



Research in Engineering Education Symposium (REES)  
Regional Conference in Engineering Education (RCEE)  
& Research in Higher Education (RHed)  
September 29 – October 3, 2025  
Johor, Malaysia



## **A New Paradigm in Virtual Learning Using The Book-End Division Approach Via Active Lightboard Virtual Education (ALIVE) ©**

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### **ABSTRACT**

#### **BACKGROUND & CONTEXT**

Although the lightboard helps make online lessons clearer, its usual use is still passive and does not encourage active learning. This often leads to low student engagement. The Active Lightboard Virtual Education (ALIVE)© framework was developed to overcome these limitations by integrating the lightboard with active learning strategies and interactive digital tools, creating a more dynamic and engaging online learning experience.

#### **PURPOSE OR GOAL**

This study aims to evaluate the impact of the ALIVE© framework on strengthen students' understanding by active engagement via ALIVE© in a Digital Logic Design course.

#### **APPROACH OR METHODOLOGY**

A mixed-methods design was adopted, utilizing both qualitative and quantitative measures. Student engagement was tracked through participation in interactive activities, while feedback was collected via end-of-semester surveys and course evaluations. Quantitative analysis involved comparing performance data from Quiz 2 and Test 2 across different cohorts, both before and after ALIVE© implementation, to assess improvements in learning outcomes.

#### **OUTCOMES**

Results reveal that ALIVE© significantly increases student engagement, with over 60% of students actively participating in class activities. Qualitative feedback indicates that students found the approach effective for maintaining attention and deepening their understanding of course material. Quantitative data further show an approximate 17% increase in course outcome attainment following the introduction of ALIVE©.

#### **CONCLUSIONS**

The ALIVE© framework makes online learning in Digital Electronics more engaging and effective. By combining visual teaching with structured activities and interactive tools, students achieve better understanding and participation.

#### **KEYWORDS**

Lightboard, active learning, student engagement, virtual education, immersive learning.

## Introduction

The rapid transition to online learning due to the COVID-19 pandemic exposed significant weaknesses in student engagement and academic performance, particularly in engineering education. Conventional online meeting platforms often focus primarily on content delivery, leading to student disengagement and a lack of opportunities for active learning (Scott et al., 2022).

The lightboard enables instructors to face the camera while writing, maintaining eye contact and allowing for natural gestures and signaling, which can increase student engagement, reduce transactional distance, and support various learning styles (Okere, 2022). However, the use of lightboard alone does not significantly improve student engagement. As shown in Table 1, adding features like the live production switcher (ATEM switcher) for synchronous teaching and an HDMI mirror for image correction makes the setup suitable for live sessions, but engagement and collaboration are still limited.

**Table 1: Comparative table of normal lightboard with additional features**

| Lightboard                                            | Asynchronous | Synchronous | Material Presentation | Engagement & Collaboration |
|-------------------------------------------------------|--------------|-------------|-----------------------|----------------------------|
| Normal                                                | ✓            | ✗           | ✗                     | ✗                          |
| With ATEM switcher                                    | ✓            | ✓           | ✗                     | ✗                          |
| With ATEM switcher and HDMI mirror                    | ✓            | ✓           | ✓                     | ✗                          |
| ALIVE©:<br>With Mirror, ATEM, BDA and Education Tools | ✓            | ✓           | ✓                     | ✓                          |

Recent research emphasizes that effective online teaching and learning is not achieved through technology alone, but rather through its purposeful integration with sound pedagogical strategies and well-designed educational tools. However, as highlighted by (Norfadilah Kamaruddin, 2017), the effectiveness of technology in education also relies on the interplay of interaction design, information design, and interface design within teaching aids.

One of the simple, yet effective pedagogy method is the Book-End Division Approach (BDA) (Smith et al., 2009). The BDA is an informal active learning, grounded in the How People Learn (HPL) framework (John Bransford, 2002), structures classes into advanced organizing, intermittent discussion, and closure, increasing student cognitive engagement. The active learning strategy, when paired with digital tools, encourages collaborative learning, reflection, and deeper student involvement (Arshad et al.). Hence, the Active Lightboard Virtual Education (ALIVE©) approach was developed to integrates active learning strategy, lightboard technology, and interactive educational tools.

## Methodology

To effectively combine the three components of the ALIVE©, namely the lightboard, the active learning approach (BDA), and educational tools, the design relationship framework proposed by Kamaruddin (2012) is adopted as a guiding structure as shown in Figure 2. This framework emphasizes that the effectiveness of teaching and learning experiences does not solely depend on the use of technology but is facilitated by the integration of three essential design elements: interaction design, information design, and interface design.

