



Industrial Motor Controller Trainer Board: The Acceptability in Instruction Setting

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Abstract. Industrial motor controller trainer boards are one of the vital pieces of equipment to augment the instructional system nowadays. This can add additional ideas not only for the students but also for the faculty members. The performance of the experimental trainer board was rated outstanding in the aspects of efficiency, safety, promotion of learning, and assembly of parts. Moreover, the efficiency and promotion of learning obtained the highest rank. This means that new designs and recent arrangements of parts contributed to the teaching-learning process for better understanding in motor control lessons. The Experimental trainer board (Improved Industrial Motor Controller Trainer Board) was highly accepted in the aspects of efficiency, safety, promotion of learning, and assembly of parts. Furthermore, the efficiency and promotion of learning obtained the highest rank. The experimental trainer board (Improved Industrial Motor Controller Trainer Board) augments the promotion of learning in motor control lessons.

Keywords: industrial, instruction, motor controller, trainer board

Rationale

In the advancement of the technology, the improved industrial motor controller trainer board has the latest device that can be switched off from distance through remote control, portable, and fixed accessories. The whole trainer can be dismantled and can be moved from one place to another by one person. These are some of qualities that make it better than the existing one. This is one of the major calls for the industries that are the recipients of the growth of technology, it is necessary to cope with the changes. There is a need to train the technical men of this field to have enough knowledge and skills to fit into the present technological set up and requirements of the industry. The technical vocational institutions play an essential role in addressing this challenge, however, instructional equipment used by shop instructors are insufficient or absent to provide the theoretical input for students. Some of the instructional equipment are already obsolete to what are presently utilized in the industry.

This is to contextualize in the interest of alleviating this problem and to enhance the delivery of quality instruction to the students, the researcher was encouraged to modify the construction of motor controller trainer board. Since, this is very useful in the part of instructor. The materials needed are locally available and some could be obtained from recycled materials. This scenario would somehow suffice the inadequacy.

As also the major solution in the cases where a shortage of instructional equipment particularly industrial motor control training board gives a challenging role for shop instructors to facilitate better learning on motor system and operations is experienced. This deficiency contributed to the difficulty of the shop instructors to fully impart the information since the instruction could not be translated to actual demonstration.

The Improved industrial motor control trainer board is a vital tool to the electrical technology. This allows students in constructing different designs in motor controls, observing how the circuit works and in testing how the design control operates. It is also helpful in simulating the present situation in the industry. It has earth leakage circuit breaker for protection against grounding and short circuits, emergency switch, digital measuring instruments, magnetic contactors, relays, timers, pilot bulb for output display and embedded circuit to control the trainer board from distance in times of emergency.

The effectiveness of teaching depends upon the instructional materials that are used and employed by the teacher in the teaching-learning process. The researcher's project can be effective instructional materials in the teaching-learning process in motor control subject hence, students can put to actual practice their lessons in the classroom.

Reports on effects of using instructional technology in colleges and universities said that the use of instructional technology in colleges has come a long way during the last four decades. Over the years, instructional technology has proven to be increasingly helpful for improving learning in college courses (Kujik, 2008)

To solve the inadequacy of instructional device in electro-mechanical shop, Lardizabal (1998) used supplies and materials which were available locally. Baclaran's study and that of the researcher's show one common objective, to develop an instructional device for laboratory instructions.

A circuit trainer was successfully designed by Capuno, to help the teacher in enhancing the various skills of the students in advanced circuitry in a more meaningful way. He further revealed that the trainer is capable of demonstrating the operation of relay and developing practical skills among students through circuit analysis (Patron, 2006). The study of Capuno and that of the researcher are related in as much as both have the same concern in motor control. The study of the researcher on improved industrial motor controller trainer board has additional features to ensure security from any possible untoward incident to the trainee while manipulating the trainer.

Research entitled "Digital Logic Trainer: A Self-paced Instructional Device for Electrical and Electronics Technology", Moberg (1987) emphasized that it also serves as a training device with self-paced instruction to the students in terms of prototyping circuits, troubleshooting and performing various experiments for skills development. Research shows similar aim to develop a trainer as an aid for instruction in electrical technology, moreover, his recommendation also motivates the researcher to modify old equipment in meeting the efficiency and effectiveness in delivering education. The researcher's project can handle high voltage ranging 110 – 250 volts

and high amount of current and mainly concern on electrical motor control while digital logic control highly focused on electronics.

To realize the aforementioned provision, schools should improve all areas in instruction. This includes improving the instructional device that can be used in instructions. The study is an essential tool for instruction to deliver quality education, specifically in the field of electrical technology.

