# EVALUATION OF ACCEPTABILITY OF AUTOTRONICS SIMULATION MODEL FOR AUTOMOTIVE PRACTITIONERS AND TECHNICIANS

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***ABSTRACT****: This study evaluates the acceptability of the Autotronics Simulation Model (ASM) among automotive practitioners and technicians. The ASM is equipped with cutting-edge technology found in modern vehicles, including a sophisticated lighting system, a 360-degree camera, and parking assist sensors. The primary objective is to assess the device's acceptability, a crucial factor for improving this technology. The study employed a descriptive research design method and adopted the Input-Process-Output (IPO) model as a framework. The Garvin's theory of quality was utilized to evaluate the developed prototype in terms of performance, conformity, reliability, aesthetics, and serviceability. The ASM demonstrated compliance with the functions and features related to safety, ergonomics, car lighting systems, 360-degree view cameras, and parking assist sensors. The study involved one hundred automotive practitioners and technicians from various automotive service centers in the provinces of Bukidnon and Misamis Oriental. The data gathered from the respondents indicated that the ASM received high ratings in all evaluated dimensions: Performance (weighted mean = 4.83), Conformity (weighted mean = 4.84), Reliability (weighted mean = 4.85), Aesthetics (weighted mean = 4.81), and Serviceability (weighted mean = 4.79). The ASM's overall weighted mean of 4.82 indicates a very high level of acceptability. These findings highlight the significant impact of the ASM on automotive practitioners and technicians. The device's exceptional quality enhances their knowledge and skills, enabling them to adapt to the modern technology present in vehicles. The ASM serves as an innovative tool for upgrading automotive professionals' proficiency and facilitating their seamless integration with advanced automotive technologies*

**Keywords:** Simulation Model, Autotronics, Evaluation of Acceptability, Automotive Practitioners, Technicians

## 1. INTRODUCTION

As technology continues to advance, there is a growing need for innovative and interactive teaching tools that can engage students and facilitate learning in new and exciting ways [1]. As a result of these developments, instructional materials that can replicate, test, and gather detailed data about the operation are required. The automobile mixes electronic sensors and the engine's computer management system. This happens because the procedures involved in the vehicle are so complex. Along with these rapidly changing designs, it is becoming more difficult for students and technicians to interpret their application of school-taught theory and workplace practices. Despite the efforts of competent instructors and trainers to explain such theories, there is a need to use instructional mock-ups or trainers to enhance a better understanding of the principles presented. This study aims investigates the level of acceptability of the developed Autotronics Simulation Model for Automotive practitioners and technicians. However, many technicians lack confidence in their abilities to undertake such autotronics work since they are unfamiliar with the contemporary technology found in modern automobiles. Through this development of the trainer model, they will improve their knowledge and skills as part of their professional development and boost their self-confidence.

The automotive electrical system is one of the most complex systems in the vehicle because a single mistake could damage the entire system. That is why the trainer model should be designed carefully to make sure that the learning exercise runs smoothly [2]. Immersive learning environments called simulations reproduce a situation, event, or place from the current world [3, 4] emphasized that a simulation gives the student the chance to engage with a representation of a scenario or action that occurs in real life. [5] Simulator are "technology-enabled settings developed to assist learning through immersion, engagement, and adaptable environments that eventually give direction and constructive feedback to the learner," according to [6]. Simulators, as opposed to traditional textbooks, are said to be better at putting knowledge and ideas to be learned into a real-world context [7, 8] highlighted that simulations can aid in the creation of scenarios that are similar to those that are experienced in real life. According to [9], simulators might help students "feel more authenticity and realism" and "interact with and participate in a virtual workplace." [7]. The benefits of employing simulations in educational contexts are frequently cited as being student involvement and motivation [9]. The beginner learner can better visualize the system depicted in the simulation with the aid of functional diagrams [10]. Aside from the technical skills needed, proper grasp and understanding on the concepts and principles of auto-electronic system is very important. Academic and other technical training institutions offering automotive technology are mandated to provide technical and technology graduates in automotive who will then be supplied to the demanding industries [11].

**Figure 1: Computer-generated Image of the ASM**

### *1.1 Theoretical Background*

According to a study completed by Ellinger [12] electricity is one of the most challenging subjects for automotive students to grasp. New automobiles have more electrical

and electronic components and more complicated electrical and electronic equipment. Students must understand electricity and how electrical systems work, how they are tested, and how they should be appropriately maintained. Knowing some electrical components and circuits does not imply that you know everything there is to know about them. The essential key to tackling the complex behavior of a vehicle's electrical system is to interpret the difficulties and diagnose the issues. With the obstacles that teachers face daily, they will innovate and, in some instances, build a model or prototype that will make lectures and practical activities easier with less effort [13]

