The Implementation of Book-end Division Approach using ClassPoint in Digital Electronics Courses

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Abstract

This paper explores the integration of the Book-End Division Approach with ClassPoint within the Technology-Enhanced Learning (TEL) framework to enhance student engagement in Digital Electronics courses at the Faculty of Electrical and Electronics Engineering Technology (FTKEE), Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA). Conventional teaching methods frequently face challenges to engage students, particularly in technical disciplines like electrical and electronic engineering. The study leverages a student engagement framework to foster an interactive learning environment, utilizing ClassPoint's interactive features to promote active participation, and collaboration among students. The Book-End Division Approach divides class sessions into advanced organizing, intermittent discussions, and closure. Results indicate significant impacts in student participation and motivation, with over than 90% of the students agree ClassPoint TEL made the classroom environment more motivating.

Keywords: Collaborative learning, book-end division, student engagement, engineering education, ClassPoint.

Introduction

Effective student engagement in class is important for successful learning. Some students face challenges in understanding course content, especially in the fields of engineering. To address this issue, our study aims is to enhance the learning experience for students in the Digital Electronics course at the Faculty of Electrical and Electronics Engineering Technology (FTKEE), Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA). We have implemented the student engagement framework proposed by (Bond & Bedenlier, 2019) as illustrated in Figure 1.

Student engagement is shaped by multiple elements. Within the Technology-Enhanced Learning (TEL) environment (Bond & Bedenlier, 2019), technology serves as a powerful driver for promoting active learning. Effective integration of technology within both the learning environment and classroom community encourages active student involvement, leading to a range of short-term and long-term academic and social benefits. In the short term, these benefits include enhanced higher-order thinking, increased motivation, and stronger interpersonal relationships, all of which are supported by peer learning and collaboration. Over the long term, these outcomes support lifelong learning, personal growth, and greater engagement in the wider educational community. Consequently, the effort and dedication that students invest are reciprocated within the TEL framework, creating a dynamic and evolving learning system.

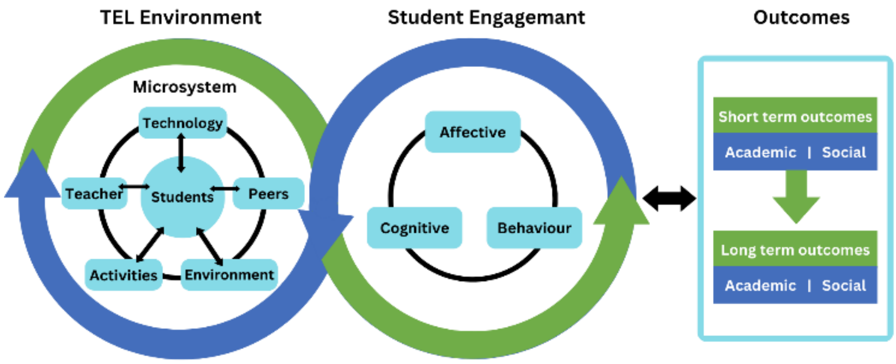

Figure 1. Student Engagement Framework

Arshad, N.W., Hasan, N., Bakar, M.S., Abdul Karim, R., Abdul Wahab, Y. (2025), The Implementation of Book-end Division Approach using ClassPoint in Digital Electronics Courses, *ASEAN Journal of Engineering Education*, 9(2), 137-143. https://doi.org/10.11113/ajee2025.9n2.208

Conventional teaching methods often fall short of effectively engaging students, particularly in technical and engineering disciplines. Traditionally, "chalk and talk" teaching often struggles to capture students' attention, especially in engineering disciplines. The motivation to create an engaging and interactive learning environment comes from the desire to ensure that students actively participate in their learning journey, rather than receiving information passively. Therefore, educators' ability to design and create classes that welcome student engagement is crucial.

The limitations of traditional pedagogical approaches in engineering education are well-documented and varied. The transmission model of instruction, where an instructor broadcasts information to passive recipients, is increasingly viewed as inadequate for the complexities of modern engineering curricula (Prince, 2004). One of the primary deficits of this method is the lack of immediate feedback mechanisms. In a standard lecture hall, misconceptions regarding complex theoretical concepts, such as circuit analysis or signal processing often go undetected until high-stakes assessments occur. Prince notes that without the interruption of active learning intervals, students' attention spans wane significantly after just 10 to 15 minutes, leading to a phenomenon known as cognitive drift.

