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EFFECT OF STRATEGIC TEACHING TO ENHANCE STUDENT LEARNING ABILITIES: APPLIED ECONOMICS AND MANAGEMENT COURSE

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Abstract
Rapid technological advancements have reshaped the teaching profession, shifting the focus from traditional lecture-based methods to student-centered strategies that actively engage learners and enhance their academic and professional skills, particularly in technical disciplines. This study evaluates the impact of strategic teaching methods on student learning outcomes in real classroom settings, hypothesizing that interactive instructional techniques can improve critical thinking, confidence, and problem-solving abilities in undergraduate engineering students. Conducted in Applied Economics and Management course–a 3+0 credit-hour subject in the undergraduate Electrical Engineering program following the Higher Education Commission of Pakistan's curriculum guidelines–the research involved 120 students across four sections, including three from Electronics Engineering and one from Telecommunications Technology. The teaching methodology combined structured lecture plans with clearly defined learning outcomes, while learning was assessed through teacher-supervised group discussions, quizzes, and assignments designed to foster mindful engagement and transferable skills. Findings indicate that student-centered strategies significantly enhance learning by promoting active participation, critical thinking, and the ability to connect theory with real-world examples, with teacher supervision proving essential for meaningful interaction and successful task completion. The study concludes that interactive, teacher-guided approaches are vital for technical excellence, improving academic performance while equipping students with the professional skills required in engineering practice.

INTRODUCTION

Professional competency of teachers is highly dependent on, and directly proportional to, their familiarity and fluency with evolving technology and new teaching methodologies. It is their utmost duty to keep themselves updated about all the relevant researches and trends. The continuous learning of teachers and their exposure to the latest learning tools are essential for the educational growth of both students and teachers. The rapid evolution of technology, when applied in education, enhances

teachers' abilities to conduct interactive sessions with students, thereby establishing high-quality learning environments. Effective learning and teaching can be achieved through the proper design and implementation of instructional system [1]. Recent studies highlight the importance of structured planning and the implementation of cognitive levels in class planning. This approach has proven to be effective in producing well-rounded, high-quality students equipped with the necessary skills to face real-world challenges [2]. The planning and assessment to evaluate student learning is a science; proper implementation across the curriculum produces meticulous results.

In the realm of education, engineering education holds a unique role in developing generations by educating them from foundational engineering skills to the advanced nature of courses in science and technology. Engineering, a branch of science focused on applying theories, laws, and concepts to real-world scenarios, encompasses various subfields, with new ones continually emerging. Employing and analyzing engineering design requires both skills and experience. Prior to 2000s, the curriculum for a Bachelor of Engineering did not extensively include humanities courses. However, with technological advancements and increased market competition, current curricula are designed to cover all aspects of student training. In a developing country like Pakistan, where the curriculum had not been revised before 2000 more frequently, the introduction of the Washington Accord has brought significant changes. The importance of introducing and implementing proper class planning, setting course objectives, formulating assessments, and finalizing results with appropriate thresholds and key performance indicators (KPIs) has now become an integral part of the curriculum.

This paper integrates Bloom's Taxonomy into the planning of the Engineering Economics and Management course. It comprises three main sections. The first section, the Introduction, outlines the purpose and objectives of the paper. The second section is the Literature Review, which is further divided into three parts. The first part explains the importance and significance of the Engineering Economics and Management course for undergraduate engineering students. The second part describes the instructional system and explains its processes. The third part discusses the theoretical background of the delivery methods used in the study. The final section of the paper explains the methodology of instructional planning for the course and concludes with the results.

