ISRG Journal of Arts, Humanities and Social Sciences (ISRGJAHSS)

ISRG PUBLISHERS
Abbreviated Key Title: ISRG J Arts Humanit Soc Sci
ISSN: 2583-7672 (Online)
Journal homepage: https://isrgpublishers.com/isrgjahss
Volume – IV Issue - VI (November-December) 2026
Frequency: Bimonthly



DESIGN, CONSTRUCTION, AND ACCEPTABILITY EVALUATION OF AN IMPROVISED SPARK PLUG TESTER FOR AUTOMOTIVE TECHNOLOGY INSTRUCTION

Reynante B. Ormilla

Assistant Professor II, Aparri Polytechnic Institute.

| **Received:** 29.10.2026 | **Accepted:** 02.11.2026 | **Published:** 10.11.2026

***Corresponding author:** Reynante B. Ormilla

Abstract

Technical-vocational institutions in the Philippines often lack adequate instructional tools and equipment, which limits hands-on training in automotive technology. This study designed, constructed, and evaluated an Improvised Spark Plug Tester (ISPT) for gasoline engines to help address this gap at the TESDA Aparri Polytechnic Institute in Aparri, Cagayan. The device was built from locally available materials and is manually operated. The study used the Project Development Method and a descriptive-evaluative design. Forty-five respondents (10 automotive instructors and technicians, 15 shop owners, and 20 BS Industrial Technology students) rated the device through a questionnaire checklist covering design and durability, usefulness and functionality, portability, and safety and maintenance. Weighted means interpreted on a five-point Likert scale described the level of acceptability, and a z-test at the 5% level of significance compared the ratings of the instructors, technicians, and shop owners (ITMSO group, n = 25) with those of the students (n = 20). Both groups rated the ISPT Strongly Agree on all four criteria, with grand weighted means of 4.80 (ITMSO) and 4.82 (students). The computed z values (0.00 to 1.73) were all below the critical value of 1.96, indicating no significant difference between the two groups. The ISPT is therefore considered highly acceptable as a well-designed, durable, functional, portable, safe, and easy-to-maintain instructional device made from affordable local materials. It is recommended for use in automotive technology shops, together with further assessment of its durability, efficiency, and other possible uses, and with institutional support for its continued development and validation.

Keywords: automotive technology, spark plug tester, improvised instructional equipment, acceptability, project development method

Copyright © ISRG Publishers. All rights Reserved.
DOI: 10.5281/zenodo.24097520

Introduction

Schools offering technical and vocational programs in the Philippines continue to face a shortage of instructional equipment and materials. Studies that assess instruction in both academic and technology areas have found that the lack of devices, apparatuses, and equipment keeps teachers and students from fully achieving instructional objectives in classrooms and shops (Seguban, 2012). Because shop and laboratory facilities are expensive, many schools cannot acquire them, and technology instruction is affected the most. Tools and apparatuses are indispensable for activity-oriented teaching, so improvised equipment made from locally available materials offers a practical way to improve the conditions of technology courses (Seguban, 2012).

In automotive technology, diagnosing the ignition system is a core skill. In a spark-ignition (gasoline) engine, the spark plug starts combustion: it fits into the cylinder head and delivers a high-voltage spark across a small gap to ignite the compressed air–fuel mixture. A compression-ignition (diesel) engine, in contrast, relies on the heat of compressed air to ignite the injected fuel (Heywood, 2018). The plug's center electrode is connected by insulated high-tension wiring to an ignition coil or magneto, and the spark gap lies between this electrode and a grounded electrode on the base of the plug.

When the ignition system supplies voltage, a potential difference builds up across the gap. The air–fuel mixture is at first an insulator, but once the voltage exceeds the dielectric strength of the gas, the mixture between the electrodes ionizes, becomes conductive, and current jumps the gap as a spark (Heywood, 2018). The voltage required depends on factors such as the width of the gap and the pressure in the cylinder, which is why a weak coil, worn electrodes, or a fouled plug can cause misfiring.

