Open Discussion Forums and Effective Group Division for Improved Student Engagement in Teaching Learning Process

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***Abstract*—Open discussion forums are increasingly recognized as a key strategy for enhancing student engagement in higher education. These forums foster interaction, critical thinking, and knowledge retention by allowing students to collaborate and solve problems together. The effectiveness of such forums largely depends on how groups are structured, with various methods like homogeneous, heterogeneous, and interest-based grouping offering different benefits. This paper presents a case study involving second-year electronics and communication engineering students at BVRIT HYDERABAD College of Engineering for Women and demonstrates that strategic group division, combined with activities like open book tests and Q&A sessions, significantly improved student performance and engagement, particularly in understanding complex concepts. This approach has proven especially beneficial for diverse learners, making it a promising method for boosting academic outcomes in higher education.**

***Keywords*—Collaborative learning; discussion forums; group division; student engagement; structured forums.**

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I. INTRODUCTION

In the evolving landscape of education, particularly within higher education, fostering student engagement has become an important objective. One increasingly prominent strategy to achieve this is the implementation of open discussion forums. These platforms provide a dynamic environment for students to interact, share knowledge, and collaboratively solve problems, thus enhancing the overall learning experience. Existing literature has given the significance of discussion forum participation in improving student learning outcomes, demonstrating that active engagement in these forums can lead to better comprehension and retention of course material as per Wikle, and West (2019).

Discussion forums serve as a pivotal tool in bridging the gap between traditional classroom settings and the digital learning space. By promoting a culture of open dialogue and critical thinking, these forums encourage students to articulate their thoughts and engage with diverse perspectives. Howard (2015) highlighted that both in-person and online discussions can significantly enhance student participation and engagement, creating a more inclusive and interactive educational environment. Moreover, the effectiveness of discussion forums is greatly influenced by the structure and organization of group divisions. Chang (2018) emphasizes the importance of active knowledge sharing in online group work, which can be optimized through well-structured discussion groups. This structured approach not only facilitates better communication but also ensures that all students are actively involved in the learning process.

The role of online discussions in fostering critical thinking is particularly noteworthy. Szabo and Schwartz (2011) illustrated how online discussions can be used to enhance critical thinking skills among students, providing a platform for them to analyse, evaluate, and construct arguments in a collaborative setting. Buckley (2011) discussed the potential of online discussion forums to engage students in meaningful conversations that contribute to their academic and personal growth.

Flipped learning models, which integrate online discussion forums, have shown promising results in higher education. Bognar, Sablić, and Škugor (2019) have explored how flipped learning combined with online discussions can create a more interactive and student-centered learning environment to promote better understanding and active participation.

The design and structuring of asynchronous discussion forums play a crucial role in their effectiveness. Tibi (2016) outlined essential components for structuring these forums for emphasizing the need for clear guidelines and objectives to facilitate productive discussions. Further, Tibi (2018) examines computer science students' attitudes towards structured and unstructured forums which has revealed a preference for well-organized discussions.

Incorporating pedagogies of engagement within classroom practices can significantly impact student participation. Smith et al. (2005) highlighted various engagement strategies, including collaborative learning and active discussion, which are vital for creating an engaging educational experience. Moreover, Wise and Cui (2018) investigate the characteristics of content-related interactions in MOOC discussion forums, underscoring the importance of social relationships and community building in online learning environments.

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The democratic nature of discussion-based teaching is also pivotal in promoting student engagement. Brookfield and Preskill (2012) provided the discussion as a key teaching tool for a democratic classroom where students share their ideas.

Social media platforms, such as Facebook, have also been explored as potential tools for online teaching. Camus et al. (2016) analysed the effects of using Facebook for student participation and learning, finding that such platforms can enhance overall course performance and engagement. Similarly, Douglas et al. (2015) compared assessed versus non-assessed participation in online discussion groups to provide insights on student engagement.

From the students' perspective, online discussion forums have a significant impact on their learning experience. Gasmi (2022) and Ithindi (2013) have given valuable insights into how students perceive these forums and their role in mediating learning. Further, highlighted the benefits and challenges associated with online discussions. Further, Yeong (2021) has explored how life sciences students approach ill-structured problems in asynchronous forums. Further, demonstrated the forums' potential to facilitate complex problem-solving. An assessment on undergraduate participation in online discussion forums is given by Tella and Adu (2014) where the need for strategies to enhance student involvement and maximizing the educational benefits are discussed. As the educational landscape continues to evolve, the integration of open discussion forums with effective group division stands out as a promising approach to foster student engagement and improve the teaching-learning process.

