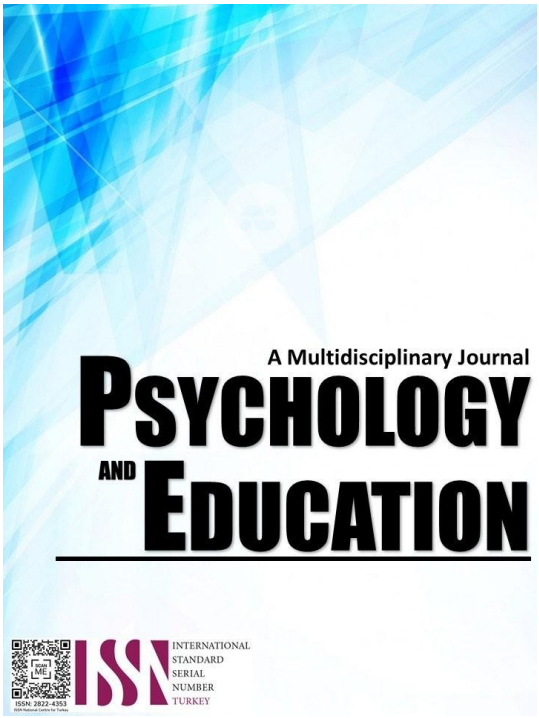
EVALUATION OF A DEVELOPED FIRE ALARM CONTROL PANEL FOR TRAINING: A COMPARATIVE STUDY OF TEACHER-EXPERTS AND LEARNERS



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Research Article

Evaluation of a Developed Fire Alarm Control Panel for Training: A Comparative Study of Teacher-Experts and Learners

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Abstract

This research evaluated the acceptability and functionality of the improvised fire alarm control panel designed as a substitute training equipment for the Don Andres Soriano National High School Grade 12 learners in Technical-Vocational-Livelihood specializing in Electrical Installation and Maintenance in preparation for the National Certificate Level II (NCII) Assessment to be conducted by the Technical Education and Skills Development Authority (TESDA). Primarily, the study employed quantitative-descriptive analysis to assess the level of acceptability and functionality of the improvised fire alarm control panel, as well as its usefulness, effectiveness, and safety as instructional material in teaching. Although there was a significant difference between learners' and teacher-experts' ratings—particularly in aspects of usability and complexity—the control panel was deemed highly acceptable overall. Specifically, the study assessed the perceptions of both 40 learners and 10 teacher-experts, revealing that despite a significant difference in their ratings, the control panel was highly acceptable overall. Teacher-experts rated the control panel favorably, particularly in terms of functionality, effectiveness, usefulness, and safety, meeting the required standards for smoke/heat detectors, manual call points, and initiating devices. Learners also found the control panel highly acceptable, noting that it enhanced their skills in circuit connection, troubleshooting, and hands-on activities. They believed it increased their chances of passing the NCII assessment and developed their initiative as future electrical practitioners. The study highlighted the importance of addressing learners' usability challenges, particularly in troubleshooting and circuit connection, suggesting future revisions in the design and supplementary training materials. Ultimately, the research highlighted the potential of the improvised fire alarm control panel to enhance teacher-learner engagement and practical competencies, while recommending simplifications to the design and the inclusion of more comprehensive training materials to improve its usability for learners further.

Keywords: *Technical Vocational Education, Improvised Fire Alarm Control Panel, quantitative-descriptive analysis, Toledo City, Philippines*

Introduction

Practical training is essential in vocational education, particularly in electrical installation and maintenance, where hands-on skills are critical. This study aims to evaluate an improvised fire alarm control panel (FACP) designed to enhance the Grade 12 Electrical Installation and Maintenance National Certificate (NC) Level II training experience. As Smith and Johnson (2018) noted, practical experience is essential in vocational education, especially in technical fields like electrical work, where hands-on skills are critical. Similarly, Brown and Jones (2020) emphasize the role of innovative tools like the improvised FACP in improving students' learning outcomes. The National Center for Construction Education and Research (2019) curriculum standards enable educators to tailor training exercises to meet industry standards and individual learning objectives through the use of an adaptable FACP, which is flexible in both design and functionality.

In line with DepEd Order No. 54, s. 2022, and Technical Education and Skills Development Authority's (TESDA) NCII assessment guidelines, the improvised FACP aligns with national objectives for enhancing technical skills and ensuring learners are prepared for employment or entrepreneurship. This tool aims to bridge the gap caused by limited resources, aligning with the Philippine Development Plan's emphasis on lifelong learning and skills development.

One of the major challenges in Electrical Installation and Maintenance (EIM) training is the lack of affordable fire alarm control panels, as commercially available units typically cost around ₱22,000 or more. This financial barrier restricts access to necessary equipment, limiting both teacher instruction and student learning.

This study aims to provide a cost-effective solution by evaluating an improved FACP that costs significantly less (₱2,000 to ₱3,000), making it more accessible for schools nationwide. This innovation aims to not only improve students' understanding of fire alarm systems but also increase the passing rate of EIM NCII assessments.

The findings of this study could address the shortage of fire alarm control panels in EIM NCII training across schools, providing a replicable model for other institutions. By sharing this innovation, the study contributes to enhancing teacher-student engagement and helping more learners achieve certification in Electrical Installation and Maintenance.

Research Questions

This research aimed to evaluate the acceptability of an improvised fire alarm control panel as an enhancement to the Grade 12 Electrical Installation and Maintenance training at Don Andres Soriano National High School, Barangay Don Andres Soriano, Toledo City, Cebu,

during the school year 2024-2025, as the basis for a training guide. Specifically, this aimed to answer the following questions:

1. What is the demographic profile of the respondent groups:
    1.1. teacher-experts
        1.1.1. age and gender;
        1.1.2. highest educational attainment; and
        1.1.3. number of years in teaching/working in electrical/industry
    1.2. learners
        1.2.1. age and gender; and
        1.2.2. grade level?
2. What is the technical requirement of the improvised fire alarm control panel in terms of circuit design?
3. How was the functionality of the developed improvised fire alarm control panel as assessed by the teacher-experts and learners in terms of:
    3.1. sensitivity of the smoke and heat detectors;
    3.2. responsiveness of the improvised fire alarm control panel to the manual call point; and
    3.3. sensitivity to the notification devices?
4. As perceived by the teacher-experts and learners, what is the level of acceptability of the improvised fire alarm control panel in terms of:
    4.1. usefulness;
    4.2. effectiveness; and
    4.3. safety?
5. Is there a significant mean difference between the level of acceptability as assessed by the teacher-experts and learners?
6. Based on the findings, what training guide can be developed?

Literature Review

Innovative Teaching and Active Learning

Using new teaching strategies has become important for improving student engagement and learning outcomes, especially in technical-vocational education. According to Prince (2004), active learning involves students participating in tasks instead of just absorbing information. This approach promotes a deeper understanding and better retention of knowledge. Techniques like group discussions, problem-solving tasks, and hands-on experiments are essential.

Freeman et al. (2014) supported this idea by showing that adding interactive activities, multimedia content, and real-life applications boosts student motivation and engagement. These strategies make learning more enjoyable and relevant. They also encourage students to take an active role in their own learning, leading to a better understanding and improved performance.

Creativity and Student Empowerment in the Classroom

New teaching methods also encourage creativity, critical thinking, and problem-solving skills in students. Robinson (2011) highlighted that environments that support experimentation, reflection, and repeated learning help develop a growth mindset. In these classrooms, mistakes are viewed as chances to learn, which motivates students to explore new ideas and actively participate in their education.

In technical-vocational education, especially in Electrical Installation and Maintenance (EIM), learners need to use theoretical concepts through practical, real-world tasks. Innovative equipment, such as improvised tools, can provide accessible and effective alternatives for schools that lack standard instructional materials.