The spark plug also has a thermal role. Its firing end is heated by combustion and must pass that heat to the cylinder head at a suitable rate. If the firing end runs too hot, it can trigger pre-ignition; if it runs too cool, deposits build up and the plug fouls. The heat range of a plug describes how quickly it transfers heat from the firing end to the engine and is unrelated to the electrical energy passing through it (NGK Spark Plugs, n.d.-a, n.d.-b).

A spark plug tester is a handy shop tool that allows a technician to check whether a plug can produce a spark outside the engine. It helps separate ignition faults from other causes of poor engine performance and can save diagnostic time. A tester that can be built from local materials could therefore give schools an affordable instructional tool.

Recent Philippine studies show that the same shortage continues to be answered by locally developed instructional devices. Bermundo (2022) built an audio amplifier trainer because instructional material for teaching basic troubleshooting was not available, and had experts evaluate its acceptability and effectiveness. Lacanilao et al. (2024) developed a portable auto-electricity trainer for industrial technology and engineering students, which Oting (2026) cites as a successful example of an accessible, reproducible alternative to site-based training. Oting (2026) himself developed a residential plumbing mock-up for a Plumbing NC II program, starting from the observation that the insufficiency of physical learning materials in technical and vocational education often leads to a purely theoretical approach. The student users rated its design Very Good (4.83 out of 5.0), although the author noted that the small sample limits how far the results can be generalized.

Research on spark plug and ignition diagnosis, on the other hand, has recently moved toward instrumented methods. Huangfu et al. (2022) trained deep learning models to detect spark-plug-related combustion faults from existing engine sensors, but reported unstable performance outside the operating conditions in their data set. Baqer (2024) used an accelerometer connected to an Arduino board to record engine vibration and trained a neural network to recognize healthy and faulty spark plugs. Abdelati et al. (2025) examined how the location of the vibration sensor affects the accuracy of neural-network misfire detection. These methods need sensors, data acquisition, and signal processing, which many school shops may not be able to afford, so a simple tester that shows the spark directly remains a practical option for teaching plug diagnosis. A locally made device of this kind, evaluated for its acceptability by the people who would use it, is the gap that the present study addresses.

This study designed, constructed, and evaluated an Improvised Spark Plug Tester (ISPT) for the automotive technology program of the TESDA Aparri Polytechnic Institute. Specifically, it sought to (1) design and construct the ISPT; (2) determine its acceptability, as evaluated by instructors, technicians, shop owners, and students, in terms of design and durability, usefulness and functionality, portability, and safety and maintenance; and (3) determine whether the evaluations of the two groups of respondents differ significantly. The null hypothesis was that there is no significant difference between the evaluations of the two groups at the 0.05 level of significance. The comments and suggestions of the respondents were also considered in improving the device.

Methodology

1. Project Design

The ISPT is a portable, manually operated spark-testing device made of locally available materials and built around a single operating mechanism (Figure 1). Its body is made of heavy-duty stainless material for a longer service life, polycarbonate (polyglass) is used for its panel parts, its extended secondary power input terminals are bolted in place, and its parts are labeled and designed for easy removal and installation. A handle with a lock/unlock button and a pair of caster wheels makes the unit easy to carry and move. Table 1 lists the parts of the device and the function of each.

Table 1. *Parts of the Improvised Spark Plug Tester and Their Functions*

No.	Part	Function
1	Handle and handle lock/unlock button	Used to carry the unit; the button locks and unlocks the handle
2	Caster wheels	Allow the unit to be rolled from place to place
3	Power switch	Turns the unit on and off
4	Power indicator light	Lights up when the unit is switched on
5	Battery charge indicator	Displays the current state of charge of the battery

Copyright © ISRG Publishers. All rights Reserved.
DOI: 10.5281/zenodo.24097520

6	Push button switch	Pressed for about 10 seconds to run the test and fire the spark plug
7	Ampere meter	Deflects to the negative side to show the discharging current each time the plug fires
8	AC power output light indicator	Indicates the AC power output of the unit
9	Spark plug holder	Holds the spark plug under test in the proper position so the spark can be observed
10	DC secondary input terminals (+/–)	Extended secondary power input terminals, bolted in place



Figure 1. *The Improvised Spark Plug Tester (ISPT)*

The wiring of the device is shown in Figure 2. The diagram shows the 12 V battery and the power supply section, the two push-button switches, the ignition coil with its condenser, the flasher relay, the switching device unit, the ampere meter and voltmeter, the power light indicator, the AC power output indicator light, and the load/bulb, together with their ground connections. The specific transformer, rectifiers, voltage regulator, and other components used are listed in Table 2.