While open discussion forums are recognized for their potential to enhance student engagement, their success largely depends on how they are structured and implemented. Effective group divisions and the integration of structured activities, such as open book tests and Q&A sessions, are essential for maximizing the benefits of these forums. However, there is a lack of comprehensive studies that systematically analyze the impact of group division strategies and structured discussions on student learning outcomes, particularly in complex topics requiring collaborative problem-solving. This paper aims to address the above problem by focusing on the following objectives.

1. Discuss about eeffective organization of discussion forums and various group division methods, such as homogeneous, heterogeneous, random, interest-based, and dynamic grouping.
2. Demonstrate practical implementation through a case study to know the impact of open discussion test and effective group division on student engagement and learning outcomes.

The organization of the remaining paper is as follows. In Section II, the paper explores the effective organization of discussion forums and highlights how open book tests, open discussion tests, and Q&A sessions can be strategically integrated to enhance student engagement. Section III discusses various group division strategies and evaluates their impact on fostering a productive and inclusive learning environment. Section IV presents a detailed case study analysis involving second-year ECE students at BVRIT HYDERABAD College of Engineering for Women. This section outlines the implemented group division algorithm, the performance data of students before and after group division, and the outcomes of an open discussion test focused on solving magnetic circuit problems with mutual inductance. The case study provides empirical evidence of the effectiveness of the proposed strategies in achieving course outcomes through enhanced student collaboration and engagement.

II. Effective Organization of Discussion Forums

This section deals with the strategies for structuring discussion forums in order to maximize their impact on student engagement and learning. Open discussion forums hold immense potential for enhancing student engagement in the learning process. However, to maximize their effectiveness, these forums require strategic organization and the implementation of structured activities. This section explores how open discussion forums can be tailored to facilitate three specific, high-impact activities: open book tests, open discussion tests, and Q&A sessions.

A. Open Book Tests

Open book tests within discussion forums offer a unique opportunity for students to assess their understanding of course material while also practicing critical thinking and application skills as per Feller (1994). Instructors can maximize student engagement by providing a set of open-ended questions that encourage learners to consult their notes, textbooks, and other approved resources to formulate well-supported responses. This approach not only promotes independent research skills but also deepens understanding of the subject matter. Additionally, fostering collaboration through smaller group discussions within the forum allows students to collectively analyze information and develop a shared understanding. Following these group discussions, incorporating a peer review component where students evaluate each other's responses further promotes critical analysis and self-reflection.

Open book tests also provide an excellent opportunity to bridge the gap between theoretical knowledge and real-world application. By integrating scenario-based questions or practical problems into the tests, instructors can challenge students to analyze the and apply the knowledge to specific situations. This method encourages students and emphasizes the value of synthesizing information and crafting solutions which develop both comprehension and creativity. Additionally, open book tests can reduce test anxiety for many students, fostering a positive learning environment where the emphasis is on understanding rather than mere performance.

B. Open Discussion Tests

Palmer, Holt, and Bray (2008) mentioned that open discussion tests within forums go beyond simple recall of facts, encouraging students to engage in deeper analysis and debate. These can be effectively implemented by posing complex case studies or real-world scenarios that students can describe from various perspectives and prompt them to apply their knowledge to practical situations. The instructor plays a crucial role as a moderator, guiding the discussion and ensuring that diverse

viewpoints are considered. This develops critical thinking, the ability to articulate well-reasoned arguments, and inclusivity. Finally, the discussion can be concluded with a prompt asking students to summarize the key arguments and get to a collective conclusion.

Moreover, open discussion tests serve as an avenue for developing soft skills, such as respectful communication and the ability to navigate disagreements constructively. By encouraging students to engage with opposing viewpoints, these tests develop the culture of intellectual curiosity and empathy. To further enrich the learning experience, instructors can incorporate multimedia resources—such as videos, articles, or infographics—into the case studies to provide diverse contextual information. This multimedia approach can deepen engagement and enhance students' ability to evaluate evidence critically and make their arguments more robust and well-rounded.

C. Q&A Sessions

Open discussion forums can be transformed into invaluable tools for answering questions and developing a supportive learning community as per Климович (2022).