Furthermore, engineering courses require the visualization of complex concepts that are often invisible to the naked eye, such as electron flow or electromagnetic fields. Traditional static lectures rely heavily on verbal descriptions and 2D whiteboard diagrams, which can impose a heavy cognitive load on students trying to mentally model these dynamic systems (AliSoy et al., 2021). Research by Theobald et al. (2020), which analyzed data from over 9,000 STEM students, confirmed that active learning environments significantly outperform traditional lecturing, particularly in reducing failure rates and narrowing achievement gaps. Additionally, Deslauriers et al. (2019) demonstrated that while students may perceive "chalk and talk" lectures as effective due to their fluency, actual learning gains are substantially higher in interactive settings. This suggests that conventional methods fail to facilitate the deep conceptual change required for mastering technical subjects.

Moreover, research by Freeman et al. (2014) provides empirical evidence that traditional lectures are less effective at engaging students compared to active learning strategies. In their comprehensive meta-analysis of 225 studies in undergraduate STEM education, Freeman demonstrated that students in classes with traditional lecturing were 1.5 times more likely to fail than those in classes with active learning. They found that active learning increases examination performance by approximately 6%. These findings highlight a critical gap in traditional pedagogy, while it may be efficient for covering vast amounts of content, but it is often inefficient for ensuring that content is retained and understood.

Table 1. 21st Century skills (Helmi et al., 2019)

Foundational Literacy	Competencies	Character Qualities
· Literacy · Numeracy · Scientific literacy · ICT literacy · Financial literacy · Cultural and civic literacy	· Critical thinking /Problem solving · Creativity · Communication · Collaboration	· Curiosity · Initiative · Persistence/ grit · Adaptability · Leadership · Social and cultural awareness
Lifelong learning		

To overcome this issue, the student engagement framework has been utilized. This framework not only supports students in achieving academic excellence but also equips them with essential 21st-century skills, as outlined in Table 1 (Helmi et al., 2019), thereby making their learning experience more comprehensive. By implementing a holistic approach to learning, students are encouraged to participate actively, think critically, collaborate with peers, and efficiently utilize digital tools.

In today’s digital era, students are increasingly familiar with interactive and dynamic learning environments. Utilizing educational applications (apps) not only grabs their attention but also offers a more immersive and active learning experience (Nadeem, 2019). These apps can turn abstract concepts into visually engaging and interactive content, making the learning process more impactful and memorable. Additionally, studies by Alim et al. (2019) and Gon & Rawekar (2017) have demonstrated that the use of educational apps significantly encourages student engagement.

ClassPoint is a plug-in app for PowerPoint that allows various interactive activities to be conducted for both online and face-to-face classes. Research by Arshad et al. (2023) focused on electrical and electronics engineering courses, where the integration of ClassPoint through the Book-end Division Approach energized student participation and led to improved academic outcomes. Similarly, study in Mahfud Hidayat et al. (2023) demonstrated that ClassPoint made lessons more interactive, motivating students and enhancing their attention, which also resulted in better performance. These findings suggest that ClassPoint is an effective tool for boosting engagement and academic success across various educational disciplines. Study in Setiyanto (2023) further supported these findings, reporting positive student perceptions of ClassPoint in midwifery documentation courses. These studies collectively suggest that

ClassPoint is an effective tool for enhancing student engagement and performance across various subjects.

Class Design Using the Book-end Division Approach

The Book-end Division Approach is a simple, yet effective instructional design used in informal collaborative learning (Smith et al., 2009), which breaks down classroom sessions into small segments; advanced organizing, intermittent discussion, and closure. The advanced organizing phase serves as an introductory session aimed at activating students' prior knowledge. Intermittent discussion encourages students to actively engage with the learning material, lecturer will assess students' understanding and facilitate discussion and collaboration. The closure segment is designed to recap and summarize the session (Helmi et al., 2019). Figure 2 illustrates the instructional design for a 50-minute session following the Book-end Division Approach.