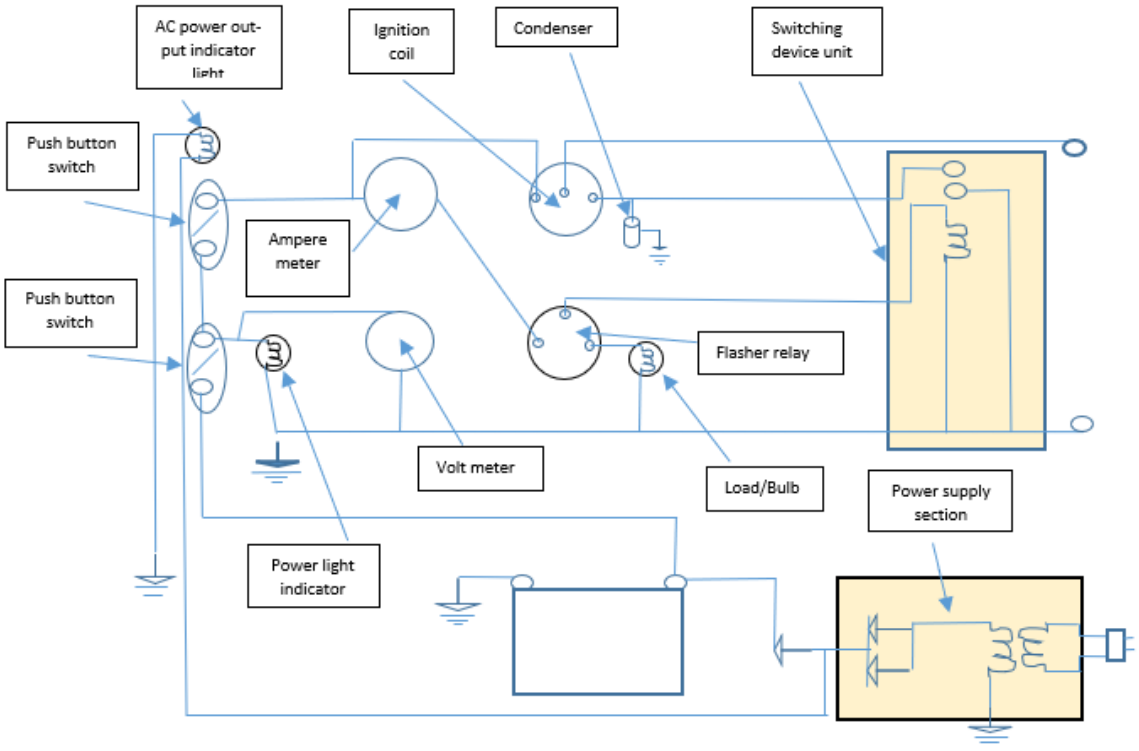


Figure 2. *Wiring diagram of the Improvised Spark Plug Tester*

2. Project Development

The ISPT was constructed from locally available materials. Table 2 presents the bill of materials with the unit cost and total cost of each item. The total cost of production was PHP 5,520.00.