Literature Review

It is crucial for engineering students to have a comprehensive understanding of not only the engineering-related courses but also of the allied courses such as economics and management, mathematics, communication skills, ethics, critical thinking etc. The knowledge of allied subjects boost their confidence as they progress in the practical professions or jobs to fulfill requirements of the employers [3]. According to a study, a macroeconomist is shown to be more of an engineer or scientist rather than just an economist [4]. Engineering students are often reluctant to study these courses, so it is important to emphasize their significance from the beginning of their semester classes. The planning of the first week's classes is crucial to capture students' attention and spark their interest. The course content designed should comprise of scope of topics, project timelines, time constraints to the submission of class activities, quality of output in terms of assessment tools, and risk management skills. Thus, the course prepared should enable the students to tackle real-world challenges. Additionally, the personal traits of engineering students significantly impact their potential for self-employment and accomplishment of their entrepreneurial endeavors [5]. Therefore, the success of a teacher to produce an engineer bearing all the above stated attributes depends upon the instruction style and quality of the lesson imparted to the students. Instruction style is a crucial aspect of teaching strategy, varying from person to person, and influenced significantly by culture and religion. Research suggests that instruction style reflects one's personality and nature [6]. Each teacher has a unique instruction style, which can be influenced by the size of class, the education level of the students and the nature of the course.

Effective teaching methodology depends on various factors, and teaching strategies are essential in understanding students' learning capabilities. Knowing students' learning patterns before lesson

planning is important, as both learning and teaching styles need to be considered in detail [7]. The best approach is one that allows the maximum number of students to effectively understand the delivered knowledge. Teaching strategies also vary by specialization; for instance, the delivery methods and requirements for engineering instructors differ from those in medical sciences, and humanities differ from social sciences. However, values should always be prioritized regardless of the teaching scheme followed. The following discussion addresses various aspects related to specific teaching styles, with a focus on technology students as the targeted audience.

The traditional or classical method of conveying knowledge in the classroom is teacher-centered, making it difficult to assess student learning levels and performance. Numerous factors must be considered when conducting a lecture-based lesson [8]. Time management, voice quality, and discipline are paramount during the lecture planning and delivery stage. The significance of discipline in large strength of students in a class is well-documented and effectively presented in literature [9]. Carbone [9] described various behavioral issues encountered by faculty members and provided appropriate remedies and strategies that involve shifting the lecture approach from instructor-centered to partially or fully student-centered classes. Research indicates that student learning capacity increases during interactive sessions [10,11].The multimedia principle suggests that people learn more effectively from pictures and words combined rather than from words alone [12]. Integrating verbal lecture delivery with multimedia is a potent teaching methodology, though it has its pros and cons. The benefits and drawbacks of this integration are discussed, along with problems and suggestions for improvement in the context of an engineering course [13]. Audio-visual presentations have consistently proven to be effective tools for teaching and learning. Highlighted points are easily displayed on slides, allowing students to grasp the information more readily. The topics of a course may include graphical support or include listings (types, steps, etc.), which will allow students to get engaged in graphics which can capture students' attention more significantly to get the understanding on a particular topic. There are numerous ways to incorporate multimedia into lectures, with many detailed techniques suggested by the researcher [14]. Therefore the multimedia approach provides valuable support for instructors in lesson delivery. Another aspect of large class and lecture delivery management includes the divide and rule approach. To manage a task assigned to a large class effectively, one can divide the class into groups and assign tasks to be completed within a specified time frame. The size of each group can vary depending on the overall size of the class. Students also takes part more actively in a group. Group performance relies on the cooperation of its members and impacts both individuals and the group as a whole. Heron [15] describes models that emphasize the importance of group work and the role of each participant. Groups of two or three are particularly effective, as they are easier to manage in terms of time and discipline. Assessments are required to keep track of students' learning. Performance of student is measured in many ways amongst which one is described in this article. Acquiring students' feedback by teachers is an essential measure possible through continuous assessment [16, 17]. Formative and summative assessments are main two types employed in judging learning process. Summative assessments having high share of points/marks and grades, is conducted at the end of greater portion/end of course [18]. In science based education combination of both assessments methodologies are considered effective [19]. In one of the recent research done for medical students, summative assessment is broken to formative assessment. 82% teachers favored the formative assessment method to identify students' weakness where as 69% teachers support this method for regulated students learning process [20]. Following is the formative assessment approach adopted in this article. Research shows that it is highly effective evaluation method for science based education. The assessments are planned in such a manner as to provide students a sense of real world problem. PBL focuses towards equipping students' attitude with problem solving skills that will provide them with lifelong learning experiences effective for the society [21]. Designing a PBL requires high expertise because it is required to develop scenarios related to real world. Integrating academia with practical application techniques provide students an

