eISSN: 3048-9601

Journal of Effective Teaching and Learning Practices, Volume-1, Issue - 1, August 2024

Unveiling Effectiveness: A Comparative Exploration of Task-Based Learning and Traditional Lecture Delivery in Teaching Engineering Drawing

[1]Anand M Gujarati*, anand.gujarati@rku.ac.in
[2]Maharshi Bhatt, maharshi.bhatt@rku.ac.in
[3]Hardik Joshi, Hardik.joshi1156@rku.ac.in
Department of Mechanical Engineering, School of Engineering, RK University
Kasturbadham, Bhavnagar – Rajkot Highway, Near Tramba, Rajkot-360020

Abstract

Engineering drawing, conventionally referred to as engineering visuals, has served as the primary communication medium for engineers. In the realm of mechanical engineering, this mode of communication is heightened to the extent that it attains the status of a first language within its domain. Within engineering applications, any shortcomings in comprehending these drawings can result in significant expenses. The occurrence of errors in the interpretation of engineering drawings has consistently posed concerns within industries employing engineering professionals. Therefore, an urgent emphasis on enhancing the teaching-learning process within this drafting course is imperative. This article reports an attempt to elevate the graphical communication skills in a class of 2nd semester engineering students with the comparison of previous year data. The findings indicate that the instructional method has the capacity to improve engineering drawing skills, and this approach holds promise for raising proficiency within the span of a single semester of study. During the semester felicitators attempt one practice.

***Keywords*— Graphical communication skills, engineering drawing, out of classroom approach.**

Introduction

The demands of individuals have risen, driven by the desire to enhance the quality of our present-day lifestyle and to attain a sense of simplicity in its presentation.

There is no doubt in the contribution of engineering and its applications which not just supports our today's living but also transform our lives. Prior to the evolution of various systems of spoken and written languages, drawing was the only reliable means of communication between the people (N. Sidheswar et al., 2012).

The importance of drawing and its communication capabilities has raised many eyebrows. Even at the Secondary School level, the Malaysian School System has successfully included Technical

or Engineering Drawing in their integrated curriculum since 1994 (Lilia et al., 2012, and Kementerian, 2004).

This form of early introduction to technical courses underscores the significance of equipping students with the capability to comprehend and interpret the language of Engineering Drawing.

Machine Drawing serves as a crucial instrument for individuals aspiring to engage in industrial work or pursue a career as a professional mechanical engineer. Producing precise drawings holds equal significance alongside the skill to accurately interpret them. The most effective approach to learning how to interpret drawings is by mastering the process of creating them. The Machine Drawing laboratory course offers a means to impart drawing skills and endeavour to narrow the gap in skill proficiency.

This method aims to enhance students' understanding of concepts and topics while providing continuous assessment throughout the semester. Here's a breakdown of the process:

1. Assessment Methodology: The primary objective of this assessment method is to promote a clearer understanding of concepts among students and provide them with a strong grasp of the subject matter.
2. Continuous Evaluation: Instead of relying solely on exams or quizzes, this method involves ongoing assessment throughout the semester. This allows students to demonstrate their understanding of concepts as they progress through the course.
3. Problem-Based Learning: Faculty members provide problems or tasks to students related to the subject. These problems likely require students to apply theoretical knowledge to practical scenarios, promoting a deeper understanding of the concepts.
4. Laboratory Work: Students work on the assigned problems during laboratory sessions. This hands-on experience helps them apply their knowledge in real-world scenarios, reinforcing their understanding of the subject matter.
5. Sketchbook: Students document their work and solutions to the problems in a sketchbook. This serves as a record of their progress and understanding over time.
6. Signature and Dates: Upon completing the problems in the sketchbook, students take a starting date signature, possibly from the instructor, on a larger drawing sheet (A2 size). This step likely indicates the beginning of their work on the selected problem.
7. Sheet Preparation: Students work on a separate sheet to create a well-structured and organized presentation of their solution to the selected problem. This sheet showcases their problem-solving approach and the application of concepts.
8. Faculty Evaluation: Once the sheet is completed, the faculty evaluates the work. This evaluation could involve checking for correctness, clarity, and depth of understanding. Corrections may be suggested if necessary.
9. Completion Signature: If the work meets the standards set by the faculty, they provide a completion date, signature, and possibly marks as an indication of successful completion and understanding.
10. Attendance Requirement: Students are required to attend the lab sessions. If a student is absent from a lab session, they might receive a zero mark for that assessment.
11. Individual Preparation: Each student prepares their drawing sheets and solutions individually, promoting independent learning and problem-solving skills.