Table 2. *Bill of Materials and Cost of Production*

No.	Description	Qty.	Unit cost (PHP)	Total cost (PHP)
1	Polycarbonate (polyglass), tinted brown	¼ part	325.00	325.00

Copyright © ISRG Publishers. All rights Reserved.
DOI: 10.5281/zenodo.24097520

No.	Description	Qty.	Unit cost (PHP)	Total cost (PHP)
2	Aluminum bar, 1/8 in × 1 in	1 ft	45.00	45.00
3	Ignition coil, 12 V	1 pc	450.00	450.00
4	Condenser, 0.47 µF	1 pc	75.00	75.00
5	Flasher relay (12 V, electronic type)	1 pc	95.00	95.00
6	Voltage regulator, 12 V	1 unit	320.00	320.00
7	Eye terminal	1 pack	350.00	350.00
8	Heat shrink insulator	30 pcs	40.00	120.00
9	Soldering lead	2 ft	40.00	40.00
10	Bolts and nuts (3/16 in × ½ in)	3 packs	35.00	105.00
11	Automotive wire #16	1 roll	350.00	350.00
12	Stainless plate, 0.67	1 pc	2,300.00	2,300.00
13	Caster wheel	2 pcs	45.00	90.00
14	Transformer (12 V, 13–20 A)	1 pc	320.00	320.00
15	Neon switch	2 pcs	15.00	30.00
16	Push button switch	2 pcs	10.00	10.00
17	Rectifier, 13 A	4 pcs	35.00	140.00
18	Voltmeter, 12 V	1 pc	85.00	85.00
19	Roller bag handle	1 assembly	150.00	150.00
20	Light indicator (DC 12 V)	2 pcs	15.00	30.00
	Total cost of production			**5,520.00**

3. Operation and Testing Procedure

The ISPT is operated manually. Because spark testing involves ignition voltage, the unit must always be switched off before anything is connected, and the plug and terminals should be handled only while the unit is switched off. The device is operated and the spark plug is tested as follows:

1. Switch on the power button until the power indicator lights up and the battery charge indicator displays the current state of charge of the battery.
2. Press the push button switch for about 10 seconds. The unit is functioning properly when:
    a. the meter deflects to the negative side, indicating the amount of discharging current every time the plug fires;
    b. the unit sounds intermittently; and
    c. the battery charge reads 12.5 V or above.
3. Switch off the unit.
4. Insert the spark plug into the plug holder in the proper position.
5. Switch on the unit.
6. Press the push button switch for about 10 seconds and observe the spark carefully, since careful visual evaluation is highly recommended. The plug must spark, and its condition is judged from the spark as shown in Table 3.
7. Switch off the unit after completing the task.

Table 3. *Interpretation of the Spark Observed During Testing*

Spark observed	Condition of the plug	Action
A bluish spark concentrated between the centers of both electrodes	Good	None required
A yellowish spark scattered elsewhere, or not between the centers of both electrodes	Bad	Service or clean the plug
No spark at all	Defective	Replace the plug

4. Evaluation Procedure

The study used the Project Development Method (PDM), in which the device was designed, constructed, and then evaluated. A descriptive-evaluative design was applied to determine the acceptability of the finished device.

Forty-five respondents evaluated the ISPT: 10 automotive instructors/technicians, 15 shop owners, and 20 BS Industrial Technology students (Table 4). For analysis, the instructors, technicians/mechanics, and shop owners were treated as one group (ITMSO, $n = 25$) and compared with the students ($n = 20$).

Table 4. *Respondents of the Study*

Respondent category	*n*	Group for analysis
Automotive instructors/technicians	10	ITMSO
Shop owners	15	ITMSO
BS Industrial Technology students	20	Students
Total	**45**	

Note. ITMSO = instructors, technicians/mechanics, and shop owners.

Data were gathered through a questionnaire checklist with five indicators for each of four criteria: design and durability, usefulness and functionality, portability, and safety and maintenance. Respondents rated each indicator on a five-point

Copyright © ISRG Publishers. All rights Reserved.
DOI: 10.5281/zenodo.24097520

Likert scale (Table 5). Likert-type scales are widely used to measure attitudes and perceptions in educational research (Joshi et al., 2015), and the mean scores of multi-item scales are commonly treated as interval-level data for analysis (Norman, 2010). The comments and suggestions of the respondents were also collected.