Experiential Learning and the Theory of John Dewey

The basis of this research is John Dewey's theory of experiential learning, which claims that learners build knowledge most effectively through direct experiences. Dewey promoted "learning by doing," suggesting that real learning occurs when students engage in meaningful, hands-on activities that relate to real-world problems (Main, 2023).

Dewey's approach to problem-based learning also supports the idea that students develop a deeper understanding when they apply their knowledge to solve real issues. This is especially important in EIM, where developing technical skills goes beyond textbook learning or lectures. According to Reese (2011), the "learning by doing" model includes various forms like trial-and-error learning, discovery-based learning, and practice-theory-practice cycles, which are crucial for mastering skills.

Addressing Equipment Shortages in Technical-Vocational Education

Despite the proven benefits of experiential learning, many public schools, especially in the Philippines, face significant challenges because of a lack of instructional tools and equipment. These limitations hinder the use of demonstration-based and hands-on teaching methods, which are essential for delivering high-quality TVL education. In response, the use of improvised instructional devices, such as the fire alarm control panel introduced in this study, offers a practical solution for schools with limited resources.

The goals of this instructional innovation match the Technical Education and Skills Development Act of 1994 (TESDA Law), which stresses the need for accessible, high-quality, and industry-relevant training for Filipino learners. By integrating improvised tools into classroom instruction, teachers can still deliver meaningful learning experiences that meet national training standards and prepare students for the NCII assessment.

Methodology

Research Design

This study used a quantitative-descriptive analysis of an improvised fire alarm control panel. The research evaluated the improvised fire alarm control panel to address the equipment shortage in EIM NCII training. The assessment specifically covered the dimensions of functionality and acceptability.

After utilizing the improvised fire alarm control panel, the innovation was evaluated, and the results were collected from the teacher-experts and learner respondents using questionnaires. Careful observation of the utilization of this innovation was ensured to determine significant results. Appropriate statistical tools were used to treat the collected data.

Respondents

Electrical teacher-experts and learners were the respondents of the study. Experts were composed of ten (10) individuals who are currently teaching Electrical subjects, and some are working in the industry. Forty (40) learners are currently enrolled in this subject in the current school year at Don Andres Soriano National High School.

Table 1. *Distribution of Respondents*

	F	*Percentage*
Teacher-experts	10	20.00
Learners	40	80.00
Total	50	100.00

Teacher-experts can provide valuable insights into the effectiveness of the improvised fire alarm control panel for educational purposes, as well as feedback on its integration into the curriculum.

On the other hand, learners can offer feedback on their learning experiences with the improvised equipment, its usability, and how it enhances their understanding of electrical installation and maintenance concepts. Including perspectives from both the experts and learners can provide a comprehensive understanding of the impact and effectiveness of the improvised fire alarm control panel in the educational setting.

Instrument

Self-made questionnaires were developed and evaluated by experts in the electrical field and in teaching-learning at Cebu Technological University-Main Campus to ensure the alignment and consistency of the questions, as well as their reliability and validity. This was achieved by administering the research instrument to a small group of learners enrolled in the Grade 12 TVL major in Electrical Installation and Maintenance for pilot testing to determine if the instrument really evaluates or assesses what it is intended to measure. The instrument utilized a 5-point Likert Scale, (1) not acceptable, (2) slightly acceptable, (3) acceptable, (4) moderately acceptable, and (5) highly acceptable.

These questionnaires were designed to extract detailed quantitative and descriptive information on participants' experiences and perspectives for the possible improvements and modifications to be integrated with the improvised fire alarm control panel.

Procedure

A request letter to conduct a study was sent to the office of the school principal of Don Andres Soriano National High School, where the study took place.

Questionnaires were personally administered to the grade 12 EIM learners and teacher-experts to make sure that each item was carefully read and answered. Respondents put a check mark in the specific numerical and descriptive indicator provided. The completed questionnaires were immediately retrieved for validation and consolidation of the significant results of using the improvised fire alarm control panel for enhanced and intensified training in electrical installation and maintenance learners at Don Andres Soriano National High School.

The results were interpreted and expressed quantitatively and qualitatively.

Data Analysis

The collected data from the respondents were analyzed and interpreted through the following:

Mean. This was utilized to determine the measure of the central position of the test results.

Standard Deviation. This was used to quantify the amount of variation or dispersion in a set of data values.

T-test. This was used to determine the result and to present whether there was any significant difference in the acceptability of the improvised fire alarm control panel as assessed by the respondent groups.

Ethical Consideration

This study followed ethical standards to protect the rights, dignity, and safety of all participants. Before collecting data, the researcher got permission from the school head and relevant authorities to carry out the study with senior high school students enrolled in Grade 12 Electrical Installation and Maintenance (EIM). All participants were informed about the nature, purpose, and procedures of the research. Informed consent was obtained from each participant, and for minors, parental consent was also requested.

Confidentiality and anonymity were strictly upheld; no names or personally identifiable information appeared in the research report. The data collected was used only for academic purposes and was stored securely to prevent unauthorized access. The researcher made sure that no physical, emotional, or academic harm occurred to the participants during the study.

Results and Discussion

This section presents, analyzes, and interprets the gathered data in the study. The data were taken from the forty (40) Electrical Installation and Maintenance learners and ten (10) teacher-experts in the field.

Demographic Profile

Understanding the demographic profile of teacher-expert and learner respondents is critical for determining the relevance and trustworthiness of their contributions to this study. The age, gender, and years of teaching or industrial experience of the teacher-experts and learners can help contextualize the data.

By examining their demographic profile, the study obtains vital context, increasing the trustworthiness of the findings and ensuring that the improvised fire alarm control panel satisfies the standards required for effective technical and vocational education and addresses possible gaps.

Age and Gender of the Teacher-Experts

The age distribution of teacher-experts plays a significant role in understanding the diversity of perspectives and experiences they bring to the study. The age brackets—below 22 years old, 22-25 years old, 26-30 years old, and 30 years old or above—highlight the range of professional maturity and exposure within the group. Gender is also indicated as male and female.

Table 2. *Age and Gender of Teacher-Experts*

Age (in years)	Female (f)	%	Male (f)	%	Total (f)	%
Below 22 years old	0	0%	2	20%	2	20%
22-25 years old	1	10%	2	20%	3	30%
26-30 years old	0	0%	3	30%	3	30%
30 years old or above	0	0%	2	20%	2	20%
Total	1	10%	9	90%	10	100%
Over-all Mean			26.65			

As presented in Table 2, two or 20 percent of teacher-expert respondents were below 22 years old, and they were all males. Three or 30 percent were within the range of 22-25 years old, one was female, and two were males. Three or 30 percent were within the range of 26-30 years old, and they were all male. And two or 20 percent were 30 years old and above; they were all males.

Collecting demographic data ensures diverse representation and helps identify potential biases in the study (Creswell & Creswell, 2018).

Table 2 shows a gender gap among teacher-expert respondents, with a significant majority of males across all age categories and only one female responder aged 22-25. This indicates that the sector may be dominated by men, particularly in technical-vocational education and the electrical industry, which could have an impact on teaching techniques, perspectives, and representation.

Highest Educational Attainment of Teacher-Experts

Educational attainment is a critical factor in evaluating the expertise and credibility of teacher-experts. It reflects their preparedness to deliver quality education and contribute effectively to studies aimed at improving instructional tools and methods. The education brackets are Bachelor's Degree, with MA units, Master's Degree, Doctoral Units, and Doctorate for the teacher-experts to choose from.

Table 3 presents that four or 40 percent of the teacher-experts had a Bachelor's Degree, three or 30 percent had an MA, two or 20 percent had a Master's Degree, one or 10 percent had a doctoral degree, and none or zero percent held a Doctorate Degree.