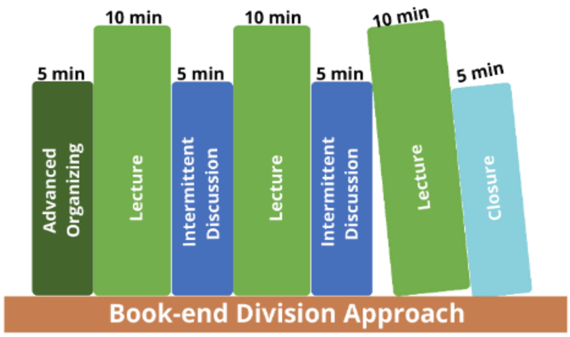

Figure 2. Book-End Division Approach

In conventional teaching, instruction is a one-way communication where only the lecturer delivers the lecture. By using this approach, the small segments provide students with opportunities to actively participate in the learning process, effectively shifting it from a lecture-centered to a student-centered learning. This engagement throughout all segments helps maintain students' learning retention, allowing them to digest the new knowledge in manageable portions.

Table 2. Active Learning Activities Using ClassPoint

Book-end Division Approach	Activity	ClassPoint Features
Advanced organizing	Focus listing, opening question	Word cloud, multiple choice, short answer
Intermittent discussions	Think-pair-share, in-class teams, question and answer pairs	Slide drawing, image upload, multiple choice
Closure	Two-minutes paper, one final question, reflection	Word cloud, multiple choice, short answer

The TEL microsystem is established in the classroom by combining the Book-end Division Approach with ClassPoint as shown in Table 2. During the Advanced organizing session, instructors use activities such as focus listing and opening questions to assess student's prior knowledge. ClassPoint facilitates these activities with features such as word clouds, multiple-choice quizzes, and short answers. In the intermittent discussion session, activity like think pair share and in-class teams helps students to cognitively engage with the lesson content. ClassPoint's slide drawing and picture uploads can be utilized to conduct intermittent discussions. Finally, the Closure session provides an opportunity for students to summarize and reflect on the class content through activities such as two-minute papers, and one final question. ClassPoint features that can be utilized for closure include word cloud, multiple-choice question, and short answer.

This approach provides a systematic framework for educators to integrate technology-enhanced activities and assessments into their lesson plans. Each session or segment is conducted through collaborative learning, beginning with thinking on the material learned individually, followed by peer discussions to exchange ideas, and concluding with a sharing of insights with the entire class. These collaborative learning also creates a comfortable learning environment that fosters critical thinking and teamwork skills.

Figure 3 depicts the research flowchart. The study begins with designing the research instrument to ensure the tools and methods align with the study's objectives. Following this, the intended lesson outcomes are defined, specifying the goals students should achieve. The implementation phase involves the constructive alignment of these outcomes with the teaching activities and assessments, facilitated by setting up the ClassPoint TEL environment to support interactive and engaging lessons.

The research then proceeds to final stage with student engagement post-test to measure the effectiveness of the instructional design. The data collected is analyzed to conclude the impact of ClassPoint TEL environment towards students' engagement. The post-test was distributed online for one week following the end of the semester. This allowing the study to account for variations in student responses by capturing a holistic view of their experience and ensures the data reflects sustained engagement over the 14 weeks period, rather than short-term excitement about the new tool or reactions to difficult topics.

To quantitatively assess the effectiveness of the intervention, a survey instrument was adopted from

Arshad et al. (2023), utilizing the methodological structure of the Utrecht Work Engagement Scale (UWES) (Bakker & Leiter, 2010). The instrument was validated through an online review with an expert to confirm relevance, a pilot test with a sample group, and revisions based on feedback to improve clarity and accuracy.