The weighted mean (WM) was computed for each indicator and interpreted using Table 5. The overall weighted mean (OWM) of a criterion is the average of its five indicator means, and the grand weighted mean is the average of the four criterion means. A *z*-test for two independent groups was used to compare the ITMSO and student evaluations at the 0.05 level of significance (two-tailed; critical $z = \pm 1.96$). The null hypothesis (H_0) was not rejected when the absolute computed *z* value was less than the critical value.

Table 5. *Five-Point Likert Scale and Verbal Interpretation*

Scale	Range of means	Verbal interpretation (VI)
5	4.21–5.00	Strongly Agree (SA)
4	3.41–4.20	Agree (A)
3	2.61–3.40	Moderately Agree (MA)
2	1.81–2.60	Disagree (D)
1	1.00–1.80	Strongly Disagree (SD)

Results and Discussion

4. Project Description

The ISPT makes it possible to test whether a spark plug produces a spark outside the engine. When the unit is switched on, the power indicator lights up and the battery charge indicator shows the state of charge of the battery, which should read 12.5 V or above. Pressing the push button switch for about 10 seconds fires the plug held in the spark plug holder. Each time the plug fires, the ampere meter deflects to the negative side to show the discharging current, and an intermittent sound shows that the unit is functioning.

The condition of the plug is judged from the spark itself (Table 3). A bluish spark concentrated between the centers of both electrodes indicates a plug in good condition; a yellowish spark scattered elsewhere indicates a plug that needs to be serviced or cleaned; and the absence of a spark indicates a defective plug that must be replaced. The battery is the power source of the unit, and the power supply section shown in Figure 2 supplies the power for it.

2. Project Structure

The parts of the ISPT are mounted on a stainless body with polycarbonate panels. The handle and its lock/unlock button are at the top; the push button switch, power switch, indicators, ampere meter, and spark plug holder are on the upper front; and the DC secondary input terminals and caster wheels are at the lower part of the unit (Figure 1). Table 6 gives the features and specifications of the device.

Table 6. *Features and Specifications of the Improvised Spark Plug Tester*

Feature	Specification
Body and panels	Heavy-duty stainless body; polycarbonate (polyglass) panels
Overall dimensions	8 in × 10 in × 7 in
Weight	3.8 kg
Power source	12 V battery, with a power supply section (transformer and rectifiers)
Operation	Manual, using a push button switch
Ignition source	12 V ignition coil
Indicators and meters	Ampere meter, voltmeter, battery charge indicator, power indicator light, AC power output light indicator
Controls	Power switch and push button switch
Test ports	Spark plug holder; DC secondary input terminals (+/–)
Portability features	Handle with lock/unlock button; two caster wheels
Component tested	Spark plugs of gasoline engines

3. Project Capabilities and Limitations

The ISPT is capable of showing whether a spark plug can produce a spark and whether that spark is of good quality, so that a plug can be classified as good, in need of service or cleaning, or defective (Table 3). It is portable, battery powered, manually operated, and made of locally available and affordable materials, and its parts are labeled and easy to remove and replace, which suits it to instructional use.

The device gives a qualitative result that depends on careful visual observation of the spark. The findings of this paper rest on the perceptions of 45 respondents who evaluated a single device, so, as with other small-scale studies of locally developed instructional devices (Oting, 2026), they may have limited generalizability. This paper reports acceptability ratings only; it does not report instrumented measurements of the device's electrical output or a side-by-side comparison with a commercial spark plug tester. These are addressed in the recommendations.

4. Project Evaluation

Tables 7 to 10 present the evaluations of the two groups for each criterion, and Table 11 summarizes them.

Design and Durability

As shown in Table 7, both groups rated all five indicators Strongly Agree, with the same overall weighted mean of 4.84. The ITMSO group gave its highest ratings (4.90) to the firm attachment of the parts and the visibility of the labels, while the students gave their highest rating (4.87) to the strategic location of the parts and the visibility of the labels. These ratings suggest that the respondents saw the ISPT as well assembled, clearly labeled, and sturdy. This agrees with Mijares (2007), who identified design as one of the main factors in the feasibility of a project and stressed that a design should be simple, economical, and easy to construct.

