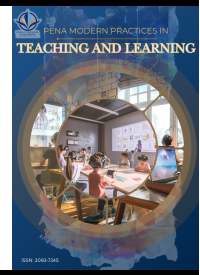




Pena Modern Practices in Teaching and Learning

Journal homepage:
<https://penacendekia.com.my/index.php/pmptl/index>
ISSN: 3093-7345



Study on the Effectiveness and Student Satisfaction towards Motor Control Trainer with Smart Notes

Fatin Nabilah Musa^{1,*}, Turina Tumeran¹, Hasnizah Geno¹

¹ Department of Electrical Engineering, Politeknik Mersing, Johor, Malaysia

ARTICLE INFO	ABSTRACT
Article history: Received 3 October 2025 Received in revised form 22 October 2025 Accepted 15 November 2025 Available online 22 November 2025 Keywords: Motor control trainer; mobile learning application; practical training	This study evaluates the effectiveness and student satisfaction of an innovative Motor Control Trainer integrated with a mobile application for enhancing practical learning in the DET30043 Electrical Machine course at Politeknik Mersing. Conventional motor control trainers are lacking digital support tools and often leave students struggling with abstract principles and inefficient lab exercises. To address this gap, a hybrid learning system combining hands-on trainer hardware with a smart notes mobile app was developed, providing real-time guidance, interactive content and performance feedback. A total of 76 students participated in the study, using the integrated system during lab sessions. Their feedback was collected via structured surveys assessing two key dimensions which are trainer design and functionality as well as smart notes utility. Data analyzed using Statistical Package for the Social Sciences (SPSS) software version 22.0 revealed high satisfaction with a mean value of 4.45. The findings revealed that this innovation helps students better understand motor control concepts, improves their confidence in handling motor starters and enhances the overall learning experience during practical sessions. The majority of students gave positive responses and agreed that the trainer is effective, engaging and suitable for technical education.

1. Introduction

Technical and Vocational Education and Training (TVET) has long been recognized as an important pillar in producing a skilled and competent workforce to support Malaysia's growing industries especially in technical fields [1]. In fact, hands-on learning has always been the backbone of TVET as it equips students not only with theoretical knowledge but also with the practical skills needed to meet industry expectations. The combination of technical expertise and hands-on experience is crucial in preparing graduates for the realities of the workplace, particularly with the rapid growth of technology and Industry 4.0 applications [2].

Despite continuous improvements, Malaysia's TVET system still faces several challenges. One of the main concerns is the gap between the skills taught in training institutions and the actual needs of industries [3]. Research by Rahman *et al.*, [4] demonstrated that traditional teaching methods,

* Corresponding author.
E-mail address: fatin@tvvet.pmj.edu.my

including the use of conventional trainers, often lack interactive features and opportunities for students to reflect on learning after practical sessions.

In response to these challenges, a Motor Control Trainer integrated with a Smart Note application was developed for the DET30043 Electrical Machine students at Politeknik Mersing. This trainer allows students to operate real AC motor control circuits while simultaneously using a mobile application during their lab work. This integration enhances engagement and interactivity in practical learning while promoting reflection and revision of previously learned concepts.

1.1 Problem Statement

Based on the analysis of the Course Learning Outcome (CLO) for DET30043 Electrical Machine Session II: 2022/2023, it was found that students' academic achievement has declined compared to the previous session. This decline raised concerns regarding the effectiveness of existing teaching and learning methods particularly in delivering practical concepts related to motor control systems. Conventional instructional approaches and training tools currently in use may lack interactive and reflective elements and limit students' engagement. Therefore, the Motor Control trainer with Smart Note application was developed as a continuous improvement measure to assist lecturers and students during classroom sessions. This study aims to identify the effectiveness of the trainer with application as a teaching and learning tool at Politeknik Mersing through a questionnaire distributed to respondents.