opportunity to excel in studies as well in career [22]. Analytical thinking is yet another successful approach of assessment in which students have a scope of exploring their capabilities and knowledge up to their highest level. One of the recent study proved that the process data of assessment is helpful in designing different and valuable assessment. It is also recommended that mixed assessments techniques are favorable for students performance evaluation [23, 24]. Descriptive approach is helpful in which students understanding and knowledge is required to be measured by the teachers through classwork assessment [25]. Confidence is an important criterion needed to be groomed and assessed for students. Presentations whether in groups or individual or of any type; poster, oral board, video [26] etc. are effective to boost up students analytical and intellectual skills [27]. Group assessment allows their leadership, cooperation, and planning and management skills to be assessed by peers [28] as well as evaluated by the teacher.

Methodology

This study focuses on the teaching strategies used in the Engineering Economics and Management course, which is part of the undergraduate electrical engineering program. The course is 3 credit hours (3+0), and the curriculum follows the guidelines set by the Higher Education Commission of Pakistan. A total of 120 students are enrolled, spread across four sections—three sections from electronics engineering and one from telecommunications engineering. The course is structured into 48 lectures, conducted over three sessions per week. The evaluation method includes class quizzes, home assignments, and examination papers, each with a clear marks distribution. The 3-credit-hour course has a total of 100 marks, and the assessment breakdown is detailed in Table I.

TABLE I: MARKS DISTRIBUTION

S.No.	Assessment Types	Number	Marks- Total
1	Quiz	5	2 each-10
2	Assignment	2	5 each-10
3	Mid term	1	30
4	Final	1	50

This paper outlines the overall methodology implemented throughout the semester for the respective course. The first and most important step is to effectively plan the course, including its assessments, to ensure a smoother evaluation process. The methodology involves organizing the course structure and assessments at the start of each semester. The key steps are explained as under and also shown in Figure 1:

1. **Define Course Learning Objective**

i) Create SMART learning outcomes for the course.
ii) Align the objectives with students required acquired skills and knowledge and course requirement.

2. **Planning Course Content**

i) Develop or structure course outline for 48 lectures.
ii) Integration of different teaching strategies to engage students and create interest of students.
iii) Adding class assessment strategically whenever a section of course content is completed.
iv) Integrating technology in teaching and assessment.

3. **Design Assessments**

i) Planning assessment that aligns with course learning objectives.

ii) Different types of assessments are added (quizzes, exams, projects, presentations) to check the student's learning process.

4. Evaluate Student Performance

i) Implementation of assessments to keep on student performance.

ii) Record the data and analyze the trend in the progress.

iii) On the basis of the analysis, devise strategy to improve the student's learning skills.

iv) Promote self and peer study work to promote the learning process.

5. Review and Improve

Based on evaluation review steps from 1- 4 for continual progress and development. Changes to be made in accordance with the student response to promote his skills and progress.

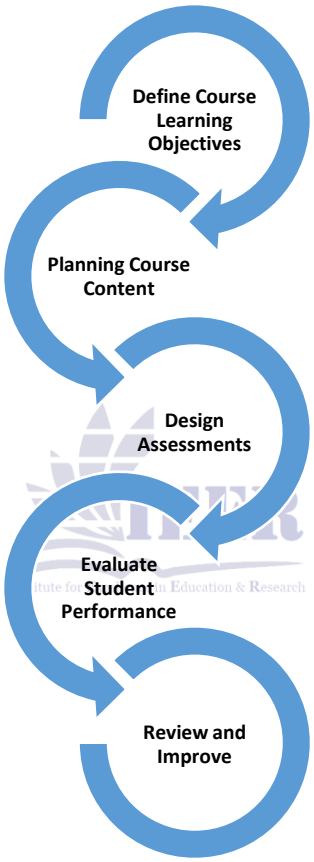

Fig I: Steps Of The Methodologies Adopted In This Paper.