Table 7. *Respondents' Evaluations of the ISPT Regarding Design and Durability*

Indicator	ITMSO	Students
The parts of the device are strategically located.	4.77	4.87

Copyright © ISRG Publishers. All rights Reserved.
DOI: 10.5281/zenodo.24097520

The parts of the device are attached firmly.	4.90	4.86
The extended secondary power input terminals are properly attached and fully bolted.	4.83	4.78
Heavy-duty stainless material is used for a longer lifespan.	4.80	4.83
The labels of the parts are visible.	4.90	4.87
Overall weighted mean	**4.84**	**4.84**

Note. ITMSO = instructors, technicians/mechanics, and shop owners. Values are weighted means; all were interpreted as Strongly Agree (SA). The last row gives the overall weighted mean (OWM).

Usefulness and Functionality

Table 8 shows that the ITMSO group (OWM = 4.69) and the students (OWM = 4.82) both rated the usefulness and functionality of the ISPT Strongly Agree. The ITMSO group gave a perfect rating (5.00) to the ease of removing and installing the parts. Its lowest ratings in the whole data set, although still high, were for effectiveness in instructional and shop uses (4.47) and for the ability of the device to perform other related activities (4.53). These indicators point to where instructors and shop practitioners see room for improvement and support the recommendation to test other uses of the device. The results are consistent with Aquino (2009), who considered usefulness and functionality the most important factor to weigh in developing a project.

Table 8. *Respondents' Evaluations of the ISPT Regarding Usefulness and Functionality*

Indicator	ITMSO	Students
The device is effective for instructional and shop uses.	4.47	4.85
The product can perform other related activities and operations.	4.53	4.76
The developed product serves its purpose efficiently.	4.83	4.80
The device is easy to operate and manipulate.	4.63	4.85
The parts are designed for easy removal and installation.	5.00	4.83
Overall weighted mean	**4.69**	**4.82**

Note. ITMSO = instructors, technicians/mechanics, and shop owners. Values are weighted means; all were interpreted as Strongly Agree (SA). The last row gives the overall weighted mean (OWM).

Portability

Both groups rated the ISPT Strongly Agree in terms of portability (Table 9; OWM = 4.84 for ITMSO and 4.80 for students). The ITMSO group rated the device as handy and easy to transfer at 4.97, and its lowest rating (4.70) was for the device being carried by a single person. The students' lowest rating (4.76) was for the ease of replacing parts during repair. Juarez (2011) observed that oversized materials reduce the portability of a project and make it difficult to move from one place to another. The high ratings for compactness (4.87 and 4.82) and for the small space the ISPT occupies (4.79 and 4.77) indicate that this was not a concern for the ISPT.

Table 9. *Respondents' Evaluations of the ISPT Regarding Portability*

Indicator	ITMSO	Students
The project is handy and easy to transfer.	4.97	4.83
The product shows compactness in design and function.	4.87	4.82
The device occupies a small space for transportation.	4.79	4.77
The project can be carried by a single person.	4.70	4.83
The parts are easy to replace in times of repair.	4.87	4.76
Overall weighted mean	**4.84**	**4.80**

Note. ITMSO = instructors, technicians/mechanics, and shop owners. Values are weighted means; all were interpreted as Strongly Agree (SA). The last row gives the overall weighted mean (OWM).

Safety and Maintenance

As shown in Table 10, the respondents Strongly Agree that the ISPT is safe to use and easy to maintain (OWM = 4.82 for ITMSO and 4.81 for students). The ITMSO group gave its highest rating (4.93) to safe use and ease of maintenance, and the students gave theirs (4.85) to the manual operation of the device. The respondents also agreed that the parts are available in the local market (4.73 and 4.81) and affordable to replace (4.87 and 4.82), which supports the claim that the ISPT is easy to maintain.

Abad et al. (2009) cautioned, however, that the safety of a project also depends on the manner in which it is used, and that instructions should be followed to avoid accidents or damage to the apparatus. Because spark testing involves ignition voltage, the favorable safety ratings should be read together with the need for proper operating instructions and careful handling, such as the procedure in Section B.3.