1.2 Objectives

- i. To evaluate student satisfaction towards the design, functionality and safety features of the Motor Control Trainer.
- ii. To assess student satisfaction towards the design, functionality and performance of the Smart Note application.
- iii. To investigate the students' understanding and confidence in applying motor control principles in using trainers and apps.

1.3 Research Questions

- i. How satisfied are students with the physical design, functionality and safety features of the AC Motor Control Trainer?
- ii. What are students' perceptions of the design, performance and user-friendliness of the Smart Note application?
- iii. Does the integration of the trainer and Smart Note app enhance students' understanding of motor control principles and confidence in practical sessions?

2. Literature Review

One effective method for achieving practical skill acquisition within TVET is through the use of specialized trainers. Specifically, in electrical engineering courses, trainers have been shown to be an excellent way to teach students practical skills. These trainers enable students to practice what they learn in theory by interacting with real equipment. This hands-on learning approach significantly helps students to better understand concepts and prepares them for real jobs [5-8].

Recently, mobile applications have become popular as new teaching tools. These apps let students learn anytime and anywhere using their phones or tablets [9]. Mobile apps for electrical engineering can include virtual labs, tutorials and quizzes that help students understand difficult topics as reported by Hasnan *et al.*, [10]. Using mobile apps together with trainers creates a better learning experience by giving students more ways to practice and get feedback.

At polytechnic level, students often struggle to relate theory to real-world applications due to static lab activities. By introducing interactive elements such as guided digital instructions, smart notes and instant feedback, instructors can bridge the gap between theoretical content and practical applications. This approach creates a more student-centred learning environment which is vital for technical skill development [11].

Smart learning environments combine digital tools like mobile applications, smart notes and IoT devices within traditional learning structures to support blended and flipped learning approaches. These tools enable students to access information at any time, reflect on lab work and interact with peers and instructors through integrated platforms. A recent study by Abdullah *et al.*, [12] involving electrical engineering students in Malaysian TVET institutions found that integrating mobile applications into laboratory training increased student performance and also improved satisfaction levels with the learning experience. Similarly, Samah *et al.*, [13] concluded that smart tools such as gamification during learning activities can positively influence cognitive, behavioural and emotional factors related to student engagement.

3. Methodology

3.1 Design

The Motor Control Trainer integrated with the Smart Note application serves as an innovative teaching aid that combines physical and digital learning experiences. Through interactive features such as wiring diagrams, explanatory videos and embedded web links, the system enables students to gain a deeper understanding of motor control concepts. A key advantage of the Smart Note lies in its flexibility, allowing access to learning materials anytime and anywhere and repeated revision according to individual learning needs. The application also includes interactive quizzes and detailed step-by-step instructions to support practical wiring exercises conducted using the trainer.

Figure 1 presents the Motor Control Trainer, which functions as a physical platform for hands-on wiring of AC motor control circuits. The trainer is equipped with clearly labelled connectors, wiring cables, and assembly tools that facilitate effective practical learning. Meanwhile, the Smart Note operates as a digital learning companion designed to reinforce conceptual understanding through interactive content, structured guidance and self-assessment activities. As shown in Figure 2, the Smart Note interface features intuitive navigation and dynamic visual wiring diagrams that assist students during laboratory sessions, enabling accurate and confident completion of practical tasks.