Creating dedicated forum threads for Q&A allows students to categorize their questions and receive focused answers, enhancing the organization and efficiency of the discussion. Encouraging peer-to-peer support within these threads promotes active learning, as students are not only post questions but also attempt to answer their peers' inquiries, which maximize their understanding. The instructor can monitor the forum to address any unanswered questions and provide additional clarification as needed while ensuring that all concerns are adequately addressed.

By strategically integrating these activities within well-organized discussion forums, instructors can create a platform that to promote knowledge retention and critical thinking as well as create a sense of community among students. This structured approach sets the stage for effective group division, which will be explored in the following section. By combining well-designed activities with strategic group structures, educators can unlock the full potential of open discussion forums and cultivate a more engaging and enriching learning experience for all students.

III. Group Division Strategies and Their Impact

This section discusses different methods of dividing students into groups for effective collaboration. Effective group division is a crucial element in maximizing the benefits of open discussion forums. While well-structured activities provide a strong foundation, the way students are grouped significantly impacts their engagement, learning outcomes, and overall forum experience.

A. Homogeneous Grouping

This strategy involves dividing students based on similar academic abilities, learning styles, or prior knowledge. Homogeneous groups can foster a sense of comfort and security for students with similar skill levels. They can build confidence by working with peers who share their learning pace and approach. However, these groups can limit exposure to diverse perspectives and stop the development of critical thinking skills that arise from grappling with different viewpoints. Further, such groups may lack the challenge necessary for higher-level learning as per Ward, Hastie, and Strunk (2019).

These groups can also facilitate the design of targeted instructional strategies. For example, instructors can tailor tasks to match the group's specific ability level to create a more personalized learning experience. This strategy can be beneficial in preparatory stages or when reinforcing foundational concepts. However, it is crucial to complement this grouping with opportunities for interaction with diverse peers to ensure holistic development and prevent insular thinking.

B. Heterogeneous Grouping

Heterogeneous grouping involves dividing students with diverse academic abilities, learning styles, and prior knowledge. It offers a dynamic learning environment where students can learn from each other's strengths. Students with advanced knowledge can explain concepts to peers who may be struggling and encourage collaboration through peer-to-peer learning. Exposure to diverse perspectives encourages critical thinking and the ability to see issues from multiple angles as per Gorgônio et al. (2017). However, these groups can be challenging for instructors to manage, particularly when there are significant skill discrepancies. Students with lower prior knowledge may feel discouraged or overwhelmed if the group moves too quickly as per Dunn et al. (1990).

Further, through these groups' individuals with diverse backgrounds and skill levels must work together to solve complex problems. This real-world alignment prepares students for future professional environments. Moreover, the shared responsibility within these groups often leads to organic leadership development and a greater appreciation for collaborative success. The instructors should actively monitor group dynamics to avoid unequal participation or dominance by more advanced students for ensuring an equitable distribution of workload.

C. Random Grouping

In this strategy, students are asked to group at random while ensuring a mix of abilities and learning styles. It promotes inclusivity and provides all students to have the opportunity to work with a diverse range of peers. Moreover, it encourages a sense of teamwork as students learn to adapt to different communication styles and learning approaches. Similar to heterogeneous grouping, random grouping can lead to challenges if there are significant skill gaps within the group. Instructors may need to provide additional support or differentiation strategies to ensure all students feel included and can contribute meaningfully as per Papamitsiou, and Economides (2018). Therefore, this strategy offers unpredictability that can be refreshing and engaging for students. It fosters adaptability and encourages students to step out of their comfort zones to work with new peers. Over time, this approach can help students develop soft skills such as interpersonal communication and conflict resolution. To

mitigate challenges posed by significant skill gaps, instructors can provide structured guidance, such as clearly defined roles within groups.

D. Interest-Based Grouping

This grouping involves dividing students based on shared interests or areas of curiosity within the subject matter as per Jong, Wu, and Chan (2006). Students are more likely to be invested in discussions and actively participate in exploring their chosen area of interest. This grouping can be time-consuming to implement effectively and may not always perfectly align with the learning objectives of the forum activity. Additionally, it's important to ensure all groups have access to sufficient resources to explore their chosen topic within the forum. This strategy encourages deep exploration and innovation, as students often bring enthusiasm and prior knowledge to discussions on topics, they are interested about. This motivation leads to higher-quality outputs and a more vibrant exchange of ideas within the group. To enhance the effectiveness of this strategy, instructors can incorporate interdisciplinary connections which allows students to approach topics from different perspectives.