Table 10. *Respondents' Evaluations of the ISPT Regarding Safety and Maintenance*

Indicator	ITMSO	Students
The device is safe to use and easy to maintain.	4.93	4.75
The parts are locally available in the market.	4.73	4.81
The materials used in the device are affordable in case of replacement.	4.87	4.82
The movable parts of the device are properly installed.	4.77	4.84
The device is manually operated, so there is no risk in the operations.	4.80	4.85
Overall weighted mean	**4.82**	**4.81**

Copyright © ISRG Publishers. All rights Reserved.
DOI: 10.5281/zenodo.24097520

Note. ITMSO = instructors, technicians/mechanics, and shop owners. Values are weighted means; all were interpreted as Strongly Agree (SA). The last row gives the overall weighted mean (OWM).

Summary of Evaluations

Table 11 shows that the respondents Strongly Agree on all four criteria, with grand weighted means of 4.80 for the ITMSO group and 4.82 for the students. The criterion means fall within a narrow band (4.69 to 4.84), which indicates consistently favorable views of the design and construction, functionality, durability, portability, and safety and maintenance of the ISPT. Ratings this uniformly high may partly reflect a ceiling effect and the respondents' favorable disposition toward a locally made device. They show acceptability, but they are not a technical performance benchmark. High acceptability ratings have likewise been reported for other locally developed instructional devices; for example, a residential plumbing mock-up was rated Very Good in design (4.83 out of 5.0) by its student users (Oting, 2026).

Table 11. *Summary of Respondents' Evaluations of the ISPT*

Criterion	ITMSO	VI	Students	VI
Design and durability	4.84	SA	4.84	SA
Usefulness and functionality	4.69	SA	4.82	SA
Portability	4.84	SA	4.80	SA
Safety and maintenance	4.82	SA	4.81	SA
Grand weighted mean	**4.80**	**SA**	**4.82**	**SA**

Note. OWM = overall weighted mean; VI = verbal interpretation; SA = Strongly Agree.

Significant Difference in the Evaluations of the Two Groups

Table 12 presents the *z*-test results. The computed *z* values ranged from 0.00 (design and durability) to 1.73 (usefulness and functionality), and all were below the critical value of 1.96 at the 5% level of significance. The null hypothesis was therefore not rejected for any criterion: there is no significant difference between the evaluations of the ITMSO group and the students. The widest gap was in usefulness and functionality, where the ITMSO group rated the device lower (4.69) than the students (4.82), but the difference did not reach significance. That working practitioners and future technicians reached the same overall judgment strengthens confidence in the acceptability of the ISPT. Failing to reject the null hypothesis, however, shows only that no difference was detected, not that the two groups' views are identical.

Table 12. *Test of Difference in the Evaluations of the Two Groups Using the z-Test*

Criterion	ITMSO WM (*s*)	Students WM (*s*)	*z*	Decision
Design and durability	4.84 (0.27)	4.84 (0.19)	0.00	Not significant
Usefulness and functionality	4.69 (0.38)	4.82 (0.29)	1.73	Not significant
Portability	4.84 (0.26)	4.80 (0.16)	0.85	Not significant
Safety and maintenance	4.82 (0.27)	4.81 (0.18)	0.14	Not significant

Note. ITMSO = instructors, technicians/mechanics, and shop owners; WM = weighted mean; *s* = standard deviation. $\alpha = 0.05$ (two-tailed); critical $z = 1.96$. H_0 (no significant difference between the two groups) was not rejected for any criterion.

Conclusions

Based on the findings of the study, the following conclusions are drawn:

1. The Improvised Spark Plug Tester was successfully designed and constructed from locally available materials around a single operating mechanism, and it can show whether a spark plug is good, needs servicing, or is defective through the color and location of its spark.
2. The ISPT is highly acceptable in terms of design and durability, usefulness and functionality, portability, and safety and maintenance, with grand weighted means of 4.80 from the ITMSO group and 4.82 from the students, both interpreted as Strongly Agree.
3. The evaluations of the ITMSO group and the students did not differ significantly on any criterion, so the null hypothesis was not rejected.
4. The ISPT is therefore considered appropriately designed, durable, functional, portable, safe to use, and easy to maintain. Because it is made of local materials around a single mechanism, it is a practical and affordable instructional tool for automotive technology shops.