Fig. 1. Motor control trainer

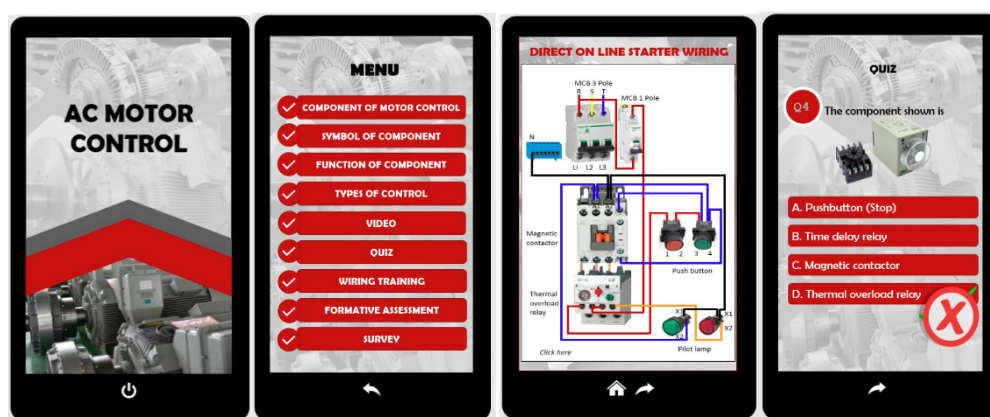


Fig. 2. Smart note interface

3.2 Respondent

The selection of participants for this study was carried out using a purposive sampling technique, targeting students directly involved in the use of the Motor Control Trainer integrated with the Smart Note application. A total of 76 respondents participated in this study, comprising students from the Diploma in Electrical Engineering and Diploma in Electrical & Electronic Engineering programmes at Politeknik Mersing. The sample was drawn from students across Semester 1 to Semester 5 that enrolled in the DET30043 Electrical Machine course as these students were actively engaged in laboratory sessions involving the trainer and application.

3.3 Instrument

The research instrument consists of a questionnaire set for students. Feedback for the questionnaire used in this study will be collected using a 5-point Likert scale, as shown in Table 1.

Table 1

Survey feedback

Scale Point	Description
1	Very Dissatisfied
2	Dissatisfied
3	Uncertain
4	Satisfied
5	Very Satisfied

4. Results and Discussion

This customer satisfaction study focuses on three categories: Section A (trainer hardware), Section B (apps interface) and Section C (learning impact) for students. The score interpretation table is used for the measurement, with reference to Table 2. To determine the degree of inclination for each tested aspect, Table 2 applies the Landell [14] guidelines. It is a sign of extremely low user satisfaction with the trainer if the average score from the data analysis is between 1.00 and 2.33. A mean score of 2.34 to 3.67 indicates a moderate level of user satisfaction, according to the data. However, it is evident that the trainer is doing well and giving users the most satisfaction if the data analysis produces a mean score within the 3.68–5.00 range.

Table 2

Interpretation of minimum scores for Likert Scale

Score range	Interpretation
1.00-2.33	Low level
2.34-3.67	Moderate level
3.68-5.00	High Level

The reliability and internal consistency of the research instrument were confirmed through the calculation of Cronbach's alpha, which yielded a value of 0.985, indicating excellent reliability. This high reliability facilitated efficient data collection, with respondents able to complete the questionnaire without difficulty. Subsequent data analysis was conducted using descriptive statistics, with mean score calculations employed to accurately represent students' satisfaction levels and perceptions across the evaluated categories.

4.1 Section A: Trainer hardware

Table 3 shows the finding of a survey on the trainer hardware. The findings of this study revealed that the item design of the trainer recorded the highest mean score of 4.54. The positive response reflects that the trainer's design effectively facilitates ease of use, clear identification of connection points and supports practical learning activities efficiently. The result aligns with Carlson & Sullivan [15], who emphasized that effective hands-on learning environments require not just functional equipment but also thoughtful design that promotes ease of use, student autonomy and confidence in practical problem-solving activities.

The item user friendly of the trainer and safety features of the trainer recorded the lowest mean value with 4.38. This suggests that students encountered some difficulties in navigating the system or performing connections during the practical sessions. In terms of safety, this reflects student concerns regarding the adequacy of protective components, clear safety instructions, or labelling on the trainer. In order to support a safe, user-centred and productive learning environment, it is crucial that safety and user-friendliness considerations be given top priority in the ongoing development of trainer designs.