The summary of delivery method and assessment tool employed with topic is mentioned in the following Table II:

TABLE II: SUMMARY OF ASSESSMENTS AND DELIVERY TOOL

Assessment Type.	Topic	Delivery Method	Description
Quiz# 1	10 Principles of Economics	Interactive Session	Discussion Based, Individual
Quiz# 2	Supply, Demand and Market Equilibrium	Book Assisted Lecture, interactive session.	Descriptive and analytical approach. Individual
Quiz# 3	Assets, Income and	Slides, Book	Numerical, Balance sheet

	Equity	Assisted Lecture	
Quiz# 4 Quiz# 5	Net Present Value, Pay Back Period, Present and Future Worth Analysis	Slides and book reading	Teacher centered Class / Numerical based
Assignment # 1	Supply, Demand and Market Equilibrium, Factors of Production	Book Assisted Lecture, interactive session.	Home based survey assignment, Group work
Assignment # 2	SWOT, SMART Objectives and Management Functions	Case based discussion Interactive Session	Case Study based home based assignment, Group work

A) Instructions Summary of Assessments

1st Quiz- In class, principles are explained using real-life examples. As part of the assessment, students are asked to provide their own examples. For the first four principles, they are required to share scenarios from their personal experiences. The next three principles should be illustrated with examples from the market or social perspectives. The final three principles focus on government-level applications and decisions aimed at promoting the country's economic stability.

2nd Quiz- Is consist of one question two parts. First part deals with the theory related to topics and second part deals with the reasoning about the graphical layout of supply, demand and market equilibrium graph.

*3rd Quiz-*Account transactions are given and students are asked to develop sheets of assets, income and equity.

4th and 5th Quiz- are combined in order to cover lengthier topic and longer time limit. Students are given numerical to find out the net present value of two project. In next question net present value and payback period for a project.

1st Assignment

This is a group based home assignment in which students are asked to find supply demand process of any company or interview any company. The guidelines for the students provided are as follows:

Conduct and submit survey based on theory of supply-demand: (Any one) A service, Product or Comparison between similar products/ service. Illustrate and explain the concepts:

1. Law of demand.
2. Law of supply.
3. Market Equilibrium.
4. Discuss the changes in market equilibrium due to different variables/determinants.
5. Incorporate your analysis into "Circular Flow Diagram" as discussed in class.

2nd Assignment

It consists of three questions:

1. Write at least 3 SMART learning outcomes related to your Final Year Project.
2. Do the SWOT Analysis of your institute Job Fair.
3. Extract and categorize the management functions from the given case study.

As both the assignments are group based on submission individual viva was taken in order to assess student's contribution properly. The midterm and final term examination is the combination of theory, numerical and case study analysis to assess student knowledge and skills in best way. After correction the marks are recorded manually as well as on (Learning Management Software) LMS software. The results of the students are discussed in detail in next section.

Results And Discussions

The assessment results for a total of 53 students are presented in Table III. Column 1 lists the serial numbers representing individual students, while Columns 2 to 6 show marks out of 2 for specific quizzes. Column 7 provides the total marks each student obtained in the quiz out of 10. Columns 8 and 10 display the assignment marks out of 5, and the final column represents the total marks scored by each student out of 10. These assessment marks contribute to a total of 20 marks, which are part of

the overall 100 course work marks. The 20 marks, referred to as "sessional," reflect the students' continuous performance throughout the semester.

Two quizzes and one assignment were administered before the midterm exam, while three quizzes and one assignment were conducted afterward. The viva was conducted individually as part of the assignment to evaluate each student's performance, contribution, and understanding. For example, although the bifurcation of the assessment is not shown, out of the 5 marks, 3 marks were allotted to the submitted report, while 2 marks were for the oral assessment. This approach helps students increase their confidence and develop greater interest in the subject.