This assessment method appears to focus on the practical application of concepts, continuous learning, and individual effort. It allows students to engage with the subject matter actively and receive feedback on their progress throughout the semester. However, it's important to ensure that

the evaluation criteria are clear and consistent to fairly assess students' work. Traditionally, students acquired drawing skills from various sources, including designated reference textbooks, structured course outlines, and a process involving the transformation of printed textbook content onto drawing sheets to varying degrees.

Observations and Discussions

The method of assessment involves students completing two drawing sheets during laboratory hours based on problems provided by the faculty. Here's a breakdown of the process and the timeline for assessment:

1. Assessment Structure: Students are required to complete two drawing sheets during laboratory hours. Each drawing sheet is associated with a problem given by the faculty.
2. Timeline of Assessment: After the completion of the chapter, assignments or drawing sheets worth 20 marks are assigned to students. Students must complete these sheets exclusively during laboratory hours.
3. Scoring and Evaluation: The total assessment score for both drawing sheets is 40 marks. The cumulative score of 40 marks will be converted to a final assessment score of 20 marks. This conversion involve scaling down the total marks to fit the grading scale or academic requirements.

This approach appears to promote regular engagement with course materials, as students are given assignments after completing each chapter. The focus on completing drawing sheets during lab hours ensures that students work on the problems within a controlled environment and helps in evaluating their understanding of concepts and practical application.

By assigning a higher total assessment score (40 marks) and then converting it to a smaller score (20 marks), you might be prioritizing a finer level of distinction in student performance. This conversion could take into account factors such as the difficulty level of the problems or the intended distribution of marks.

It's important to have clear guidelines and criteria for evaluating the drawing sheets to ensure fairness and consistency. Providing constructive feedback to students on their completed sheets can help them understand their strengths and areas for improvement. Additionally, this approach encourages students to stay up-to-date with the course content and actively engage in the learning process throughout the semester.

Result and Discussion

Task based assessment implemented in 2nd Semester B.Tech Civil, Electrical and Mechanical students for different academic year AY2023 and AY2022 for Engineering Drawing subject.

TABLE I
RESULT ANALYSIS OF AY2022-23 & AY2021-22 YEAR STUDENTS

Grade	Levels	2023 Year	2022 Year	% Student 2023 Year	% Student 2022 Year
A+	Outstanding	**2**	**2**	**2.25**	**3.70**
A	Excellent	**9**	**7**	**10.11**	**12.96**
B+	Very Good	**23**	**7**	**25.84**	**12.96**
B	Good	**18**	**14**	**20.22**	**25.93**
C+	Above average	14	7	15.73	12.96
C	Average	8	8	8.99	14.81
D	Poor	5	6	5.62	11.11
F	Failed	10	3	11.24	5.56

Here the analysis of traditional and task based assessment approach. The average score of the 2023 year is 33.02 or 66.04% in and for 2022 year is 31.79 or 63.59%.