Collecting data about the educational background of the respondents aligns with research by Darling-Hammond (2000), which emphasizes that teachers with advanced degrees tend to demonstrate stronger content knowledge and teaching strategies. The presence of respondents with master's and doctoral qualifications ensures that the study benefits from a well-rounded perspective, combining

theoretical knowledge with practical insights.

Table 3. *Highest Educational Attainment of Teacher-Experts*

Highest Educational Attainment	*Frequency (f)*	*Percentage (%)*
Bachelor's Degree	4	40%
With MA Units	3	30%
Master's Degree	2	20%
With Doctoral Units	1	10%
Doctorate	0	0%
Total	10	100%
Over-all Mean	2.0	

The educational attainment of teacher-experts underscores their capacity to provide informed feedback, ensuring the validity and reliability of the study's findings. Their academic backgrounds support the development of tools that meet both educational standards and industry requirements, enhancing the effectiveness of technical-vocational education.

Teacher-Experts' Number of Years in Teaching/ Working in Electrical/ Industry

Years in teaching or industry contribute to the ability to mentor others, as seasoned professionals often have a nuanced understanding of both technical skills and complex knowledge in the field of electrical installation and maintenance. The years of experience brackets—below 2 years, 3-5 years, 6-10 years, and 11 years and up—emphasize the skills gained during the time of experience.

As presented in Table 4 below, 20 percent of the teacher-expert respondents, or two out of 10, had 2 years or less experience, and they were all male. Four or 40 percent of the teacher-expert respondents have three to five years of experience; one is female, and three are males. Three or 30 percent of the teacher-expert respondents have 6-10 years of experience, and they were all males. One or 10 percent of the teacher respondents have 11 years or more experience, and are male.

Table 4. *Number of Years in Teaching/ Working in Electrical/ Industry*

Years of Experience	*Female (f)*	*%*	*Male (f)*	*%*	*Total (f)*	*%*
Below 2 years	0	0%	2	20%	2	20%
3-5 years	1	10%	3	30%	4	40%
6-10 years	0	0%	3	30%	3	30%
11 years and above	0	0%	1	10%	1	10%
Total	1	10%	9	90%	10	100%
Over-all Mean			5.4			

Experience is important in the study because it directly determines the depth of expertise, the quality of training, and the effectiveness with which real-world difficulties are addressed. In technical-vocational education, particularly in areas such as electrical installation and maintenance, competent teachers bridge the gap between academic understanding and practical application.

Shulman (1987) underlined that hands-on experience is critical for properly teaching complicated tasks because it allows learners to build industry-relevant abilities. Furthermore, experienced educators are more likely to have a full awareness of industry norms and practices.

Age and Gender of the Learners

The age distribution of learners plays a significant role in understanding the diversity of perspectives and experiences they bring to the study. Age groups—below 16, 16–17, 18–19, and 20 or older—reflect varying levels of learning experiences, which can influence their learning needs and outcomes. Additionally, identifying gender as male or female provides valuable insights into how different demographics engage with and benefit from the study.

Table 5. *Age and Gender of the Learners*

Age (in years)	*Female (f)*	*%*	*Male (f)*	*%*	*Total (f)*	*%*
Below 16 years old	0	0%	5	12.5%	5	12.5%
16-17 years old	1	2.5%	20	50%	21	52.5%
18-19 years old	0	0%	10	25%	10	25%
20 years old or above	0	0%	4	10%	4	10%
Total	1	2.5%	39	97.5%	40	100%
Over-all Mean			17.16			

Table 5 shows that five or 12.5 percent of the learners were 16 years old or younger, and they were all male. 21 learners, or 52.5 percent, were between the ages of 16 and 17, with one female and 20 males. Ten or twenty-five percent of the learners were 18 to 19 years old, and they were all male. Additionally, four to ten percent of the learners were 20 years old or older, and all were male.

According to research, gender diversity in educational programs fosters innovation, inclusion, and the development of collaborative skills, all of which are essential for success in technical professions (UNESCO, 2017).

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Grade Level of the learners

The learners' grade level is an important component in determining their preparation, prior knowledge, and ability to connect with the study's technical content. Learners at higher grade levels, such as Grade 11 or 12, are more likely to have a strong foundation in basic technical and vocational abilities, making them more prepared for advanced topics, specifically, electrical installation and maintenance.

Table 6. *Grade Level of the Learners*

Grade Level	*Frequency (f)*	*Percentage (%)*
Grade 11	0	0%
Grade 12	40	100%
Total	40	100%

As presented in Table 6, 40 or 100 percent of the learners were in Grade 12, and none or zero percent were in Grade 11.

Recognizing learners' grade levels enables educators to implement differentiated instruction, tailoring instruction to address varying readiness levels, interests, and learning profiles. Grade-specific identification ensures that the curriculum meets both academic standards and individual needs (Tomlinson, 2001).

Research has demonstrated the need to focus on senior high school learners in TVL in electrical installation and maintenance, specifically Grade 12, as these learners are preparing for the NCII assessment and will be the first group to utilize the improvised fire alarm control panel.

Technical Requirements of the Improvised Fire Alarm Control Panel

The idea for the improvised fire alarm control stems from the existing designs of fire alarm control panels, which are considered too expensive for the school to purchase in sufficient quantities to serve the learners enrolled in TVL-Electrical Installation and Maintenance at Don Andres Soriano National High School.

Affordable alternative devices or components are assembled to create an improvised fire alarm control panel that functions almost identically to the prior art of this equipment, thereby enhancing learners' skills and preparing them for the NCII assessment.

Designs

The improvised fire alarm control panel shown below was designed and created to address the lack of fire alarm control panels, serving as an alternative instructional aid in the NCII training of TVL Electrical Installation and Maintenance learners at Don Andres Soriano National High School. This can trigger an alert anytime the smoke or heat detectors detect elements of fire, or when manually activated due to the presence of fire elements. The components used are electrical-mechanical relays, a power supply, light indicators, push buttons, and a switch, which are very cost-efficient.

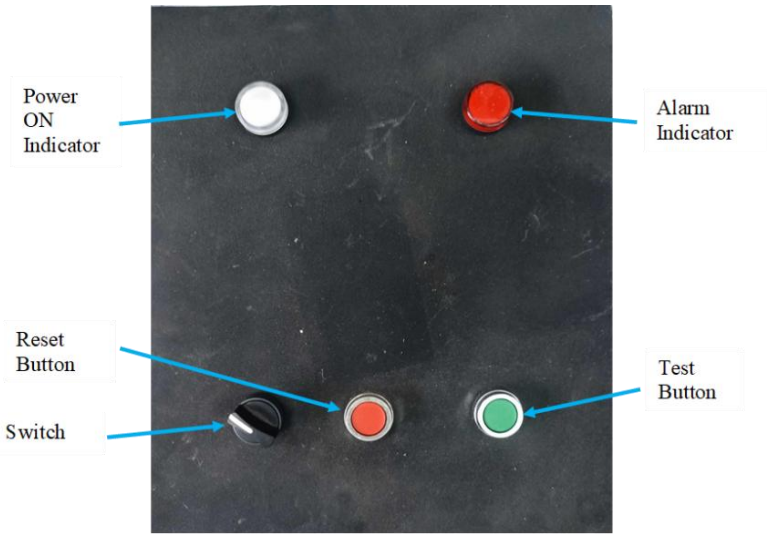

Figure 1. *Improvised Fire Alarm Control Panel Diagram*

The labeled parts in Figure 1 are the user interface that learners need to be familiar with when utilizing the improvised fire alarm control panel. These parts are discussed below as follows:

Switch. This is used to turn on and off the power supply of the improvised fire alarm control panel.

Power ON Indicator (White LED). This white-light indicator found in the improvised fire alarm control panel will be energized if the main switch of the improvised fire alarm control panel is turned on.