The last three rows of the table provide key statistical analysis of the data. The first row represents the average marks scored by all students for each quiz and the total quiz marks, with the same calculation applied to the assignments. The results show that the class average is close to the maximum possible marks, indicating strong overall performance on the assessed topics.

The overall performance of the students appears to be strong, with average scores across most assessments being high. The average total quiz score is 8.54 out of 10, and the average total assignment score is 8.415 out of 10. This suggests that the strategic teaching methods and assessments were largely successful in helping students grasp the course material.

Quizzes 1, 3, 4, and 5 have high average scores (1.684, 1.764, 1.762, and 1.8 out of 2, respectively) and low standard deviations. This indicates that students performed consistently well on these topics, and most of them understood the concepts taught. Quiz 2 on "Supply, Demand and Market Equilibrium" has the lowest average score (1.529 out of 2) and the highest standard deviation (0.570377) among all quizzes. The higher standard deviation indicates a wider range of scores, with some students performing very well and others struggling. This suggests that the topic was more challenging for the students and that a significant portion of the class may have had difficulty with the reasoning and graphical representation required by the quiz. This aligns with the paper's original finding. The low standard deviations for the other quizzes suggest that the class, as a whole, had a consistent level of understanding for those topics.

Assignment #1 and Assignment #2 have high average scores (4.2453 and 4.1698 out of 5) and relatively low standard deviations (0.852726 and 1.122083). The low minimum scores (2 and 1.5) compared to the high averages suggest that a few students either submitted late or copied their work, as noted in the paper's original discussion.

The standard deviations for the assignments are higher than those for most of the quizzes. This might be due to the nature of group work, where contributions can vary, or due to factors like late submission and plagiarism, which result in a wider spread of scores.

The average and median scores are generally very close for most assessments. For example, the average total quiz score is 8.54, and the median is 8.8. This correlation indicates that the data distribution is fairly symmetrical and not heavily skewed by a few extremely high or low scores, proving that the majority of students performed at or near the class average. The added standard deviation provides a crucial measure of consistency. It highlights that while the class average for Quiz 2 was decent, the understanding of that topic was more varied among the students compared to the other quizzes. This confirms the original conclusion that Quiz 2's topic required more attention and reinforcement from the teacher.

TABLE III: DETAILS OF STATISTICAL ANALYSIS

S.No.	Quiz1	Quiz2	Quiz3	Quiz4	Quiz 5	Total	Assn # 1	Assn # 2	Total
Out of	2	2	2	2	2	10	5	5	10
1	1.7	0.4	2	2	2	8.1	3	4	7
2	1	2	1	1	1.5	6.5	5	5	10
3	2	1.5	1.5	1.5	1.5	8	5	4	9
4	1.5	1.5	2	2	2	9	5	5	10