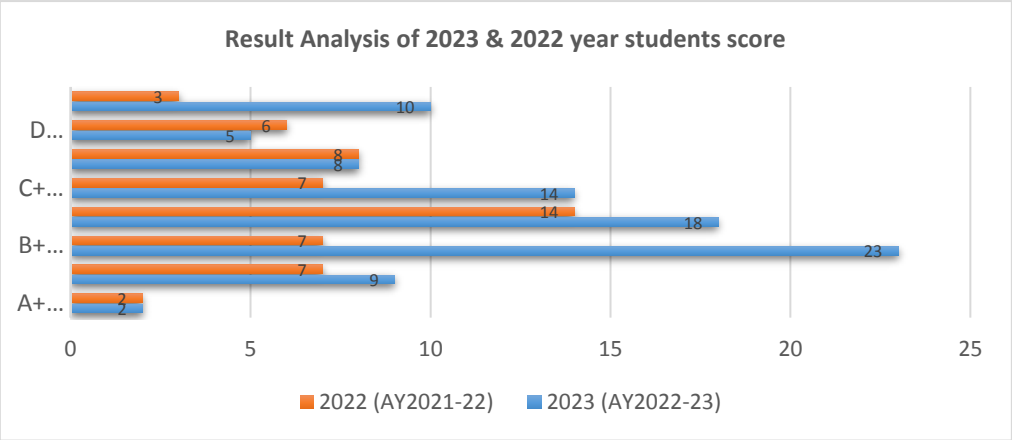


Fig. 1. Result Analysis of 2023 & 2022 year students score

The overall average difference quite less if we compared both year. The factor affecting to this result was absent student who are not able to attend the exam which also include into this count. In 2023 the 6 students was not able to appeared for the exam because of the less attendance (<50%) so if we didn't consider this above 6 students which approximately 6.88% of the class. This deviation value will increase by 10% of the 2023 results.

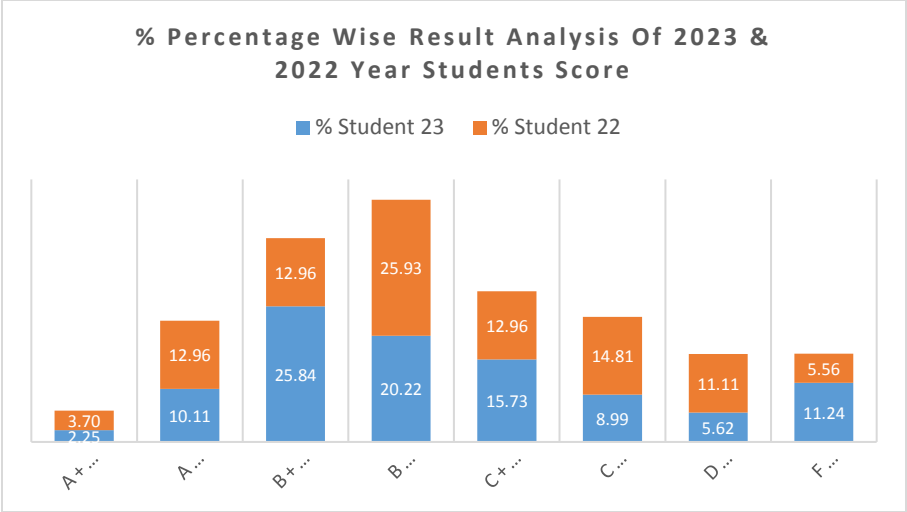


Fig. 2 Percentage wise Result Analysis Of 2023 & 2022 Year Students Score in 8 levels

TABLE II
ANOVA IN EXCEL

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	76.5625	1	76.5625	2.525773	0.134321	4.60011
Within Groups	424.375	14	30.3125			
Total	500.9375	15				
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2023 (AY2022-23)	8	89	11.125	47.55357		
2022 (AY2021-22)	8	54	6.75	13.07143		

Above result and analysis of done by ANOVA method in excel which gives the comparison of the two groups (2023 & 2022) with 8 different levels. The p-values was 0.134 which accepted.

TABLE 3
T-TEST – PAIRED TWO SAMPLE FOR MEANS TEST IN EXCEL

	2023 Year	*2022 Year*
Mean	11.125	6.75
Variance	47.55357143	13.07142857
Observations	8	8
Pearson Correlation	0.580154807	
Hypothesized Mean Difference	0	
df	7	
t Stat	2.19795039	
P(T<=t) one-tail	0.031962061	
t Critical one-tail	1.894578605	
P(T<=t) two-tail	0.063924123	
t Critical two-tail	2.364624252	

Above result and analysis of done by T-Test – Paired two sample for means test in excel which compared the data for Year 2023 and 2022. Into this test the mean value of 2023 year was 11.125 compared to 2022 year it was 6.75 only, which indicate 39.32% growth.