Recommendations

Based on the conclusions, the following recommendations are offered:

1. The ISPT should be used for instructional purposes in automotive technology shops.
2. The device should be further assessed in terms of durability and efficiency, including instrumented tests of its performance.
3. Other possible uses of the device should be tested to determine whether it can serve additional purposes.
4. Similar studies should be conducted to compare its performance with other spark plug testers.
5. School administrators should allocate funds for the further development and validation of the device.
6. A short user's manual with safety instructions should accompany the device; the operation and testing procedure in this paper may serve as its basis.

References

1. Abad, F. P., Palabay, V. C., & Aquino, D. (2009). *Full paper of the technological research*. Don Mariano Marcos Memorial State University, San Fernando City, La Union.

Copyright © ISRG Publishers. All rights Reserved.
DOI: 10.5281/zenodo.24097520

2. Abdelati, M. H., Matar, A.-H., Mourad, M., & Rabie, M. (2025). Evaluating sensor placement in vibration-based engine misfire detection using artificial neural networks. *International Journal of Automotive and Mechanical Engineering*, *22*(3).

3. Aquino, D. C. (2009). *Honey extractor machine* [Technological research full paper]. Don Mariano Marcos Memorial State University, San Fernando City, La Union.

4. Baqer, I. A. (2024). Intelligent fault detection of spark plugs using vibration signal analysis and artificial neural networks. *International Journal of Vehicle Noise and Vibration*, *20*(1).

5. Bermundo, D. R. L. (2022). Effectiveness and acceptability of audio amplifier trainer. *International Journal of Educational Management and Innovation*, *3*(3), 279–287. https://doi.org/10.12928/ijemi.v3i3.6245

6. Heywood, J. B. (2018). *Internal combustion engine fundamentals* (2nd ed.). McGraw-Hill Education.

7. Huangfu, Y., Seddik, E., Habibi, S., Wassyng, A., & Tjong, J. (2022). Fault detection and diagnosis of engine spark plugs using deep learning techniques. *SAE International Journal of Engines*, *15*(4), 515–525. https://doi.org/10.4271/03-15-04-0027

8. Joshi, A., Kale, S., Chandel, S., & Pal, D. K. (2015). Likert scale: Explored and explained. *British Journal of Applied Science & Technology*, *7*(4), 396–403. https://doi.org/10.9734/BJAST/2015/14975

9. Juarez, B. Q. (2011). *Improvised air compressor: A technical feasibility study* [Unpublished master's thesis]. Marikina Institute of Science and Technology.

10. Lacanilao, J. I., Subia, G. S., Pascual, R. R., Lucas, T. J., & Santiago, R. R. (2024). Development and evaluation of a portable auto-electricity trainer (PAET) for industrial technology and engineering students. *Journal of Advanced Research in Applied Sciences and Engineering Technology*, *33*(1), 232–243.

11. Mijares, J. O. (2007). *Multi-purpose hand tapping device* [Unpublished master's thesis]. Marikina Institute of Science and Technology.

12. NGK Spark Plugs. (n.d.-a). *Spark plug basics*. Retrieved October 27, 2026, from https://www.ngksparkplugs.com/about-ngk/spark-plug-basics

13. NGK Spark Plugs. (n.d.-b). *Understanding spark plug heat range*. Retrieved October 27, 2026, from https://ngksparkplugs.com/en/resources/understanding-spark-plug-heat-range

14. Norman, G. (2010). Likert scales, levels of measurement and the "laws" of statistics. *Advances in Health Sciences Education*, *15*(5), 625–632.

15. Oting, E. S. (2026). Development and evaluation of a residential plumbing mock-up. *Journal of Technical Education and Training*, *18*(1), 293–305. https://doi.org/10.30880/jtet.2026.18.01.020

Copyright © ISRG Publishers. All rights Reserved.
DOI: 10.5281/zenodo.24097520