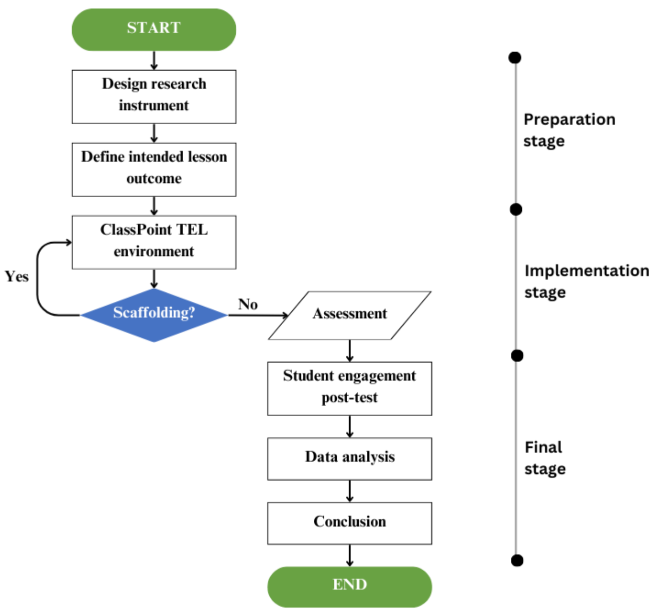

Figure 3. Methodology Flowchart for ClassPoint TEL Environment

The instrument evaluates student engagement across three dimensions as defined by Maroco et al. (2016). The first dimension is cognitive engagement, which reflects a student's willingness to exert effort to comprehend difficult concepts and skills. Next is affective engagement, which encompasses the student's emotional connection to the learning environment, instructors, and peers. The third dimension is behavioural engagement, which pertains to observable participation and conduct within the classroom. The final instrument comprised 39 items utilizing a 5-point Likert scale and multiple-choice formats to gather data on these engagement domains, alongside demographic characteristics (gender, race, learning mode) and student perceptions of the technology-enhanced class atmosphere.

The Implementation using ClassPoint

Every class is unique; during the first class of the semester, students are provided with a ClassPoint class code to join the class activity, as depicted in Figure 4. The class remains accessible in PowerPoint throughout the semester (14 weeks). This longitudinal approach ensures that the data reflects sustained engagement rather than temporary interest. Once enrolled, students can engage in all activities via their mobile phones, laptops, or tablets. For the lecturer, all displays and activities are managed and viewed directly through PowerPoint.

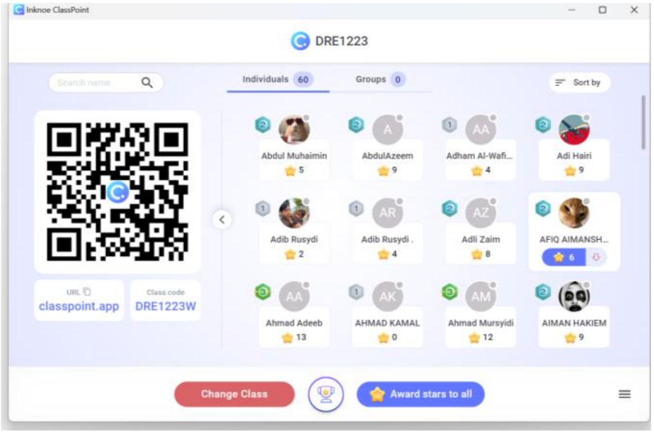

Figure 4. Students for the DRE1223 course joined the class through ClassPoint.

An example of the implementation of the Book-End Division Approach using ClassPoint for one of the topics in the Digital Electronics course is shown in Table 3. All students' answers for each activity are received directly by the lecturer, who can provide immediate feedback to help improve students' understanding during the class session. This strengthens student engagement in the learning process.

Table 3. Example of Book-End Division Approach Activities for the Magnitude Comparator Topic

BDA Activity	Activity
Advanced organizing	1. Focus Listing - Students individually list the characteristics of each Medium Scale Integrated (MSI) logic circuit they have previously learned, then compare with a neighbor. A pair is then selected using the ClassPoint name picker. 2. Card Game - Students are given binary number cards and asked to differentiate their number from their neighbor's. This question aims to engage students with the next topic, Magnitude Comparator (MC).
Lecture 1	Explanation of the basic concept of MC.
Intermittent discussions (ID1)	Pair composition activity through a worksheet. Students design a 2-bit MC and upload a picture of the worksheet through ClassPoint.
Lecture 2	Explanation on how to design an MC with more bits.

Intermittent discussions (ID2)	Pair composition activity through a worksheet. Students design a 4-bit MC by modifying answers from ID1. The 4-bit MC operation is broken down into steps to make "scaffolding" easier for students.
Closure	Formative assessment is given to evaluate students' understanding. Feedback is requested for the active learning activity through ClassPoint quick poll.

One of the activities conducted is shown in Figure 5. This activity allows students to upload images of their answers directly into PowerPoint through ClassPoint. The lecturer can view the answers and initiate discussions based on the submitted responses.