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Alarm Indicator (Red LED). This red-light indicator, located in the improvised fire alarm control panel, will produce light in conjunction with the notification devices if fire elements are detected by the smoke or heat detector.

Reset Button. This is a switch used to reset the improvised fire alarm control panel after detecting some elements of fire that caused the alarm. Once the improvised fire alarm control panel is reset, it will eventually turn off the alarm of the notification devices, and the red-light indicator will be turned off.

Test Button. This is used to manually trigger the notification devices (e.g. bells, horns, etc...) or check the functionality of the circuit.

A. Dimension

Size Number of Zone	H (mm) * W(mm) * D (mm)
4 zones (expandable)	340 * 290 * 120

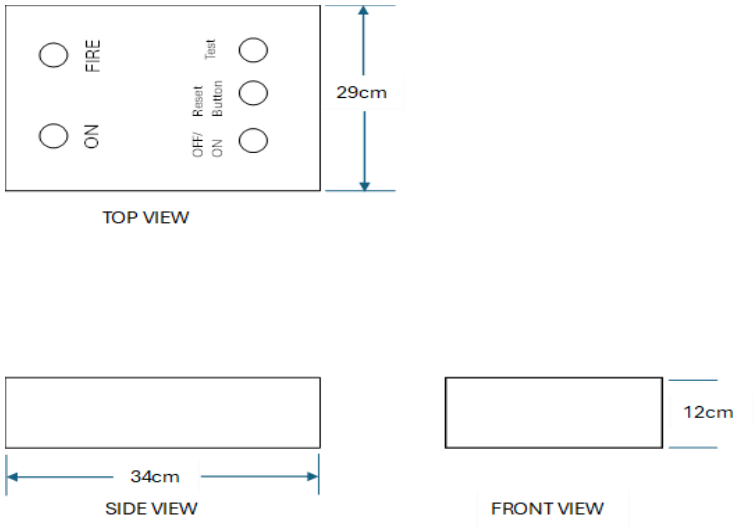

Figure 2. *Orthographic Drawing of the Improvised Fire Alarm Control Panel*

B. Description

The improvised fire alarm control panel is made of electrical-mechanical relays, a power supply, light indicators, push buttons, and a switch.

C. Electric Characteristics

Input Power: AC 220 V

Power Supply: Input AC 220V; and output DC 24V

D. Panel Functions

The "POWER" white LED light turns on as the control unit activates.

E**. Diagram**

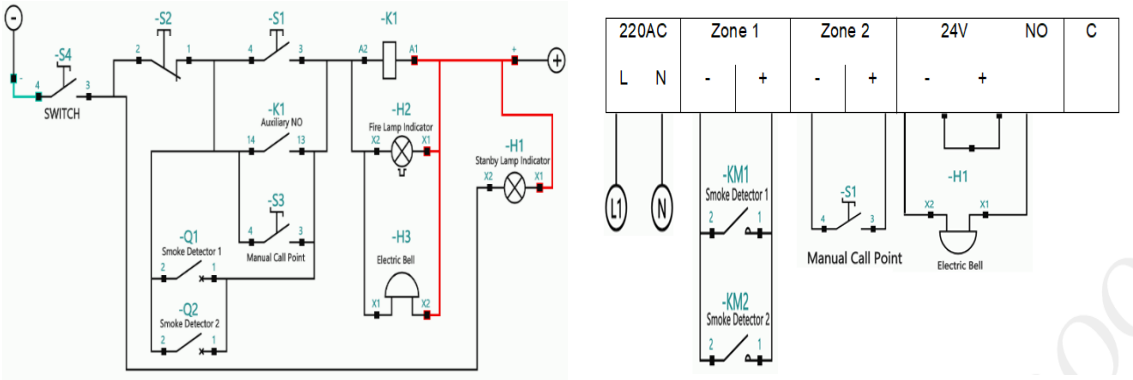

Figure 3. *Improvised Fire Alarm Control Panel Diagram*

F. Specifications

Item	*Specification*
Model	Improvised (prototype)
Category	Conventional Fire Alarm Control Panel
Type	Wall-mount
Power Source	240V AC 50 / 60 Hz ±10%
Standby Battery	None
Charging Voltage	Not Applicable
Circuit Voltage	24V DC operation voltage, under 10~11V DC 32mA
Rated Impedance	Below 50Ω
Detector Connection	No limitation for Conventional Rate of Rise or Fixed Temperature Heat Detectors; Up to 30 Photoelectric Smoke Detectors can be connected per zone (monitor current for detectors: 24V DC 40μA)
E.O.L Resistor	10KΩ
No. of Indicators	Power On (white LED) and Alarm Indicators (red LED)
No. of Bells	The same as the number of zones
Color	Black
Buttons	Push-button
Cabinet Material	Metal
Main Audio	Monotone sounder (above 85dB for 1m distance)
Alarm Relay Contact	No-Voltage NO contact, capacity 220V AC / 7A

Functionality of the Improvised Fire Alarm Control Panel

The functionality of the improvised fire alarm control panel will be evaluated by the teacher-experts and learners based on the sensitivity of the smoke and heat detectors, responsiveness to the manual call point, and sensitivity to the notification devices.

Sensitivity of the Smoke and Heat Detectors

The tables below present the weighted mean and standard deviation of the teacher-experts and learners' assessment of the level of acceptability in terms of the functionality of the improvised fire alarm control panel in sensing fire through smoke and heat detectors.

As presented in Table 7, indicator (1) has a mean of 4.8 and a standard deviation of 0.42, indicating a highly acceptable level. This means that the circuit for the smoke and heat detectors is within the standards. Indicator (2) has a mean of 4.9 and a standard deviation of 0.32 with a verbal description of highly acceptable, including indicators (3) and (4), this would mean that the improvised fire alarm control panel is sensitive in sensing fire through smoke and heat detectors, the wiring connections are easy and simple, and the troubleshooting of whatever circuit problem is easy. Indicator (5) has a mean of 4.8 and a standard deviation of 0.42, with a verbal description of 'highly acceptable.' This indicates that the circuit diagrams provided for the smoke and heat diagrams are easy to understand.

Table 7. *Sensitivity of the Smoke and Heat Detectors (Teacher-experts)*

	Indicators	*Mean*	*Standard Deviation*	*Verbal Description*
1.	The circuit for the smoke & heat detectors of the innovation is within standards.	4.8	0.42	Highly Acceptable
2.	The smoke and heat detectors are very sensitive and can easily trigger an alarm.	4.9	0.32	Highly Acceptable
3.	The wiring connections for smoke and heat detectors are easy and simple.	4.9	0.32	Highly Acceptable
4.	Circuit problems in smoke and heat detectors are easy to troubleshoot.	4.9	0.32	Highly Acceptable
5.	The diagrams provided for the smoke and heat detectors are easy and simple to understand.	4.8	0.42	Highly Acceptable
	Overall Mean And SD	4.86	0.36	High Acceptable

Legend: 4.21-5.00- Highly Acceptable, 3.41-4.20- Moderately Acceptable, 2.61-3.40- Acceptable, 1.81-2.60- Slightly Acceptable, 1.00-1.80- Not Acceptable

The assessment by the teacher-experts on the level of acceptability of the functionality of the improvised fire alarm control panel, in terms of the sensitivity of the smoke and heat detectors, has an overall mean of 4.86 and an overall standard deviation of 0.36. This indicates that the developed improvised fire alarm control panel is highly acceptable.

According to Barakzai (2004), innovative teaching methods to deal with the diversity of today's students are widely being used worldwide. Students' learning needs are also diversifying due to these differences. Searching for instructional strategies that might meet their demands is a new problem. Teachers at higher educational levels employ a variety of innovative teaching strategies and methodologies, along with individualized instruction, to meet the unique requirements of their pupils.