TABLE 4
DESCRIPTIVE STATISTICS

2023 (AY2022-23)		**2022 (AY2021-22)**	
Mean	11.125	**Mean**	6.75
Standard Error	2.438072277	**Standard Error**	1.278252155
Median	9.5	**Median**	7
Mode	#N/A	**Mode**	7
Standard Deviation	6.895909761	**Standard Deviation**	3.615443067
Sample Variance	47.55357143	**Sample Variance**	13.07142857
Kurtosis	-0.253599394	**Kurtosis**	2.067831228
Skewness	0.576296603	Skewness	0.897788066
Range	21	Range	12
Minimum	2	Minimum	2
Maximum	23	Maximum	14
Sum	89	Sum	54

TABLE 5
COMPARISON MEAN AND STANDARD DEVIATION OF DATA IN GROUP OF GRADE

Levels	**Mean**		**Standard Deviation**	
	2023	2022	2023	2022
Outstanding to Good (A+ to B)	14.61	13.89	10.50	9.13
Above Avg to Failed (C+ to F)	12.39	09.11	8.24	3.32

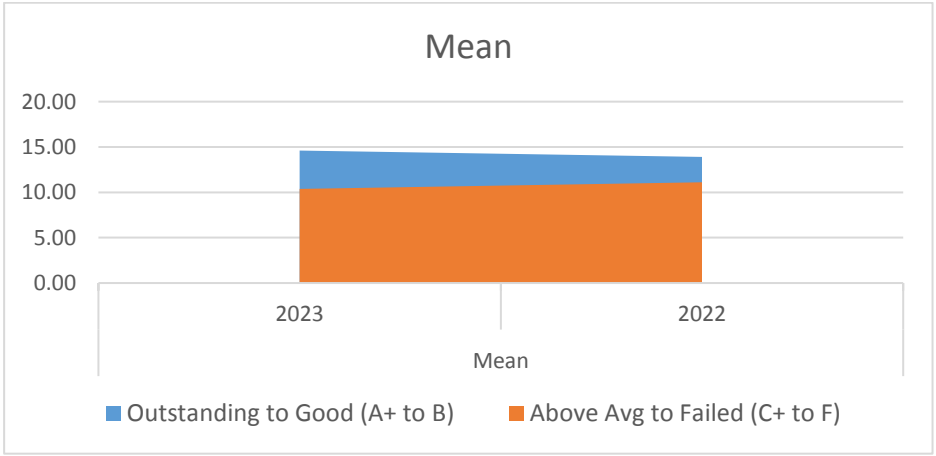


Fig. 3 Comparison mean and standard deviation of data in Group of grade

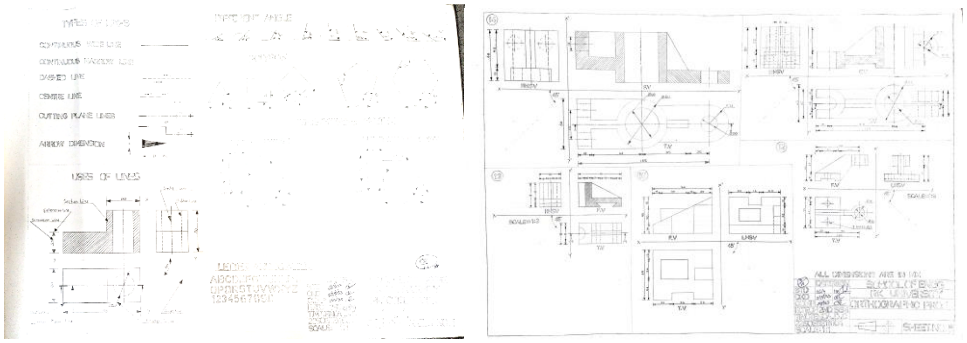
From the above table which shows Comparison mean and standard deviation of data in Group of grade for different year. The 2 group formed where Outstanding, Excellent, Very good and good (A+ to B) four variable include in one group on other side the Above Average, Average, Poor and failed (C+ to F) four variable were consider in group 2. In year 2023 the 89 student's papered for the examination and out of the 57 student got more than 31 marks which more than average (31 Marks in 2022 year) marks in 2022 year for the same course.