E. Dynamic Grouping

As per Barber, A. H et al. (2024), with dynamic grouping flexible groups are created which can change throughout the course or based on the specific activity. It allows instructors to tailor group composition to specific learning objectives. For example, students with complementary skillsets can be grouped together for specific tasks. It also exposes students to a wider range of perspectives and learning styles throughout the course. However, this grouping can be disruptive if students are constantly changing groups. Building group cohesion and trust can be challenging. Moreover, students may need additional time to adjust to new group dynamics.

The optimal group division strategy depends on the specific learning objectives of the activity, the size and composition of the class, and the instructor's teaching philosophy. By carefully considering these factors, instructors can leverage group division to create a dynamic and inclusive learning environment within their open discussion forums.

IV. Case Study Analysis

This section provides a practical implementation of the discussed strategies, involving second-year ECE students at BVRIT Hyderabad College of Engineering for Women. The case study was conducted to investigate the impact of open discussion test and effective group division on student engagement and learning outcomes. The activities included open discussion test, effective group divisions, to address various issues faced during the course of Network Analysis and Transmission Lines. The study involved II Year I Semester ECE A & B students at BVRIT HYDERABAD College of Engineering for Women. It included diploma students who joined in the second year and were typically observed to have difficulty in integrating with other students who have interacted with each other for one full year.

A. Open Discussion Test

To achieve the learning outcome of solving electrical circuit with Kirchhoff's voltage law when mutual inductance is present, an open discussion test was conducted. A glimpse of open discussion test is shown in Fig. 1. This allowed students to refer to their class notes and identify the steps where they were facing difficulties. Following the test, a detailed explanation was provided on writing KVL equations when mutual inductance is present.

The performance of students of ECE-A and ECE-B with open discussion test is given in Table 1 and 2, respectively. It is observed that the open discussion test specifically aimed to help students understand and solve problems related to mutual inductance i.e. Question 1b. The data from Tables 1 and 2 illustrate the performance of ECE-A and ECE-B students after participating in an open discussion test during their Midterm-1 exam. The test specifically aimed to enhance their understanding and problem-solving skills related to mutual inductance, particularly in Question 1b. For ECE-A students, 78.6% attempted Question 1b, achieving a mean score of 1.9 out of a possible 3 marks. This indicates a relatively high engagement and moderate success in applying the concepts discussed. Similarly, ECE-B students also demonstrated considerable engagement, with 68.6% attempting the same question and achieving a higher mean score of 2.4. This suggests that the open discussion test positively impacted the students' ability to apply their knowledge of mutual inductance,

Fig. 1. Students learning through open discussion test.

TABLE I

PERFORMANCE OF ECE-A STUDENTS AFTER OPEN DISCUSSION TEST IN MIDTERM-1

Question	Blooms level	Maximum marks	Attempted students' percentage	Mean score of attempted students
1a	Understand	2	82.9	1.6
1b	Apply	3	78.6	1.9
2a	Apply	2	52.9	1.7
2b	Understand	3	38.6	1.6
3a	Apply	3	4.3	2.3
3b	Apply	2	2.9	1
4a	Apply	4	52.9	1.9
4b	Understand	1	41.4	0.6

TABLE II
PERFORMANCE OF ECE-B STUDENTS AFTER OPEN DISCUSSION TEST IN MIDTERM-1

Question	Blooms level	Maximum marks	Attempted students' percentage	Mean score of attempted students
1a	Understand	2	70	1.7
1b	Apply	3	68.6	2.4
2a	Apply	2	21.4	1.5
2b	Understand	3	14.3	1
3a	Apply	3	22.9	2.5
3b	Apply	2	11.4	1.4
4a	Apply	4	77.1	3.3
4b	Understand	1	60	0.7

as evidenced by the relatively high attempt rates and improved scores in both groups, especially in ECE-B. The open discussion format seems to have been effective in reinforcing students' understanding and application of complex concepts like mutual inductance.

B. Effective Group Division

To achieve the course outcomes (COs) through student-student collaboration, the students were paired in this manner struggling learners/diploma students were paired with regular students. This approach ensures balanced group dynamics and maximizes the potential for peer learning. The algorithm for group division is as follows:

1. Group Size: Each group consists of four members.
2. Total Groups: For 72 students, 18 groups are formed. The step- by-step grouping process is discussed as follows.