Table 3

Trainer hardware

No.	Item	Mean	Level
1	Design of the trainer	4.54	High Level
2	Functionality of the trainer	4.49	High Level
3	Physical build and durability of the trainer	4.49	High Level
4	Quality of the trainer	4.41	High Level
5	Performance of the trainer	4.41	High Level
6	User friendly of the trainer	4.38	High Level
7	Safety features of the trainer	4.38	High Level

4.2 Section B: Apps interface

Table 4 shows the mean scores for all four evaluated aspects of the Smart Note application interface in terms of the design, functionality, performance and user-friendliness were consistently high and closely ranged. This consistency indicates that students were satisfied with the overall usability and quality of the application indicating that the interface was well-designed to support their learning process. The Smart Note application effectively satisfies the fundamental requirements of a quality teaching tool as evidenced by the high and steady mean scores. This positive feedback demonstrates that the application's creation successfully met pedagogical and technical requirements in improving the learning process. The findings are in line with Kamran *et al.* [3], who highlighted that interactive teaching tools with user-friendly, well-designed interfaces significantly improve student engagement and learning outcomes at the tertiary level.

Table 4

Apps interface

No.	Item	Mean	Level
1	Design of the apps interface	4.41	High Level
2	Functionality of the apps interface	4.41	High Level
3	Performance of the apps interface	4.41	High Level
4	User friendly of the apps interface	4.41	High Level

4.3 Section C: Learning Impact

Table 5 revealed that items' understanding of motor control principles, along with the responsiveness and reliability of the trainer consistently recorded high mean values. This indicates that students perceived the integrated Motor Control Trainer with Smart Note application as highly effective in supporting both conceptual learning and practical skills development. The combination of theoretical notes, interactive diagrams and hands-on wiring exercises within the Smart Note environment enabled students to visualize, apply and reflect on motor control concepts, reinforcing deeper learning through active, experiential practice. This support claim was made by Carlson and Sullivan [15] who highlighted that thoughtfully designed, interactive learning environments enhance

engagement, understanding and student autonomy in technical education. Additionally, Amin *et al.* [1], who reported that reliable, well-designed and student-centred laboratory equipment significantly enhances learning outcomes, student motivation and engagement in technical and vocational education settings.

Table 5

Learning impact

No.	Item	Mean	Level
1	Enhance your understanding of motor control principles	4.51	High Level
2	Responsiveness and reliability of the	4.51	High Level

5. Conclusion

The findings of this study indicate that respondents agreed on the effectiveness of using the Motor Control Trainer integrated with the Smart Note application as an innovative tool in the teaching and learning process particularly for AC motor control topics. The analysis revealed that this system had a positive impact on students' understanding and increased their confidence in performing practical exercises. Furthermore, the integration of the Smart Note application, equipped with interactive notes, videos, web links and quizzes serve as an engaging alternative for instructors to diversify their teaching methods. This approach contributes to creating a more interactive, dynamic and less monotonous learning environment for students. It is hoped that this study will serve as a useful reference for educators in designing more creative and effective teaching innovations as well as for other researchers interested in the field of educational technology and teaching aids to better meet the current needs of technical education.

Acknowledgement

This research was not funded by any grant.

