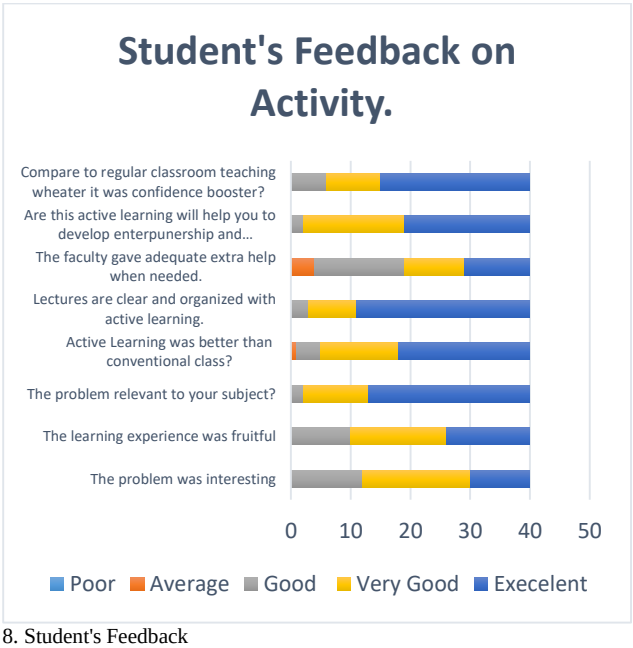


Fig. 8. Student's Feedback

## IV. Result and Discussion

The integration of real-world experiences into the industrial engineering curriculum yielded positive outcomes for enhancing practical learning and skill development. Incorporating hands-on experiences led to significant improvements in analyzing complex industrial processes a 15% increase in problem-solving skills compared to traditional classroom instruction. Student feedback highlighted increased engagement and a better connection between theory and real world practices. This technique has the potential to bridge the gap between theory and practice in industrial engineering education, generating flexible and informed graduates equipped for industry problems, and developing a business mindset. Furthermore, this type of educational tool provides as a platform for students to develop as technocrats. Both businesses and students gain from the outcome of this engagement. Students meet with business people and work on real-world problems as part of the process. With parallel path through this activity students come to know that even a small business setup at Rajkot region earns profit up to 60,000 Rs. [Ref.Table (3)] and franchise business can 1,11,000 Rs. [Ref.Table (4)] per month. With a focus on the curriculum topic 'Value Analysis and Value Engineering,' students have effectively proposed practical solutions to business owners, resulting in tangible recommendations aimed at enhancing profitability. This application of theoretical knowledge demonstrates the practical relevance and real-world impact of incorporating value analysis and engineering principles into business strategies."

## V. Conclusion

This investigation reveals greater engagement of both teachers and students in the teaching-learning process due to the addition of "outside the classroom" activities in any technical course. This activity has a longer lasting impact than a classroom lecture and increases creativity, inventiveness, and skill. This technique helps the student overcome behavior challenges while also feeling motivated and interested in class. [Ref.Fig.6]. Attendance is also boosted as a result. In conclusion, the methodology explored in this research sparks an entrepreneurial mindset, setting it apart from conventional job-seeking approaches. By encouraging students to explore business from early in their academic journey, it establishes a foundation for potential entrepreneurial careers.

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