Objectives

This study aims to present and create the improved industrial motor controller trainer board for instruction particularly on its acceptability.

Methodology

This study uses the quasi-experimental research design that employs the used of research questionnaires and was distributed to the electrical instructors and students in Bohol Island State University to assess the level of acceptability of the improved trainer board. There were 22 students and 10 instructors who were involved in three trials of the improved industrial motor controller trainer board. The existing unit was also exposed to the participants for them to compare. Questionnaires were distributed to the students to assess the level of performance of the device. Moreover, the researcher distributed another questionnaire to the electrical instructors and students to assess the acceptability of the improved trainer board.

Research Environment and Participants. The locale of this study was the Bohol Island State University (BISU-Calape Campus), one of the satellite campuses of BISU, the only state university in Bohol. It is located forty-two (42) kilometers from the capital of Bohol, Tagbilaran City. BISU-Calape is offering Bachelor of Science in Industrial Technology major in electricity. Subjects such as Industrial Motor Controller and Industrial Electronics are part of the course where the trainer board is needed to make the delivery of instruction more comprehensive and realistic.

Research Instruments. A self-made questionnaire was designed as a main tool in gathering data to evaluate the level of performance of the improved trainer board as perceived by the electrical instructors and students. Questionnaires cover the items in efficiency, safety, promote learning, and assembly of parts of the improved industrial motor controller trainer board.

Research Procedure. Construction of the Trainer Board. Needed tools such as hacksaw, pull push rule, side cutting pliers, long nose pliers, drill bit, soldering gun, desoldering tool, screw driver, flat file, round file, blade cutter and electric drill were secured. Materials such as digital measuring instrument, push button switch, and earth leakage circuit breaker were borrowed from the BISU- Calape with the consent of the Campus Director since this instructional device will be used by the instructors who are handling the subject in Industrial Motor Controller. To complete the needed components in the construction, the researcher bought some materials such as plastic board, radio frequency remote control, under over voltage sensor, time delay timers, pilot lamp, light emitting diode, soldering lead, banana jack, wires, bolt and nut, and AC-DC power supply.

The researcher also tested the recycled magnetic contactor and overload relay to ensure its normal operation.

Statistical Treatment. Data were analyzed using the SPSS version 24. The data includes the descriptive statistics which is the mean and inferential statistics which is the t-test to facilitate the level of responses from students and faculty.

Results and Discussion

Acceptability

The study only focuses on the acceptability of the designed product that is being evaluated by the students and selected faculty members. Results of the study are being shown in table. Table 1 presents the acceptability of the Improved Industrial Motor Controller Trainer Board (experimental) in terms of efficiency as perceived by electrical instructors and electrical students.

Trials 1, 2 and 3 were described as highly accepted by the respondents having an average weighted mean of 4.65 described as highly accepted. It shows that trainer execute the required output thus respondents accepted the trainer board since this is a relevant instructional device to the course.

Item circuit control of a roll-on-roll-off shutter door ranked 1 with a weighted mean 4.72 rated highly accepted illustrates that the trainer easily performs the circuit control though it is complicated where it needs several push buttons switch to perform the operation.

Those items ranked 5 still described as highly accepted. The trainer performs the circuit control which varies only through switch.

Sequential motor control got the lowest rank with a weighted mean of 4.53 described as highly accepted since this control is quite complicated but the trainer can still perform on it.

Table 1. Acceptability of Efficiency of the Improved Industrial Motor Controller Trainer Board

N=32

	EFFICIENCY	WM	DESCRIPTIO N	RANK
Trial 1	a. Simulates the circuit control of a roll-on-roll off shutter door.	4.72	Highly Accepted	1
	b. Demonstrates start-stop motor control.	4.66	Highly Accepted	5
	c. Illustrates start-stop in two locations.	4.66	Highly Accepted	5
Trial 2	a. Simulates the sequential circuit control of a water tank.	4.53	Highly Accepted	9
	b. Demonstrates stop forward-reverse.	4.66	Highly Accepted	5
	c. Demonstrates stop forward-reverse with inching station.	4.63	Highly Accepted	8

Trial 3	a. Illustrates stop forward-reverse with automatic reversing.	4.66	Highly Accepted	5
	b. Demonstrates stop-start, star-delta motor control.	4.66	Highly Accepted	5
	c. Shows part-winding motor control.	4.69	Highly Accepted	2
AVERAGE		4.65	Highly Accepted	

Table 2 presents the acceptability of safety of the Improved Industrial Motor Controller Trainer Board.

Items manual emergency switch has served its purpose obtained the highest weighted mean of 4.75 which ranked 1 demonstrates that respondents found out that manual emergency switch is noticeable, visible and easy to press if emergency occurs.