Table 8. *Sensitivity of the Smoke and Heat Detectors (Learners)*

	Indicators	*Mean*	*Standard Deviation*	*Verbal Description*
1.	The circuit for the smoke & heat detectors of the innovation is within standards.	4.88	0.33	Highly Acceptable
2.	The smoke and heat detectors are very sensitive and can easily trigger an alarm.	4.83	0.50	Highly Acceptable
3.	The wiring connections for smoke and heat detectors are easy and simple.	4.78	0.48	Highly Acceptable
4.	Circuit problems in smoke and heat detectors are easy to troubleshoot.	4.88	0.40	Highly Acceptable
5.	The diagrams provided for the smoke and heat detectors are easy and simple to understand.	4.88	0.33	Highly Acceptable
	Overall Mean And SD	4.85	0.40	High Acceptable

Legend: 4.21-5.00- Highly Acceptable, 3.41-4.20- Moderately Acceptable, 2.61-3.40- Acceptable, 1.81-2.60- Slightly Acceptable, 1.00-1.80- Not Acceptable

As presented in Table 8, indicator (1) has a mean of 4.88 and a standard deviation of 0.33, with a verbal description of 'highly acceptable.' This indicates that the circuit for the smoke and heat detectors is within the standards set by the learners. Indicator (2) has a mean of 4.83 and a standard deviation of 0.50 with a verbal description of highly acceptable. Indicator (3) has a mean of 4.78 and a standard deviation of 0.48 with a verbal description of highly acceptable. Indicator (4) has a mean of 4.88 and a standard deviation of 0.40 with a verbal description of highly acceptable. This would mean that the improvised fire alarm control panel is sensitive to sensing fire through smoke and heat detectors, the wiring connections are easy and straightforward, and troubleshooting any circuit problem is straightforward. Indicator (5) has a mean of 4.88 and a standard deviation of 0.33, with a verbal description of 'highly acceptable.' This indicates that the circuit diagrams provided for the smoke and heat diagrams are easy to understand for learners.

The learners' assessment of the level of acceptability of the functionality of the improvised fire alarm control panel, in terms of the sensitivity of the smoke and heat detectors, has an overall mean of 4.85 and an overall standard deviation of 0.40. This means that the developed improvised fire alarm control panel is highly acceptable for the learners.

Cutting-edge pedagogies, such as integrating technology or implementing project-based learning, foster the development of critical thinking, problem-solving, and teamwork skills—all essential for 21st-century success (Sawyer, 2014). Furthermore, by offering adaptable, diversified instruction that serves students at varying comprehension levels, innovation helps address diverse learning requirements (Tomlinson, 2001).

Responsiveness of the Improvised Fire Alarm Control Panel to Manual Call Point

The tables below present the weighted mean and standard deviation of the teacher-experts and learners' assessment of the level of acceptability in terms of the functionality of the improvised fire alarm control panel in responding to the manual call point.

As presented in Table 9, indicator (1) has a mean of 4.9 and a standard deviation of 0.32 with a verbal description of highly acceptable, this means that the improvised fire alarm control panel is receptive to the manual call point's signal. Indicator (2) has a mean of 5.0 and a standard deviation of 0, with a verbal description of being highly acceptable, along with indicators (2) to (5), this means that the improvised fire alarm control panel is receptive to the signals from the manual call point, wiring connections are easy to troubleshoot, and the diagrams provided are clear and simple.

Table 9. *Responsiveness of the Improvised Fire Alarm Control Panel to Manual Call Point (Teacher-experts)*

	Indicators	*Mean*	*Standard Deviation*	*Verbal Description*
1.	The circuit for the manual call point is within standards.	4.9	0.32	Highly Acceptable
2.	The innovation is sensitive to the signals from the manual call point.	5.0	0	Highly Acceptable
3.	The wiring connections for the manual call point are easy and simple.	5.0	0	Highly Acceptable
4.	Circuit problems in manual call points is easy to troubleshoot.	5.0	0	Highly Acceptable
5.	The diagrams provided for the manual call point are easy and simple to understand.	5.0	0	Highly Acceptable
	Overall Mean and SD	4.98	0.06	Highly Acceptable

Legend: 4.21-5.00- Highly Acceptable, 3.41-4.20- Moderately Acceptable, 2.61-3.40- Acceptable, 1.81-2.60- Slightly Acceptable, 1.00-1.80- Not Acceptable

The assessment by the teacher-experts on the level of acceptability of the functionality of the improvised fire alarm control panel in responding to the manual call point has an overall mean of 4.98 and an overall standard deviation of 0.06. This means that the developed improvised fire alarm control panel is highly acceptable.

Students are prepared for the demands of a society that is changing quickly through innovative approaches, including project-based learning and technology integration (Fullan & Langworthy, 2014). Moreover, innovation fosters the development of critical skills such as problem-solving, teamwork, and flexibility, which are essential for success in the twenty-first century (Mishra & Koehler, 2006). Through innovation, learners are engaged in a more realistic situation that requires initiative to solve problems that may occur in their future work environment.

As presented in Table 10, indicator (1) has a mean of 4.8 and a standard deviation of 0.41, with a verbal description of 'highly

acceptable'. This means that the improvised fire alarm control panel is receptive to the manual call point's signal according to the assessment of the learners in their performance. Indicator (2) has a mean of 4.9 and a standard deviation of 0.30, with a verbal description of being highly acceptable, indicator (3) has a mean of 4.88 and a standard deviation of 0.33 with a verbal description of highly acceptable, indicator (4) has a mean of 4.75 and a standard deviation 0.44 with a verbal description of highly acceptable, and indicator (5) has a mean of 4.7 and a standard deviation of 0.46 with a verbal description of highly acceptable, this means that the improvised fire alarm control panel is receptive to the signals from the manual call point, wiring connections are easy to troubleshoot, and the diagrams provided are clear and simple.

Table 10. *Responsiveness of the Improvised Fire Alarm Control Panel to Manual Call Point (Learners)*

	Indicators	*Mean*	*Standard Deviation*	*Verbal Description*
1.	The circuit for the manual call point is within standards.	4.8	0.41	Highly Acceptable
2.	The innovation is sensitive to the signals from the manual call point.	4.9	0.30	Highly Acceptable
3.	The wiring connections for the manual call point are easy and simple.	4.88	0.33	Highly Acceptable
4.	Circuit problems in manual call points is easy to troubleshoot.	4.75	0.44	Highly Acceptable
5.	The diagrams provided for the manual call point are easy and simple to understand.	4.7	0.46	Highly Acceptable
	Overall Mean and SD	4.81	0.39	Highly Acceptable

Legend: 4.21-5.00- Highly Acceptable, 3.41-4.20- Moderately Acceptable, 2.61-3.40- Acceptable, 1.81-2.60- Slightly Acceptable, 1.00-1.80- Not Acceptable

The assessment by the learners of the level of acceptability of the functionality of the improvised fire alarm control panel in responding to the manual call point has an overall mean of 4.81 and an overall standard deviation of 0.39. This means that the developed improvised fire alarm control panel is highly acceptable.

These modifications encourage better participation, more individualized learning opportunities, and easier access to resources. Empirical evidence suggests that incorporating cutting-edge technologies into the classroom enhances students' critical thinking abilities, teamwork capabilities, and overall academic performance (Schleicher, 2018). Additionally, innovations facilitate differentiated instruction, enabling teachers better to address the diverse learning needs of their students (Means et al., 2014).

Sensitivity to the Notification Devices

The tables below present the weighted mean and standard deviation of the teacher-experts and learners' assessment of the level of acceptability in terms of the functionality of the improvised fire alarm control panel in initiating the notification devices.