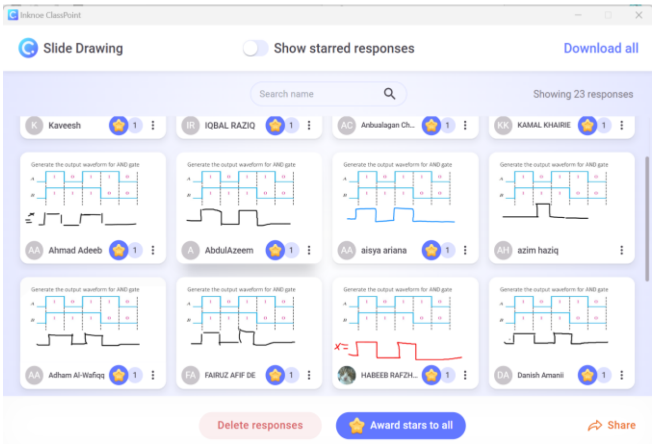

Figure 5. Intermittent discussion activity using the slide drawing function in ClassPoint

Results and Discussion

A study was carried out to assess student engagement and participation during class sessions. To collect data, a post-test instrument was designed, gathering information on demographics, student perceptions of educational technology use in the classroom, and levels of engagement.

The study involved 69 participants from the Digital Electronics courses, comprising 51 male students and 15 female students. Participants were both diploma and degree students enrolled in Digital Electronics and Digital Logic Design courses as tabulated in Table 4.

Table 4. Example of Book-End Division Approach Activities for the Magnitude Comparator Topic

Program	Course name	Numbers of participants
Diploma	Digital Electronics	38
Degree	Digital Electronics	13
	Digital Logic Design	15
Total		66

The demographic diversity included various ethnicities within the FTKEE, UMPSA as shown in Figure 6. The donut chart illustrates the racial composition of the survey participants, with a significant majority being Malay, who constitute 78% of the respondents. This is followed by Chinese and Indian participants, each making up 7% of the total. Participants identified as "Other" account for 6%, while Foreigners represent the smallest group at 2%.

ClassPoint's interactive features varied in terms of usage and student preference. Figure 7 shows student preferences for interactive quizzes within ClassPoint. Multiple Choice stands out as the most favoured option, with 48% of students preferring it due to its simplicity, user-friendly interface, and structured response options. Image Upload, chosen by 19% of students, allows sharing visual content like diagrams or images, facilitating collaborative discussions and visual explanations during class activities. Short Answer, selected by 13% of students, requires providing concise written responses, suitable for open-ended queries or exercises that encourage critical thinking. Slide Drawing is the least preferred tool, possibly due to its complexity in allowing students to effectively convey ideas through drawing on slides. These findings enable educators to adjust their teaching methods effectively by using preferred tools to enhance engagement and interaction within the classroom setting.

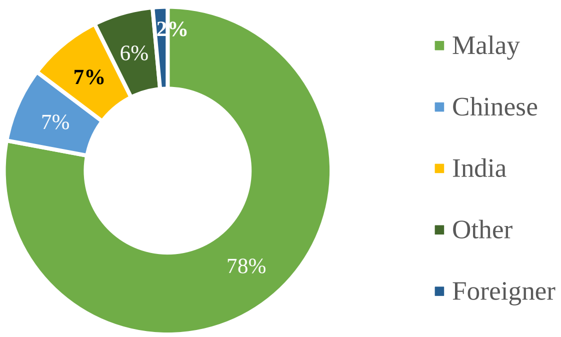

Figure 6. Race composition of the survey participants

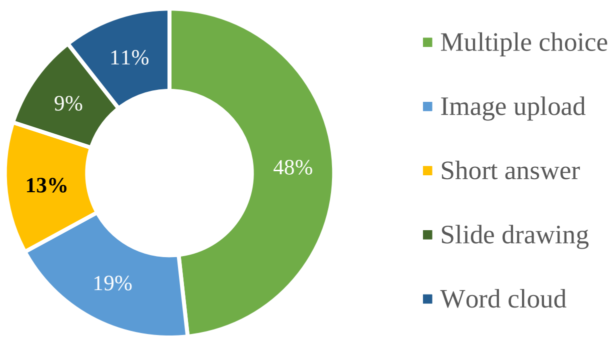

Figure 7. Interactive quiz in ClassPoint that had been actively applied

The Likert scale responses in Figure 8 indicate an impact in student participation in class. ClassPoint has significantly boosted student participation in group discussions and question-asking, with more than half of the students actively engaging. For instance, 33 students mentioned that ClassPoint often encourages them to participate more actively in class by asking questions, while 26 students mentioned it does occasionally. Furthermore, 40 students reported that they participate more active in class discussion, and 24 students mentioning they participate occasionally, showing a high level of engagement in ClassPoint TEL environment.