Remote control shuts-off the trainer board from distant far ranked 2 with a weighted mean of 4.69 described as highly accepted because it adds to the security to both students and equipment's to more damage where it can shuts-off the trainer board from distance if accident will happen.

The capability of the trainer board to handle high voltage ranging 110 – 250 volts described as moderately accepted appeared to be the lowest weighted mean of 4.41, ranked 9 because respondents would like and expected that the trainer board design can handle voltage above 250 volts.

The average weighted mean of 4.58 rated as highly accepted illustrates that respondents perceived the Improved Industrial Motor Controller Trainer Board met its prescribed design to safeguard equipment's from further damage and students from serious injuries as added information in the study of Tranh Vo-Duy et al, 2020.

Table 2. Acceptability of Safety of the Improved Industrial Motor Controller Trainer Board

N=32

SAFETY	WM	DESCRIPTIO N	RANK
1. Demonstrates that earth leakage circuit breaker automatically shuts-off during short circuits.	4.63	Highly Accepted	4
2. Demonstrates that manual emergency switch has served its purpose.	4.75	Highly Accepted	1
3. Demonstrates that remote control can shut-off the trainer in times of emergency.	4.69	Highly Accepted	2
4. Illustrates that conductors are properly insulated.	4.66	Highly Accepted	3
5. Shows proper connections of the wirings.	4.47	Moderately Accepted	8
6. Shows that the wiring connection does not have loose contact.	4.53	Highly Accepted	6.5
7. Illustrates that safety devices function to their	4.53	Highly Accepted	6.5

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purpose.			
8. Demonstrates that it can handle high voltage ranging 110 – 250 volts.	4.41	Moderately Accepted	9
9. Shows that wiring connections are properly enclosed.	4.59	Highly Accepted	5
AVERAGE	4.58	Highly Accepted	

Table 3 presents the acceptability of the Improved Industrial Motor Controller Trainer Board in terms of promotion of learning. All respondents described the items under promotion of learning as highly accepted with an average weighted mean of 4.65 indicates that the Improved Industrial Motor Controller Trainer Board has the capability to promote learning among electrical students and a relevant instructional device in the course of Bachelor of Science in Industrial Technology major in Electricity.

Items develop students' creativity in motor control designs and builds up students' potentials in motor control has the highest weighted mean of 4.88 and 4.69 highly accepted ranked 1 and 2 respectively since they can perform their own design using the trainer where the process will become visible through the manipulation of their control circuit in the trainer board.

Table 3. Acceptability of Promotion of learning of the Improved Industrial Motor Controller Trainer Board

N=32

PROMOTION OF LEARNING	WM	DESCRIPTIO N	RAN K
1. Develops creativity in motor control designs.	4.88	Highly Accepted	1
2. Builds up students' potentials and discover talents in motor control.	4.69	Highly Accepted	2
3. Facilitates the teaching and learning process for a more comprehensive motor control lesson.	4.66	Highly Accepted	3
4. Builds students' self-confidence in troubleshooting motor control.	4.59	Highly Accepted	5.5
5. Enhances the delivery of motor control lesson.	4.56	Highly Accepted	7
6. Makes the students more skillful in motor control.	4.59	Highly Accepted	5.5
7. Improves the comprehension on how motor control is constructed and connected.	4.63	Highly Accepted	4
AVERAGE	4.65	Highly Accepted	

With the trainer board, students become skillful and build their self-confidence in troubleshooting motor control obtain the same weighted mean of 4.59 highly accepted ranked 5.5 since they can practice the control circuit and test the operation thus, making them familiar in interlocking with the different kinds in motor control circuits.

The trainer board enhances the delivery of motor control lesson got the lowest weighted mean of 4.5 ranked 7 but still described as highly accepted demonstrates that the Improved

Industrial Motor Controller Trainer Board cannot address and facilitate entirely some of the respondents' request and desires much more in the study of Chaouch, S. *et al.*, 2018.

Table 4. Acceptability of Assembly of Parts of the Improved Industrial Motor Controller Trainer Board

N=32

ASSEMBLY OF THE PARTS	WM	DESCRIPTIO N	RAN K
1. Shows that parts are properly labeled.	4.50	Moderately Accepted	8
2. Shows that installed parts are arranged.	4.44	Moderately Accepted	9
3. Shows that parts are intact and immovable.	4.56	Highly Accepted	6.5
4. Shows that wiring of the parts is in proper position.	4.63	Highly Accepted	1
5. Illustrates that parts can be assembled and dismantled.	4.63	Highly Accepted	1
6. Illustrates that the parts function as indicated.	4.59	Highly Accepted	4.5
7. Shows recent technology concepts through its parts.	4.56	Highly Accepted	6.5
8. Shows legible markings and labels of the parts.	4.59	Highly Accepted	4.5
9. Displays the connections, switches, contactors and light indicators which are easy to manipulate.	4.63	Highly Accepted	1
AVERAGE	4.57	Highly Accepted	

Table 4 presents the acceptability of the Improved Industrial Motor Controller Trainer Board in the aspect of assembly of the parts.