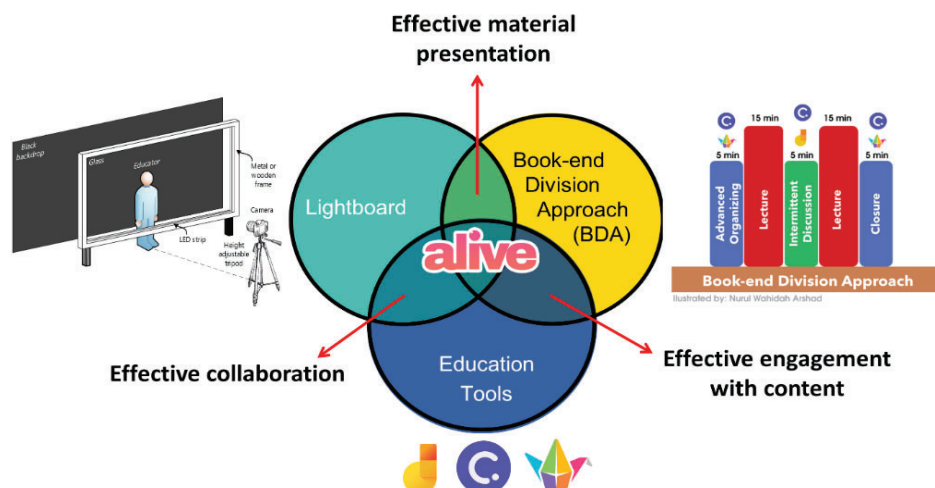


**Figure 2. Active Lightboard Virtual Education (ALIVE©) framework**

The lightboard system serves as a visually engaging medium that enhances the clarity of instructional delivery, especially when combined with HDMI mirroring and the ATEM switcher for both asynchronous and synchronous teaching. To further boost student engagement, the ALIVE© method integrates with BDA, and educational tools such as ClassPoint, Jamboard (currently obsolete and can be replaced by using Canva), and Padlet provide real-time collaboration and feedback, transforming the online class into an interactive learning environment. In this study, ALIVE© was implemented in the Digital Logic Design (BTE3223) course, focus on course outcome 2 (CO2), which is analyzing combinational logic systems using Medium Scale Integrated (MSI) logic design. Each session included advanced organizing activities to introduce topics and assess prior knowledge, live lectures delivered via YouTube Live using the lightboard, intermittent discussions through online platforms, and closure activities for reflection. This comprehensive approach fostered cognitive, social, and teaching presence throughout the course.

The course ran for 14 weeks, with four weekly sessions specifically using the ALIVE method to address CO2. Throughout the course, students accessed various learning materials such as lecture notes, instructional videos, and tutorial questions via the institution's Learning Management System (KALAM) to support their studies. Constructive alignment was emphasized, ensuring that course outcomes, teaching activities, and assessment tasks (including quiz 2 and test 2) were well-coordinated to help students achieve the targeted learning objectives.

The implementation of ALIVE©, as detailed in Table 2, promotes active student participation through advanced organizing activities with Padlet, real-time collaborative problem-solving using Jamboard, and closure sessions for reflection and clarification. This approach keeps students engaged, encourages teamwork, and supports a meaningful and interactive learning experience.

**Table 2: Example of ALIVE© implementation**

| BDA                         | Student involvement                                                                                                                        | Content engagement                                                                                                            |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Opening feedback via Padlet | Collecting feedback on prior knowledge through Padlet, students can establish connections between the new topic and real-life experiences. | Students share their responses and perspectives. The opening question attracts students' curiosity and interest in the topic. |
| Intermittent discussion     | Collaborative learning is enabled through JamBoard, with video showing real-time progress                                                  | Students work together in real-time to solve challenging Karnaugh Map questions,                                              |

|         |                                                                                           |                                                                        |
|---------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
|         | of 6 students from a lightboard towards resolving a question related to the Karnaugh Map. | promoting critical thinking and teamwork.                              |
| Closure | One final question for closure activity where students ask a final question via live chat | Students reflect on the lesson, ask questions, and clarify any doubts. |

## Results and Discussion

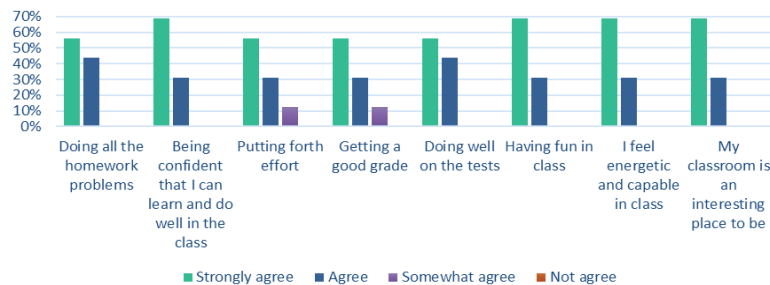


**Figure 3. Positive student attitudes that impact students' motivation**

In this study, the ALIVE© approach was implemented for 60 undergraduate students in a BTE3223 course. At the end of the semester, students completed a classroom survey of student engagement. The effectiveness of ALIVE© was measured through both this engagement survey and course outcome (CO2) attainment. Figure 3 shows nearly 60% of students strongly agreed and about 35% agreed that they actively participated in small group discussions. Similarly, almost 70% strongly agreed and around 30% agreed that they helped their peers, while enjoyment of group work was also high. Nearly 70% of students strongly agreed that they have fun in class, feel energetic and capable, and find the classroom an interesting place to be.

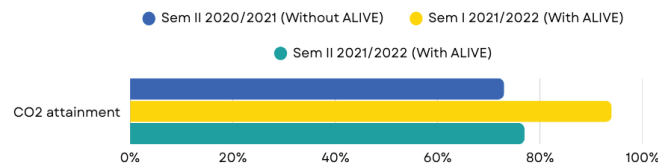


**Figure 4. Comparison of CO2 attainments without ALIVE and with ALIVE**

In addition, Figure 4 demonstrates an increment in CO2 attainment, with an improvement of approximately 17% after adopting the ALIVE© approach. This result underscores the effectiveness of ALIVE© in not only enhancing student engagement but also in supporting measurable academic achievement and course outcome attainment.

## Conclusion

This study demonstrates that integrating active learning strategies with lightboard technology through the ALIVE© approach significantly enhances student engagement, motivation, and academic performance in an online engineering course. By combining the Book-End Division Approach with interactive tools, ALIVE© transforms the virtual classroom into a dynamic, participatory, and student-centered environment. The results show that students became more engaged and collaborative, with measurable improvements in both course grades and learning outcome attainment, including a notable increase in CO2 achievement.

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## Acknowledgements

This work was financed by Universiti Malaysia Pahang Al-Sultan Abdullah (UMPSA) under teaching and learning research grant (PPU230104) and Tabung Persidangan Dalam Negara.

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