5	2	2	2	2	2	10	3	4	7
6	1.5	2	2	2	2	9.5	5	5	10
7	0.8	1.8	2	2	2	8.6	5	5	10
8	1.6	1.2	2	2	2	8.8	3	4	7
9	2	2	2	2	2	10	3	5	8
10	0.4	0.4	1.25	2	2	6.05	5	5	10
11	2	2	1.75	2	2	9.75	4	3	7
12	2	2	2	2	2	10	5	4	9
13	2	2	2	2	2	10	3	3	6
14	2	0.6	1.25	2	2	7.85	5	5	10
15	1	1	2	2	2	8	5	4	9
16	1.4	1.2	1	2	2	7.6	4	3	7
17	1.25	1.5	1.25	2	2	8	3	3	6
18	1.5	2	1.25	2	2	8.75	4	4	8
19	1.8	1.9	1.75	2	2	9.45	5	5	10
20	2	2	2	2	2	10	3	5	8
21	2	2	2	2	2	10	3	5	8
22	2	2	2	2	2	10	4	5	9
23	0.6	0.6	2	2	2	7.2	5	5	10
24	1.8	2	2	2	2	9.8	5	5	10
25	1.3	1.25	1.25	1.5	1.5	6.8	5	5	10
26	2	2	2	2	2	10	4	4	8
27	1.8	1.8	1.25	2	2	8.85	4	4	8
28	2	2	2	2	2	10	4	4	8
29	1.4	0.6	1.25	1.5	1.5	6.25	5	5	10
30	1.2	1.2	1.5	2	2	7.9	4	5	9
31	2	2	2	2	2	10	5	5	10
32	1.9	2	2	2	2	9.9	4	5	9
33	2	2	2	2	2	10	4	4	8
34	2	2	2	2	2	10	5	4	9
35	0.7	0.3	2	2	2	7	5	5	10
36	1.8	2	2	0.5	1	7.3	4	1.5	5.5
37	2	2	2	2	2	10	5	5	10
38	2	1.7	2	1.5	2	9.2	4	5	9
39	1.9	1.7	2	2	2	9.6	5	5	10
40	2	1.5	1.5	1.5	2	8.5	4	5	9
41	2	2	2	1.4	1.4	8.8	4	4	8
42	1.6	0.2	2	2	2	7.8	4	4.5	8.5
43	1.8	2	2	2	2	9.8	4	2	6
44	1.7	1.1	2	1	1	6.8	4	2	6
45	1.6	1	2	1	0.5	6.1	4	1.5	5.5
46	1.7	1.7	1.5	2	2	8.9	5	5	10
47	1.6	0.7	2	1	1.5	6.8	5	2	7
48	2	1.6	2	1	1	7.6	2	1.5	3.5
49	2	2	2	2	2	10	5	5	10
50	2	0.6	1	1	1	5.6	2	2	4
51	1.9	1.5	2	1	1	7.4	5	5	10

52	1.9	1.9	1.25	2	2	9.05	5	5	10
53	1.6	1.1	1	1	1	5.7	5	5	10
Average	1.684	1.529	1.764	1.762	1.8	8.54	4.2453	4.1698	8.415
Minimum	0.4	0.2	1	0.5	0.5	5.6	2	1.5	2
Median	1.8	1.8	2	2	2	8.8	4	5	9
Standard Deviation	0.41	0.57	0.36	0.41	0.39	1.38	0.85	1.12	1.70

The high median scores for Quizzes 1, 3, 4, and 5 show that students have a strong foundational understanding of those topics. This information can be used to build on these successes. We can briefly review these topics at the start of future classes and then introduce more complex, related concepts or problems that challenge students to apply their knowledge in new ways. This keeps the class moving forward while still ensuring a solid grasp of the fundamentals.

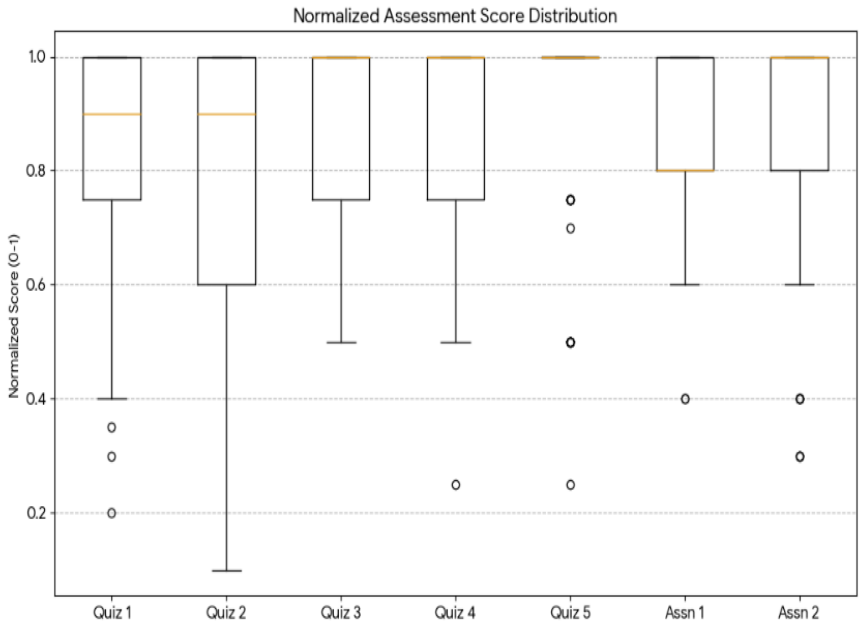

Fig. 2 Box-Whisker Graph of Assessment of all Students

Fig.2. box-whisker plot shows the distribution of scores for all of quizzes and assignments, with each assessment represented by its own box. The median score (the line inside the box) for most of the assessments is very high, close to the maximum. This indicates that more than half of the students performed exceptionally well. The box itself represents the middle 50% of the scores. A short box suggests that a majority of the students scored within a very tight range.