1. Top and Bottom Pairing:
   a. First, the top 18 students are paired with the bottom 18 students.
   b. For example, the top 1st student is paired with the bottom 1st student, the top 2nd student is paired with the bottom 2nd student, and so on.
2. Middle Grouping:
   a. The remaining two members of each group are selected from the middle 36 students (split into two sets of 18 each).
   b. One member is chosen from the second set of 18 (students ranked 19th to 36th).
   c. The final member is chosen from the third set of 18 (students ranked 37th to 54th).

This method ensures each group has a balanced mix of abilities, facilitating effective peer learning and collaboration which is a type of heterogeneous grouping. The formed groups with this method for ECE A and ECE B are shown in Table 3 and 4, respectively. Note that diploma students are highlighted to show their improved performance through group division.

TABLE III
GROUPS DIVISION OF ECE-A

Group No.	Students IDs			
1	R53	R35	R29	R22
2	R27	R11	R38	R28
3	R40	R05	R56	R42
4	R54	D06	R57	R62
5	R25	R20	R65	R63
6	R41	R10	R31	R06
7	D05	R09	R59	R21
8	R49	R02	D03	R52
9	R50	D04	R01	D02
10	R61	R47	R13	R18
11	R64	R46	R14	R43
12	D01	R39	R32	R45
13	R15	R23	R33	R55
14	R26	R16	R44	R03
15	R34	R12	R60	R08
16	R51	R48	R07	R30
17	R04	R37	R17	
18	R24	R36	R19	

TABLE IV
GROUPS DIVISION OF ECE-B

Group No.	Students IDs			
1	D08	RB2	R98	R97
2	R72	R86	RA2	RB4
3	R81	R85	RA7	RC4
4	R67	R70	RB1	RC9
5	D10	RA6	RC0	D13
6	R84	RA3	RC3	RA0
7	RB9	RC7	D07	RB8
8	RC6	RB6	R76	RC1
9	RD0	RB5	R83	R66
10	R88	R95	R90	R74
11	R96	R77	R91	R79
12	RC2	RA5	R99	R82
13	RC8	R73	RB0	R89
14	D09	RA9	RB3	RA1
15	R69	RA4	RC5	RA8
16	R71	R94	D11	R68
17	R87	R92	D12	
18	R93	R80	R75	

Firstly, in order to know the overall performance of the students based on the groups division, the groupwise mean score obtained by the students before (during Midterm-1) and after effective group division (Midterm-2) is obtained along with the standard deviation. Note that the blooms level of questions asked in Midterm-1 is same as that of Midterm-2 which include apply and understand levels. This impact of group division on ECE-A &B is also indicated in Fig. 2 and 3, respectively.

It is observed that the group division in ECE-A had a positive impact across all categories. The most significant improvements are seen in the middle and bottom groups, both in terms of mean scores and the increase in standard deviation. The increase in standard deviation, particularly for the middle

and bottom groups, suggests that while the average performance improved, there was greater variability in student performance, indicating that some students benefited more than others. The top group also improved, but the gains were modest both in terms of the mean score and the standard deviation, suggesting that their performance was already consistent and near their potential.

The group division also had a positive impact on ECE-B, but the effects were less pronounced than in ECE-A. The top group saw minimal improvement in both mean score and standard deviation, indicating that they were already performing near their potential, and their performance remained consistent. The middle sets and bottom group showed moderate improvements in mean scores, accompanied by increases in standard deviation. This suggests that while the group division helped these students, the improvement was not uniform across all students within these groups, leading to increased variability in their performance.

Further, to highlight the impact of group division, the performance of diploma students of ECE-A and ECE-B are given in Fig. 4 and 5, respectively. It is observed that the performance data of ECE-A and ECE-B before and after the implementation of effective group division shows a generally positive trend.

1. ECE-A Students: All students showed reasonable overall performance attainment past a threshold of 7/10 except for student D04 who showed a small improvement but performed at a lower level. No significant drop in performance of the students was noted in this group.

2. ECE-B Students: All students showed reasonable overall performance attainment past a threshold of 7/10. No significant drop in performance of the students was noted in this group.

These two results indicate that diploma students' performance stayed above a threshold indicating improvement in most cases.