As presented in Table 11, indicator (1) has a mean of 4.3 and a standard deviation of 0.67, with a verbal description of highly acceptable. This means that the circuit of the improvised fire alarm control panel for the notification devices is within the standards. Indicator (2) has a mean of 4.9 and a standard deviation of 0.32 with a verbal description of highly acceptable.

This means that the improvised fire alarm control panel can initiate alarms whenever the initiating devices, such as smoke and heat detectors, sense smoke or fire. Indicators (3) and (4) have the same mean of 4.2 and standard deviation of 0.42, with a verbal description of moderately acceptable. This means that wiring connections and circuit troubleshooting are a bit challenging. Indicator (5) has a mean of 4.9 and a standard deviation of 0.32, with a verbal description of 'highly acceptable.' This indicates that the diagrams provided for the circuit connection of notification devices in the improvised fire alarm control panel are easy and simple to understand.

The assessment by the teacher-experts on the level of acceptability in terms of the functionality of the improvised fire alarm control panel in initiating the notification devices has an overall mean of 4.5 and an overall standard deviation of 0.43 with a verbal description of highly acceptable.

Table 11. *Sensitivity of the Innovation to the Notification Devices (Teacher-experts)*

	Indicators	*Mean*	*Standard Deviation*	*Verbal Description*
1.	The circuit for the notification devices is within standards.	4.3	0.67	Highly Acceptable
2.	The innovation is capable of initiating the alarms whenever there is fire.	4.9	0.32	Highly Acceptable
3.	The wiring connections for the notification devices are easy and simple.	4.2	0.42	Moderately Acceptable
4.	Circuit problems in notification devices are easy to troubleshoot.	4.2	0.42	Moderately Acceptable
5.	The diagrams provided for the notification devices are easy and simple to understand.	4.9	0.32	Highly Acceptable
	Overall Mean and SD	4.5	0.43	Highly Acceptable

Legend: 4.21-5.00- Highly Acceptable, 3.41-4.20- Moderately Acceptable, 2.61-3.40- Acceptable, 1.81-2.60- Slightly Acceptable, 1.00-1.80- Not Acceptable

Technology makes it possible to incorporate educational tools, simulations, and innovative instructional materials that accommodate different learning styles, which raises motivation and engagement levels (Mishra & Koehler, 2006). Innovation and improvising increase learners' experiences and allow them to broaden their concepts, which are helpful in real-life situations.

Table 12. *Sensitivity of the Innovation to the Notification Devices (Learners)*

	Indicators	*Mean*	*Standard Deviation*	*Verbal Description*
1.	The circuit for the notification devices is within standards.	4.98	0.16	Highly Acceptable
2.	The innovation is capable of initiating the alarms whenever there is fire.	4.9	0.30	Highly Acceptable
3.	The wiring connections for the notification devices are easy and simple.	4.93	0.27	Moderately Acceptable
4.	Circuit problems in notification devices are easy to troubleshoot.	4.85	0.36	Moderately Acceptable
5.	The diagrams provided for the notification devices are easy and simple to understand.	4.83	0.38	Highly Acceptable
	Overall Mean and SD	4.9	0.30	Highly Acceptable

Legend: 4.21-5.00- Highly Acceptable, 3.41-4.20- Moderately Acceptable, 2.61-3.40- Acceptable, 1.81-2.60- Slightly Acceptable, 1.00-1.80- Not Acceptable

Meanwhile, as presented in Table 12, indicator (1) has a mean of 4.98 and a standard deviation of 0.16, with a verbal description of 'highly acceptable.' This indicates that the circuit of the improvised fire alarm control panel for the notification devices is within the standards. Indicator (2) has a mean of 4.9 and a standard deviation of 0.30, with a verbal description of highly acceptable. This means that the improvised fire alarm control panel can initiate alarms whenever the initiating devices, such as smoke and heat detectors, sense smoke or fire. Indicator (3) has a mean of 4.93 and a standard deviation of 0.27, with a verbal description of 'highly acceptable.' Indicator (4) has a mean of 4.85 and a standard deviation of 0.36, also with a verbal description of 'highly acceptable.' This means that wiring connections and circuit troubleshooting are easy for learners. Indicator (5) has a mean of 4.83 and a standard deviation of 0.38, with a verbal description of 'highly acceptable.' This indicates that the diagrams provided for the circuit connection of notification devices in the improvised fire alarm control panel are easy and simple to understand for learners.

The learners' assessment of the level of acceptability in the functionality of the improvised fire alarm control panel in initiating the notification devices has an overall mean of 4.9 and an overall standard deviation of 0.30, with a verbal description of being highly acceptable.

Level of Acceptability of the Improvised Fire Alarm Control Panel

The level of acceptability of the improvised fire alarm control panel will be evaluated by the teacher-experts and learners based on its usefulness, effectiveness, and safety as a substitute instructional equipment.

Usefulness

The tables below present the weighted mean and standard deviation of the teacher-experts and learners' assessment of the level of acceptability in terms of the usefulness of the improvised fire alarm control panel.

Table 13. *Usefulness (Teacher-experts)*

	Indicators	*Mean*	*Standard Deviation*	*Verbal Description*
1.	Utilization of the improvised fire alarm control panel improves initiative and the performance of the learners.	4.3	0.67	Highly Acceptable
2.	Utilization of the innovation increases the learners' understanding of fire detection alarm systems.	4.9	0.32	Highly Acceptable
3.	Utilization of the innovation intensifies the NCII training.	4.5	0.53	Highly Acceptable
4.	The improvised fire alarm control panel aids the lack of electrical equipment in NCII training.	4.4	0.52	Highly Acceptable
5.	The improvised fire alarm control panel can help both the teachers and learners in the conduct of NCII training.	4.5	0.53	Highly Acceptable
	Overall Mean and SD	4.52	0.51	Highly Acceptable

Legend: 4.21-5.00- Highly Acceptable, 3.41-4.20- Moderately Acceptable, 2.61-3.40- Acceptable, 1.81-2.60- Slightly Acceptable, 1.00-1.80- Not Acceptable

As presented in Table 13, indicator (1) has a mean of 4.3 and a standard deviation of 0.67, with a verbal description of 'highly acceptable.' This suggests that the use of the improvised control panel enhances the initiative and performance of the learners. Indicator (2) has a mean of 4.9 and a standard deviation of 0.32, with a verbal description of 'highly acceptable', which indicates that the improvised fire alarm control panel enhances and broadens learners' understanding of the fire alarm system. Indicator (3) has a mean of 4.5 and a standard deviation of 0.53, with a verbal description of 'highly acceptable', which indicates that the improvised fire alarm control panel effectively enhances the NCII training. Indicator (4), has a mean of 4.4 and a standard deviation of 0.52 with a verbal description of highly acceptable, furthermore, indicator (5) has a mean of 4.5 and a standard deviation of 0.53 with a verbal description of highly acceptable, this means that the improvised fire alarm control panel aids the lack of electrical equipment for NCII training and can help both teachers and learners in the conduct of training.

The assessment by the teacher-experts on the level of acceptability in terms of the usefulness of the improvised fire alarm control panel has an overall mean of 4.52 and an overall standard deviation of 0.51, with a verbal description of highly acceptable. This shows a significant result that the innovation can be used in conducting an NCII training to enhance the skills of the learners.

Innovative teaching practices enable the enhancement of the educational experience, encourage greater involvement, and improve learning outcomes. It enables teachers to go beyond conventional techniques and implement more student-centered strategies, such as active learning, which has been demonstrated to increase retention and academic achievement in students (Freeman et al., 2014).