Quiz 2 stands out. It has a significantly lower median and a much wider spread of scores compared to the other assessments. confirming that this topic was more challenging. The dots represent outliers, or scores that fall well outside the typical range for each assessment. These indicate a few students who may have struggled with that particular assessment.

The normalized plot shows that while overall performance was strong, there was a greater variation in student understanding for Quiz 2. In the future, dedicate more class time to this topic. Use different teaching strategies, such as providing more real-world examples, conducting more

interactive problem-solving sessions, or offering additional guided practice to ensure better understanding.

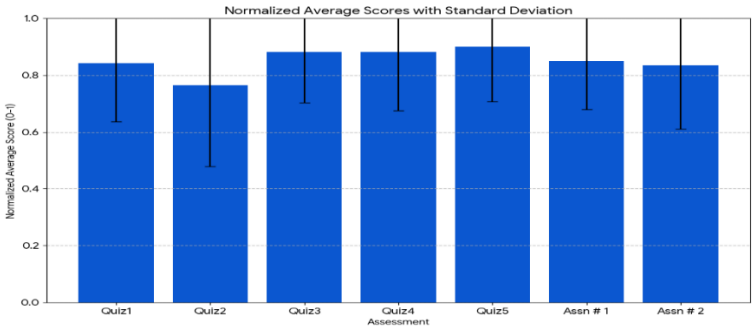

Fig. 3 Bar Graph with error Bars

Fig.3. represents a bar chart that displays the normalized average scores and their standard deviations for all quizzes and assignments. The height of each bar represents the average normalized score for that assessment. The error bars on top of each bar represents the standard deviation. A short error bar indicates that most students scored very close to the class average, while a long error bar (like on Quiz 2) shows a wider spread of scores, with a greater difference between high and low performers. This plot clearly highlights that while the average scores for most assessments are high, Quiz 2 had the most varied performance among the students.

The assignments, which included group work and a viva, produced a wider spread of scores. This suggests that while these methods are good for some students, others may need more structured guidance. To improve consistency, we could provide more detailed rubrics for group work, check in with groups more frequently, or conduct a brief formative assessment before the viva to gauge individual understanding.

Conclusion

This paper highlights the need for effective planning in delivering lectures for undergraduate courses, with a focus on the Engineering Economics and Management course taught in the Electrical Engineering department. The performance of 53 students in quizzes and assignments was analyzed. The findings suggest that students are more engaged and learn better in interactive sessions where teachers encourage discussions and actively involve students. A student-centered learning environment is found to be more effective in honing student skills compared to traditional teaching methods. Maintaining discipline and control in the classroom is also crucial for fostering a productive learning atmosphere. When numerical problems are involved, clear and detailed explanations are essential. It is shown that for technical topics, a teacher-centered approach is more beneficial, where the instructor thoroughly explains the concept, followed by numerical exercises to assess student understanding. This paper offers recommendations and strategies for instructors teaching similar courses. The approaches implemented were successful, and students responded positively to this learning environment.

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Statement of Declaration

Data Availability Statement:
The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Conflict of Interest Disclosure:
The authors declare that they have no conflict of interest.

Ethics Approval Statement:
Ethical approval was not required for this study.

Patient or Participant Consent Statement:
Consent was not required as students' data were collected and analyzed anonymously.

Permission to Reproduce Material from Other Sources:
Not applicable. No material from other sources was used.

Clinical Trial Registration:
Not applicable / This study is not a clinical trial

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