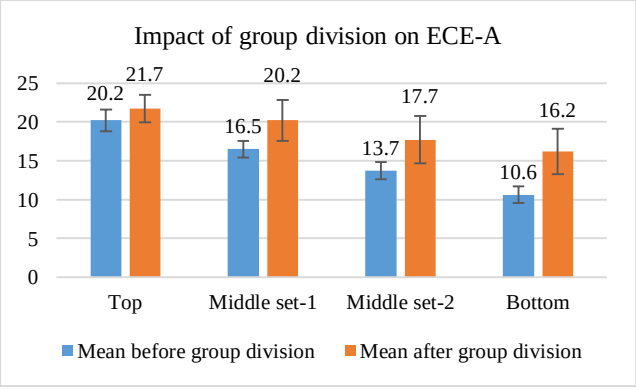

Fig. 2. Impact of group division on ECE-A.

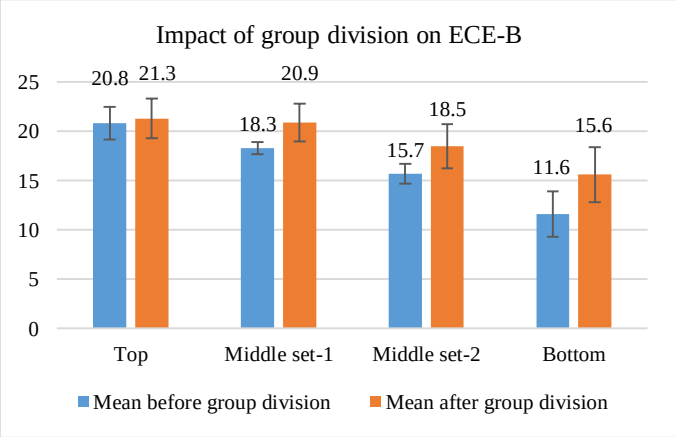

Fig. 3. Impact of group division on ECE-B.

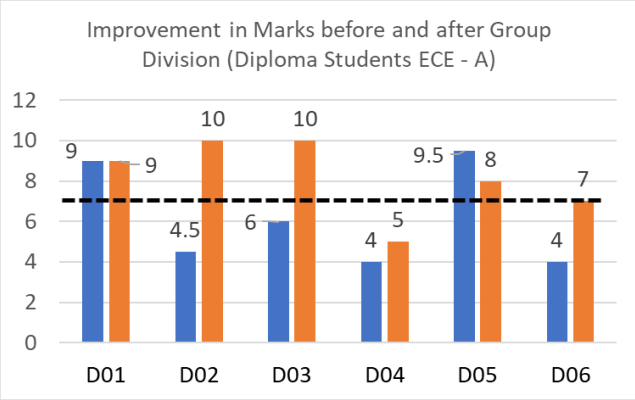

Fig. 4. Performance of ECE-A diploma students before and after effective group division.

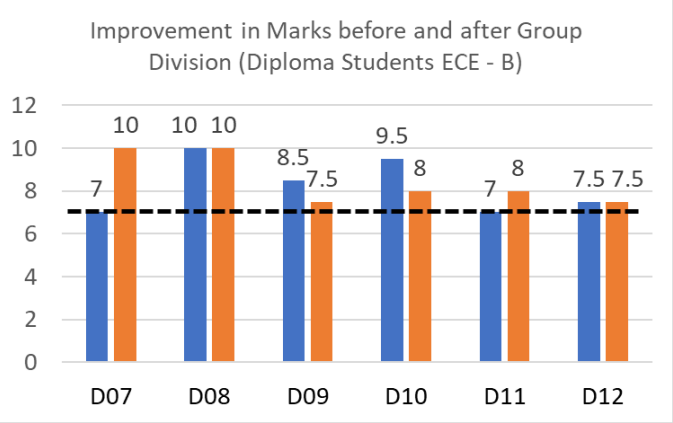

Fig. 5. Performance of ECE-B diploma students before (during Midterm-1) and after effective group division (Midterm-2).

CONCLUSIONS

This study demonstrates that open discussion forums and structured group divisions significantly improve student engagement and learning outcomes. Both ECE-A and ECE-B students showed positive performance gains, particularly in middle and bottom groups, with diploma students also showing notable improvement. The use of open discussion tests further enhanced students' problem-solving skills, especially in challenging areas like mutual inductance. Overall, the findings suggest that effective group division and open discussion tests

create a more interactive and inclusive learning environment, leading to better academic performance and higher student satisfaction.

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