Table 14. *Usefulness (Learners)*

Indicators	*Mean*	*Standard Deviation*	*Verbal Description*
1. Utilization of the improvised fire alarm control panel improves initiative and the performance of the learners.	4.53	0.51	Highly Acceptable
2. Utilization of the innovation increases the learners' understanding of fire detection alarm systems.	4.78	0.42	Highly Acceptable
3. Utilization of the innovation intensifies the NCII training.	4.68	0.53	Highly Acceptable
4. The improvised fire alarm control panel aids the lack of electrical equipment in NCII training.	4.8	0.41	Highly Acceptable
5. The improvised fire alarm control panel can help both the teachers and learners in the conduct of NCII training.	4.68	0.53	Highly Acceptable
Overall Mean and SD	4.68	0.48	Highly Acceptable

Legend: 4.21-5.00- Highly Acceptable, 3.41-4.20- Moderately Acceptable, 2.61-3.40- Acceptable, 1.81-2.60- Slightly Acceptable, 1.00-1.80- Not Acceptable

As presented in Table 14, indicator (1) has a mean of 4.53 and a standard deviation of 0.51, with a verbal description of highly acceptable. This means that the utilization of the improvised control panel increases the initiative and the performance of the learners. Indicator (2) has a mean of 4.78 and a standard deviation of 0.42, with a verbal description of highly acceptable, which means that the improvised fire alarm control panel increases and broadens learners' understanding of the fire alarm system. Indicator (3) has a mean of 4.68 and a standard deviation of 0.53, with a verbal description of highly acceptable, which means that the improvised fire alarm control panel intensifies the NCII training. Indicator (4), has a mean of 4.8 and a standard deviation of 0.41 with a verbal description of highly acceptable, furthermore, indicator (5) has a mean of 4.68 and a standard deviation of 0.53 with a verbal description of highly acceptable, this means that the improvised fire alarm control panel aids the lack of electrical equipment for NCII training and can help both teachers and learners in the conduct of training.

The assessment by the learners on the level of acceptability in terms of the usefulness of the improvised fire alarm control panel has an overall mean of 4.69 and an overall standard deviation of 0.48, with a verbal description of highly acceptable. This shows a significant result that the innovation can be used in conducting an NCII training to enhance the skills of the learners.

In many cases, locally developed materials can be more effective than their commercial counterparts because they are designed with the local context in mind, addressing specific educational challenges. Prince (2004) also emphasizes that active learning methods, often implemented through improvised materials, lead to better student outcomes than traditional instruction.

Contextualized instruction or training enables learners to better relate to resources that are tailored to meet specific needs or circumstances, making it significantly more effective.

Effectiveness

The tables below present the weighted mean and standard deviation of the teacher-experts and learners' assessment of the level of acceptability in terms of the effectiveness of the improvised fire alarm control panel.

Table 15. *Effectiveness (Teacher-experts)*

Indicators	*Mean*	*Standard Deviation*	*Verbal Description*
1. The improvised fire alarm control panel is effective in detecting fire and notifying about fire.	4.4	0.84	Highly Acceptable
2. The innovation is effective as instructional material to intensify the NCII training.	4.5	0.71	Highly Acceptable
3. The innovation is effective in hands-on activities.	4.5	0.71	Moderately Acceptable
4. The innovation is effective in enriching the knowledge about the electrical field.	4.4	0.52	Highly Acceptable
5. The innovation is efficient.	4.5	0.71	Highly Acceptable
Overall Mean and SD	4.46	0.70	Highly Acceptable

Legend: 4.21-5.00- Highly Acceptable, 3.41-4.20- Moderately Acceptable, 2.61-3.40- Acceptable, 1.81-2.60- Slightly Acceptable, 1.00-1.80- Not Acceptable

As presented in Table 15, indicator (1) has a mean of 4.4 and a standard deviation of 0.84, with a verbal description of 'highly accepted.' This indicates that the improvised fire alarm control panel is effective in detecting fires and notifying personnel of the fire. Indicators (2) and (3) have a mean of 4.5 and a standard deviation of 0.71, with a verbal description of highly acceptable. This means that the innovation is effective as instructional material/equipment to intensify the NCII training and effective in the hands-on activities of the learners. Indicator (4) has a mean of 4.4 and a standard deviation of 0.52, with a verbal description of 'highly acceptable.' This indicates that the innovation is effective in enriching learners' knowledge about the electrical field. In addition, indicator (5) has a mean of 4.5 and a standard deviation of 0.71, with a verbal description of 'highly acceptable.' This could indicate that the improvised fire alarm

control panel is efficient and effective.

The assessment by the teacher-experts on the level of acceptability in terms of the effectiveness of the improvised fire alarm control panel has an overall mean of 4.46 and an overall standard deviation of 0.70, with a verbal description of highly acceptable. This shows a significant result that the innovation is very effective.

Innovative teaching approaches, such as active learning and the integration of technology, have been shown to enhance student performance and retention significantly (Freeman et al., 2014). These methods promote critical thinking, problem-solving, and collaboration, which are essential for preparing students for the complexities of the 21st century (Sawyer, 2014). Additionally, innovation in education can support personalized learning, allowing students to progress at their own pace and enabling differentiated instruction to meet diverse learning needs (Means et al., 2010).

As presented in Table 16 below, indicator (1) has a mean of 4.83 and a standard deviation of 0.38, with a verbal description of 'highly accepted.' This indicates that the improvised fire alarm control panel is effective in detecting fires and notifying personnel about them. Indicators (2) has a mean of 4.9 and a standard deviation of 0.30 with a verbal description of highly acceptable, and (3) has a mean of 4.93 and a standard deviation of 0.35 with a verbal description of highly acceptable, this means that the innovation is effective as instructional material/equipment to intensify the NCII training and effective in the hands-on activities of the learners. Indicators (4) and (5) have a mean of 4.93 and a standard deviation of 0.27, with a verbal description of 'highly acceptable'. This means that the innovation is effective and efficient in enriching the learners' knowledge about the electrical field.

Table 16. *Effectiveness (Learners)*

	Indicators	*Mean*	*Standard Deviation*	*Verbal Description*
1.	The improvised fire alarm control panel is effective in detecting fire and notifying about fire.	4.83	0.38	Highly Acceptable
2.	The innovation is effective as instructional material to intensify the NCII training.	4.9	0.30	Highly Acceptable
3.	The innovation is effective in hands-on activities.	4.93	0.35	Moderately Acceptable
4.	The innovation is effective in enriching the knowledge about the electrical field.	4.93	0.27	Highly Acceptable
5.	The innovation is efficient.	4.93	0.27	Highly Acceptable
	Overall Mean and SD	4.9	0.31	Highly Acceptable

Legend: 4.21-5.00- Highly Acceptable, 3.41-4.20- Moderately Acceptable, 2.61-3.40- Acceptable, 1.81-2.60- Slightly Acceptable, 1.00-1.80- Not Acceptable

The assessment by the learners of the level of acceptability in terms of the effectiveness of the improvised fire alarm control panel has an overall mean of 4.9 and an overall standard deviation of 0.31, with a verbal description of 'highly acceptable.' This shows a significant result, indicating that the innovation is very effective.

Realia, or real-life objects used in teaching, can positively affect learners' interest by making lessons more concrete, relatable, and engaging. When students interact with tangible materials, abstract concepts become easier to understand, which increases their motivation and curiosity (Thompson, 2015). Realia helps learners connect classroom content to real-world applications, fostering a deeper sense of relevance and promoting active learning (Azhar & Nadeem, 2015). This hands-on approach stimulates sensory engagement, which enhances memory retention and makes the learning experience more dynamic and enjoyable.

Safety

The tables below present the weighted mean and standard deviation of the teacher-experts' and learners' assessments of the improvised fire alarm control panel's safety acceptability level.