References

- [1] Amin, Samir Muhazzab, Siti Shazwani Ahmad Suhaimi, and Nur Shuhamin Nazuri. "The present and future of Malaysian technical and vocational education and training (TVET)." *International Journal of Academic Research in Business and Social Sciences* 13, no. 18 (2023): 107-117. <https://doi.org/10.6007/ijarbss/v13-i18/19952>
- [2] HARUN, ANAS, RUZITA MD YUSOFF, and Ahmad Munzir Zakaria. "Tvet in Malaysia: Capabilities and challenges as viable pathway and educational attainment." *Journal on Technical and Vocational Education* 5, no. 1 (2020): 52-58.
- [3] Kamran, Farrukh, Ayesha Kanwal, Ayesha Afzal, and Shahid Rafiq. "Impact of interactive teaching methods on students learning outcomes at university level." *Journal of Positive School Psychology* 7, no. 7 (2023): 89-105.
- [4] Rahman, Siti Fatimah Abd, Melor Md Yunus, and Harwati Hashim. "An Overview of Flipped Learning Studies in Malaysia." *Arab World English Journal* 10, no. 4 (2019): 194-203. <https://doi.org/10.24093/awej/vol10no4.15>
- [5] Mahizan, Maisarah, and Siti Noor Sha'adah Ali. "Pembangunan dan Keberkesanan Transformer Training Kit sebagai Alat Bantu Mengajar bagi Kursus Electrical Circuit." *Jurnal Pengajian Umum/Journal of General Studies* 4, no. 1 (2024): 52-61.
- [6] Mohamed, Siti Munirah Binti. "Keberkesanan Electric Field Key Accelerator Module Dalam Meningkatkan Kemahiran Menyelesaikan Masalah Electric Field." *Journal on Technical and Vocational Education* 6, no. 2 (2021): 123-160.
- [7] Saim, Aishah, Saharuddin Talib, and Ibrahim Burhan. "The Effectiveness of the Electro-Pneumatic Trainer Embedded with PIC and Visual Basic Platform for Educational Purposes." *Asian Journal of Vocational Education And Humanities* 2, no. 2 (2021): 1-7. <https://doi.org/10.53797/ajvah.v2i2.1.2021>
- [8] Morsin, Marriaty, and Halizah Ali. "Block-Based Development of a Mobile Application in Basic Electrical Concept for Diploma in Electrical Engineering Student." *Journal of Electronic Voltage and Application* 2, no. 2 (2021): 67-74. <https://doi.org/10.30880/jeva.2021.02.02.007>

- [9] Muthu, Nalienaa, Faieza Abdul Aziz, Lili Nurliyana Abdullah, Makhfudzah Mokhtar, Muhd Khaizer Omar, and Muhammad Amir Mustaqim Nazar. "The Mobile Augmented Reality Application for Improving Learning of Electronic Component Module in TVET." *International Journal of Software Engineering and Computer Systems* 9, no. 2 (2023): 82-92. <https://doi.org/10.15282/ijsecs.9.2.2023.2.0113>
- [10] Hasnan, Khairul Anuar, Che Ghani Che Kob, Abu Bakar Mamat, and Arman Shah Abdullah. "Keberkesanan Alat Bantu Mengajar bagi Tangan Kiri Fleming dalam Pengajaran dan Pembelajaran TVET: The Effectiveness of Teaching Aids for Fleming Left Hand in TVET Teaching and Learning." *Journal of Advanced Research in Social and Behavioural Sciences* 12, no. 1 (2018): 77-88.
- [11] Abd Majid, Nazatul Aini, and Nooraidah Kamarudin Husain. "Mobile learning application based on augmented reality for science subject: Isains." *ARNP Journal of Engineering and Applied Sciences* 9, no. 9 (2014): 1455-1460. <https://doi.org/10.1108/14666180010345537>
- [12] Abdullah, Siti Azwanee, Muhammad Sukri Saud, and Yusri Kamin. "M-learning for technical and vocational education training (TVET)." *International Journal of Recent Technology and Engineering* 8, no. 3 (2019): 7236-7239.
- [13] Samah, Laily Abu, Amirah Ismail, and Mohammad Kamrul Hasan. "The effectiveness of gamification for students' engagement in technical and vocational education and training." *International Journal of Advanced Computer Science and Applications* 13, no. 9 (2022). <https://doi.org/10.14569/ijacsa.2022.0130920>
- [14] K. Landell, *Management by Menu*, 3rd ed. (New York: John Wiley & Sons, 1997).
- [15] Carlson, Lawrence E., and Jacquelyn F. Sullivan. "Hands-on engineering: learning by doing in the integrated teaching and learning program." *International Journal of Engineering Education* 15, no. 1 (1999): 20-31.