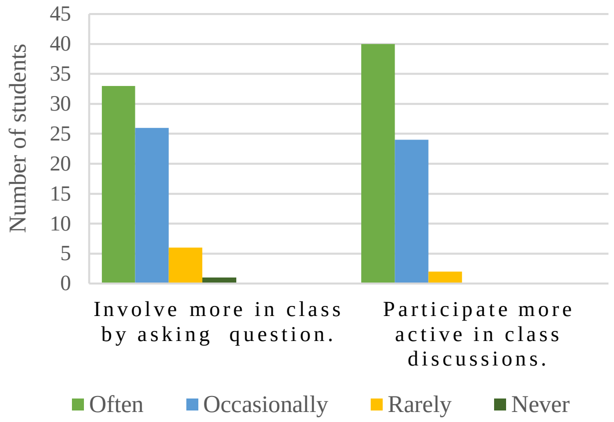

Figure 8. Impact of ClassPoint on student participation frequency

The results also indicate high levels of motivation and positive feelings towards the classroom environment, as illustrated in Figure 9. Specifically, 29 students strongly agreed and 34 students agreed that they felt energetic and capable, while 32 students strongly agreed and 29 students agreed that the classroom was an interesting place. Furthermore, 58 students strongly agreed and agreed that they had fun in class, and 27 students strongly agreed and 33 students agreed that they were motivated to learn more about the topic.

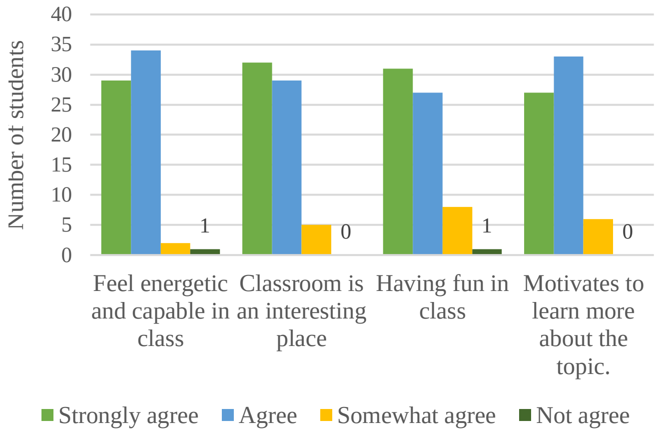

Figure 9. Impact of ClassPoint on student motivation in class

These results highlight that the Book-end Division Approach using ClassPoint not only enhanced student engagement but also made the learning experience enjoyable and motivating. The interactive nature of the classroom by ClassPoint activities contributed to students' positive perceptions and strengthened their commitment to continuous learning. The enriched microsystem with technology integration using ClassPoint played a significant role in fostering a meaningful learning experience.

Conclusion

In conclusion, integrating the Book-end Division Approach with ClassPoint within the TEL framework has effectively fostered student engagement in Digital Electronics courses at FTKEE, UMPSA. This method has fostered a more interactive and collaborative learning environment, encouraging active participation and the development of essential 21st-century skills. Future work will also extend this approach into online learning environments through the lightboard ecosystem and studio-based teaching model developed at UMPSA. This includes adapting Book-end Division Approach and ClassPoint for synchronous online delivery, leveraging real-time interaction tools, and exploring how AI-enhanced features can further support presence, participation, and continuity of engagement in virtual classrooms. These enhancements aim to optimize the scalability of active learning across physical, hybrid, and fully online courses in future iterations.

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Conflict of Interest

The authors declare that there are no conflicts of interest associated with this research. No financial, personal, or professional relationships have influenced the design, execution, or reporting of this study.

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