Table 17. *Safety (Teacher-experts)*

	Indicators	*Mean*	*Standard Deviation*	*Verbal Description*
1.	The improvised fire alarm control panel is safe in the electrical field.	5.0	0	Highly Acceptable
2.	The innovation is safe to be used as instructional materials.	5.0	0	Highly Acceptable
3.	The innovation is safe if used in the hands-on activities.	5.0	0	Highly Acceptable
4.	The innovation is adaptable.	4.9	0.32	Highly Acceptable
5.	The innovation is safe as a substitute for the sophisticated fire alarm control panels that are commercially used.	5.0	0	Highly Acceptable
	Overall Mean and SD	4.98	0.06	Highly Acceptable

Legend: 4.21-5.00- Highly Acceptable, 3.41-4.20- Moderately Acceptable, 2.61-3.40- Acceptable, 1.81-2.60- Slightly Acceptable, 1.00-1.80- Not Acceptable

As presented in Table 17, only indicator (4) has the lowest mean of 4.9 and a standard deviation of 0.32 with a verbal description of highly acceptable, which means that innovation is safe and adaptable. In contrast, indicators (1), (2), (3), and (5) have a mean of 5.0 and a standard deviation of 0 with a verbal description of highly acceptable, this means that the teacher-experts agreed the improvised fire alarm control panel is very safe in the electrical field, as instructional materials, in the hands-on activities of the leaners, and safe as substitute to the commercially used fire alarm control panel.

The teacher-experts' assessment of the improvised fire alarm control panel's safety acceptability has an overall mean of 4.98 and an overall standard deviation of 0.06, with a verbal description of highly acceptable. This shows a significant result that the innovation is very safe and can be recommended to other electrical practitioners.

Additionally, as presented in Table 18, indicator (1) has a mean of 4.93 and a standard deviation of 0.27 with a verbal description of highly acceptable. This means that the improvised fire alarm control panel is safe in their performance and hands-on activities. Indicator (2) has a mean of 4.95 and a standard deviation of 0.22 with a verbal description of highly acceptable, indicator (3) has a mean of 4.93 and a standard deviation of 0.27 with a verbal description of highly acceptable, indicator (4) has a mean of 4.9 and standard deviation of 0.30 with a verbal description of highly acceptable, and indicator (5) has a mean of 4.8 and a standard deviation of 0.41 with a verbal description of highly acceptable, this means that the improvised fire alarm control panel is safe as instructional materials, safe in the hands-on activities, and safe as substitute equipment to those commercially sold in the store.

The assessment by the learners on the level of acceptability in terms of the safety of the improvised fire alarm control panel has an overall mean of 4.9 and an overall standard deviation of 0.29, with a verbal description of highly acceptable. This shows a significant result that the innovation is very safe in the performance of the learners.

Table 18. *Safety (Learners)*

	Indicators	*Mean*	*Standard Deviation*	*Verbal Description*
1.	The improvised fire alarm control panel is safe in the electrical field.	4.93	0.27	Highly Acceptable
2.	The innovation is safe to be used as instructional materials.	4.95	0.22	Highly Acceptable
3.	The innovation is safe if used in the hands-on activities.	4.93	0.27	Highly Acceptable
4.	The innovation is adaptable.	4.9	0.30	Highly Acceptable
5.	The innovation is safe as a substitute for the sophisticated fire alarm control panels that are commercially used.	4.8	0.41	Highly Acceptable
	Overall Mean and SD	4.9	0.29	Highly Acceptable

Legend: 4.21-5.00- Highly Acceptable, 3.41-4.20- Moderately Acceptable, 2.61-3.40- Acceptable, 1.81-2.60- Slightly Acceptable, 1.00-1.80- Not Acceptable

Moreover, schools must implement proper training and guidelines to ensure that both educators and students understand how to safely use innovative equipment and technologies (Vanderlinde et al., 2015). Innovation can enhance learning, but should be paired with comprehensive safety measures, including developing safe physical and virtual learning environments.

Test of Significant Difference

The table below presents the test of significant difference in the acceptability of the improvised fire alarm control panel as assessed and perceived by the teacher-expert and learner respondents.

Table 19. *Test of Significant Difference*

t-value	*p-value*	*Remarks*
-2.71253	0.008813	The p-value is less than 0.05, indicating statistical significance

The negative t-value (-2.71253) suggests that the mean acceptability level as assessed by the learners is lower than that assessed by the teacher-experts. A p-value of 0.008813, which is less than the significance level of 0.05, indicates a statistically significant difference between the two groups' assessments. This implies that the differences in perceptions of the acceptability of the fire alarm control system control panel between learners and teacher-experts are unlikely to have occurred by chance.

Furthermore, this study evaluated the improvised fire alarm control panel as a substitute instructional equipment to be used for the NCII training of Grade 12 TVL major in Electrical Installation and Maintenance at Don Andres Soriano National High School, for better real-life application (Freeman et al., 2014). The respondent groups of the study were the teacher-experts and learners who evaluated the improvised fire alarm control panel in terms of the sensitivity of the smoke and heat detectors, responsiveness to the manual call point, and sensitivity to the notification devices, including the level of acceptability in terms of usefulness, effectiveness, and safety. As highlighted by Robinson (2011), environments that support experimentation, reflection, and repeated learning help develop a growth mindset. The study's results, as perceived by the respondent groups regarding the functionality and level of acceptability, showed a significant difference, with learners rating lower scores than the teacher-experts on the acceptability of the innovation. This suggests that further improvements to the design or the development of a training guide may be needed to address the gaps. However, the improvised fire alarm control panel was found to be highly acceptable overall.

Therefore, based on the findings, the researcher will develop an enhanced training guide that is learner-centered and suggest revisions to certain features for future improvements, aiming to foster better learning experiences during training, consistent with John Dewey's theory of experiential learning. This will be useful to both teachers and learners to address the gap in this study.

Conclusions

The study concludes that the improvised fire alarm control panel is an effective, innovative instructional equipment that can increase learners' engagement in EIM and can also expand their knowledge about fire alarm installation helpful in ensuring a 100 percent passing

rate in the NCII assessment despite the significant difference in the level of acceptability of the developed fire alarm control panel as perceived between learners and teacher-experts. Specifically, learners rated the acceptability of the improvised control panel lower than that of the teacher-experts. These findings suggest that further examination of the factors contributing to this difference in perception is necessary, potentially leading to adjustments in the control panel's design or additional education for learners to improve its acceptability, since trial-and-error learning, discovery-based learning, and practice-theory-practice cycles are crucial for mastering skills (Reese, 2011). The lower acceptability ratings by learners suggest that the fire alarm control panel may need revisions to improve its usability or user interface for this group. Conducting user-centered design sessions with learners to identify specific usability issues may be considered in the future. The significant difference in acceptability levels may indicate that learners require more training or familiarization with the control panel, as Dewey advocated for "learning by doing," arguing that genuine learning occurs when learners participate in worthwhile, practical exercises relevant to real-world issues (Main, 2023).

Developing instructional materials or hands-on training sessions specifically designed for learners could help bridge this gap. These highlight the importance of addressing the differences in perceptions between learners and teacher-experts to enhance the acceptability and effectiveness of the developed fire alarm control system control panel.

The findings and conclusions of the study suggest and recommend insights into the following:

The school should assist with the implementation of this innovation to provide cost-effective training for electrical learners. It must allow learners to explore the technical aspects of the improvised fire alarm control panel for better familiarity.

Teachers should follow the training guide when giving instructions to learners to achieve positive learning outcomes and to engage learners in more hands-on activities.

The learners should also follow the presented training guide to better familiarize themselves with the concept and technicalities of the improvised fire alarm control panel.

The community should also support the innovation, especially in improving the innovation for entrepreneurial opportunities, and support the school in the development of a better model that is cost-effective.

The researcher must develop a training guide useful for both teachers and learners to address the gap in this research. Also, one must never stop improving the design of the improvised fire alarm control panel to meet the never-ending change of standards in the industry and the technology itself.

The future researcher may benchmark the presented design to come up with a better version of this innovation that is cost-effective.

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