CONCLUSION

In our investigation, it was noted that the average overall assessment score among the Problem-Based Learning (PBL) cohort surpasses that of the traditional group. The PBL groups also exhibit elevated mean values of 11.125, coupled with a standard deviation of 6.89. The progress in results presents comparative data that has risen from 31% to 33%. The incorporation of instructional exercises and evaluations founded on the problem-based learning methodology holds substantial promise for notably augmenting the intuitive grasp of the subject matter.

APPENDIX

Glimpse of PBL "students attending the classroom activity in which student were preparing the sheet into the class according to the task given by the felicitator



Sample drawing of the submited sheet by the students (Note: the quality may be degraded because of the camera.)

REFERENCES

Amit Lathigara, Lipika Gupta, Binu K. G., Veena Kumar, "Sustaining Motivation of Engineering Students in India by Managing their Academic & Affective Needs" Year: 2020, Volume: 34, Issue: Special Issue, Pages: 507-517

Aparajita Biswal, Hemalkumar Rajyaguru, Vimalkumar N. Patel, Vaibhav Gandhi, Sidhharthsinh Jadeja, "A framework proposal to set the 'Ground Rule Book' effectively and enhance mutual understanding in the context of engineering education for India" Year: 2023, Volume: 36, Issue: Special Issue 2, Pages: 229-235.

Bhavdip Bharadia, Kapil Pandya , Kishan Majethia, "Improvement of Student learning outcomes by implementation of Model Making Approach for Student Evaluation", Year: 2018, Volume: 31, Issue: 3, Pages: 187-191

Dr. Amit Lathigara, Dr. Paresh Tanna, Dr. Nirav Bhatt "Activity Based Programming Learning", Journal of Engineering Education Transformations, Volume 34, January 2021, Special issue, eISSN 2394-1707

Dr. Chetankumar Patel, Dipesh M. Chauhan "Motivation Based Engineering Education – A case study at RK University", Journal for Engineering Education Transformations (JEET), Year: 2017-18

Dr. Paresh Tanna,, Dr. Amit Lathigara, Dr. Nirav Bhatt, "Task Based Assessment: An Innovative Methodology for Studying and Assessing High Level Programming-Oriented Courses" Year:2023

Dr. Paresh Tanna,, Dr. Amit Lathigara, Dr. Nirav Bhatt , "Implementation of Problem Based Learning to Solve Real Life Problems", Year: 2022, Volume: 35, Issue: Special Issue 1, Pages: 103-111

Dr. Paresh Tanna , Dr. Nirav Bhatt, Sweta Patel "An Innovative Approach for Learning and Evaluating Programming-Oriented Courses" Journal of Engineering Education Transformations , Volume 33 , No. 3, January 2020, ISSN 2349-2473, eISSN 2394-1707

Kamlesh M Patel, Chetankumar M Patel, "Problem Based Learning: An Experimental Study of Problem Based Learning with Problem Solving Assessment" Professional Development of Instructors in Higher Education and Training Institutions, WISDOM PUBLICATIONS, DELHI, First Edition 2019, ISBN: 978-93-85504-98-3.

Mantri, S. Dutt, J.P. Gupta, and M. Chitkara, "Design and Evaluation of a PBL based Course in Analog Electronics," IEEE Transactions on Education, vol. 51, no. 4, pp. 432–438, Nov 2008.

Mihir Velani , Mayuresh Dave, "Multi-Facet Evaluation of Under-Graduate Engineering Students by Taxonomy based MCQTest", Journal for Engineering Education Transformations (JEET), Year: 2017-18

Patel Kamlesh, Patel Chetankumar,"AN EXPERIMENTAL STUDY ON CANVAS LMS PLATFORM WITH BLENDED LEARNING APPROACH IN COMPUTER ENGINEERING & INFORMATION TECHNOLOGY: AN EVIDENCE OF RK UNIVERSITY" Journal of Entrepreneurship and Business Resilience, Year -2, Vol 2, No 2. pp. 14-26

Vimalkumar N Patel , Vaibhav Gandhi , Kajal Thummar , Rahul Parmar , Jay Vekariya, Jay Kapadiya , Virang H Oza , Siddharthsinh Jadeja, "A case study of students' skill development through the project carried out for sustainable development of rural area for transformation to urbanization", Journal of Engineering Education Transformations, Year: 2023, Volume: 36, Issue: Special Issue 2, Pages: 435-440