The trainer board can be assembled and dismantled, wirings of the parts in proper position, and switches, contactors and light indicators easy to manipulate all obtained the weighted mean of 4.63 highly accepted and ranked 1. This shows that respondents prefer the design of the trainer board where the table-support can be assembled and dismantled for safekeeping purpose however, parts are permanently installed for direct use.

The arrangements of the installed parts in the trainer board got the lowest weighted mean of 4.44 described as moderately accepted ranked 9, illustrates that respondents partly accepted the fixed set-up of the parts particularly the position of the magnetic contactors, push button switch and jumpers.

The same table reveals the average weighted mean of 4.57 highly accepted demonstrates that its new design, some modern gadgets, and use of recycled materials were accepted by the respondents.

Table 5 presents the summary of the acceptability of the Improved Industrial Motor Controller Trainer Board in the aspects of efficiency, safety, promotion of learning and assembly of the parts.

Table 5. Summary of Acceptability of the Improved Industrial Motor Controller Trainer Board

N=32

CRITERIA	AVERAGE WEIGHTED MEAN	DESCRIPTION	RANK
Efficiency	4.65	Highly Accepted	1
Safety	4.58	Highly Accepted	3
Promotion of learning	4.65	Highly Accepted	1
Assembly of the parts	4.57	Highly Accepted	4
Average	4.61	Highly Accepted	

Efficiency and promotion of learning were ranked 1 with an average weighted mean of 4.65 highly accepted shows that the improved industrial motor controller trainer board has the capability to facilitate the teaching-learning process in motor control lesson.

The protection of students from untoward accident and equipment's from being damage in using the trainer board ranked number 3 with an average weighted mean of 4.58 described as highly accepted demonstrates that protective device installed function to its purpose, however, it does not guarantee total safety since 220 volts power supply is needed to operate the trainer board which is a potential danger, thus, precautions is highly advised.

Assembly of the parts got the lowest rank of 4 with an average weighted mean of 4.57 highly accepted shows that some parts used in the trainer board has concept in recent technology were appreciated, however respondents understand that there is still a need of acquiring more modern gadgets to supplement students' needs of information in Industrial Technology.

In summary, acceptability of efficiency and promotion of learning were ranked 1 since it is a relevant instructional device in the course of BSIT-Electricity. Motor control is still currently used in prevailing industries. Safety and assembly of parts were ranked 3 and 4 since students are still exposed to 220 volts which is still danger and the parts may not be the latest in the field of technology.

Conclusion

The experimental trainer board (Improved Industrial Motor Controller Trainer Board) augment the promotion of learning in motor control lesson. The performance of existing trainer board in the aspects of efficiency, safety, promotion of learning and assembly of parts is enhanced in the experimental trainer board (Improved Industrial Motor Controller Trainer Board) and Experimental trainer board (Improved Industrial Motor Controller Trainer Board) is a significant instructional device in Electrical Technology.

References

Chaouch , S. *et al.*, "DC-Motor Control Using Arduino-Uno Board for Wire-Feed System," 2018 *International Conference on Electrical Sciences and Technologies in Maghreb (CISTEM)*, Algiers, Algeria, 2018, pp. 1-6, doi: 10.1109/CISTEM.2018.8613492, from <https://ieeexplore.ieee.org/abstract/document/8613492>

- Keljik, J. (2008). *Electricity 4 AC/DC motors, controls and maintenance*. Thomson, Delmar Learning.
- Lardizabal, A, et. al. (1998). *Principles and methods in teaching*. Phoenix Publishing House, Inc.
- Maloney, T. (2000). *Modern industrial electronics*. Pearson Education Asia Pte. Ltd.
- Moberg, G. (1987). *AC and DC motor control*. JMC Press, Incorporated.
- Patron, J. (2006). *Laws on education with implementing rules and regulations*. Neo Asia Publishing, Inc.
- Tranh Vo-Duy, Minh C. Ta, Bao-Huy Nguyen and Joao Pedro F. Travao. 2020. *Experimental Platform for Evaluaton of On-board Real Time Motion Controller for Electric Vehicles*. <https://doi.org/10.3390/en13236448> from <https://www.mdpi.com/1996-1073/13/23/6448>