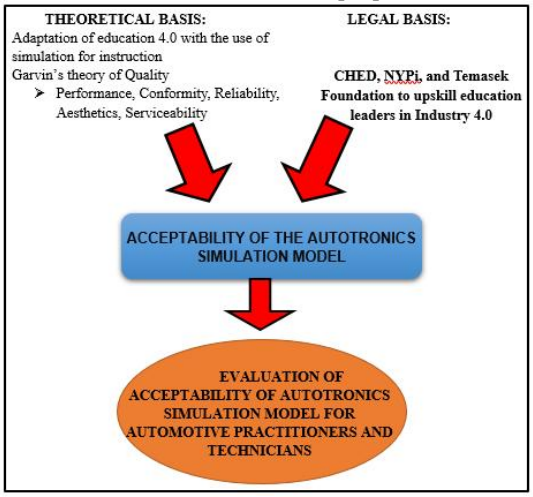



**Figure 2: Theoretical Framework of the Study**

### *1.2 Statement of the Problem*

This research aims to determine the level of acceptability of the ASM for automotive practitioners and technicians throughout the province of Bukidnon and Misamis Oriental Specifically, it answered the following questions:

1. What is the demographic profile of the respondents as to;
   1.1. Age;
   1.2. Sex;
   1.3. Length of Service;
   1.4. skills training attended for last five years.
2. What is the level of acceptability of the Autotronics Simulation Model in terms of:
   2.1 Performance,
   2.2 Conformity,
   2.3 Reliability,
   2.4 Aesthetics, and
   2.5 Serviceability?

## 2. MATERIALS AND METHODS

### *2.1 Research Design*

The researcher used the descriptive research design method wherein the trainer model is generally designated as the device that performs electrical system and autotronic simulations such as: car lighting, 360° view camera, and park assist sensor systems that can help automotive practitioners and technicians to upgrade their knowledge and skills.

### *2.2 Flow of the Study*

The Input-Process-Output (IPO) model provided the general structure and guide for the direction of this study. It has many interdisciplinary applications and conveys system fundamentals in industrial technology. It overviews education as a brainstorming, preliminary investigation tool in systems development processes. It consists of at least three, and sometimes four, distinct components. The IPO model is viewed as a series of boxes (processing elements) connected together to make a complete schematic diagram. According to guidelines or description points, information or tangible things go through a series of tasks or activities [14]. To depict the process, flow charts and process diagrams are frequently utilized. The three components of an equation are the input, the process, and the result [15]. Figure 3 shows the schematic diagram of the study.

The input-process-output model has historically been the dominant approach to understanding and explaining team performance and continues to exert a strong influence on group research today. The concept is based on traditional systems theory, which claims that a system's overall organization affects how well it will perform just as much as its constituent parts do. Similar to this, the IPO model has a causal structure where outputs result from several group activities that are impacted by diverse input factors.

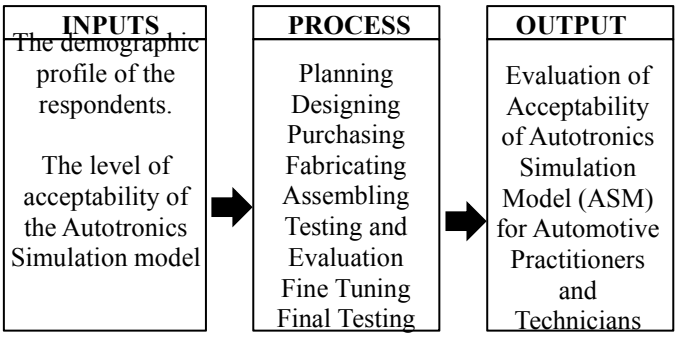
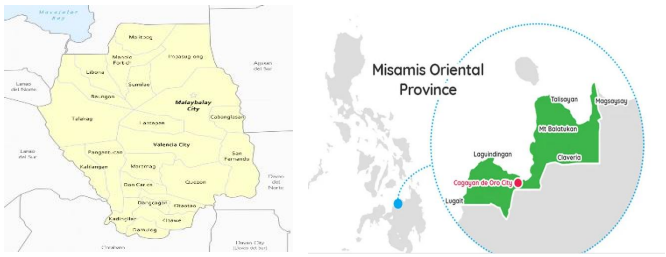



**Figure 3: Schematic Diagram of the Study**

### *2.3 Environment*

The study was were done in the different automotive service centers throughout the province of Bukidnon and Misamis Oriental.




(a) (b)

**Figure 4: Map of Bukidnon (a) and Misamis Oriental (b)**

### *2.4 Respondents*

The study's participants were automotive practitioners and automotive technicians from the different service centers throughout Bukidnon and Misamis Oriental provinces. The study employed a simple random selection approach to picking one hundred (100) individuals composed of 50 practitioners and 50 technicians. They were chosen to evaluate the acceptability of the Autotronics Simulation Model. They are considered skillful in their field of specialization.

**Table 1: Respondents of the study**

| Respondents | Population Size (N) | Percentage |
|---|---|---|
| Automotive Practitioners | 50 | 50% |
| Automotive Technicians | 50 | 50% |
| TOTAL | 100 | 100% |

### *2.5 Instruments*

A survey questionnaire was adopted from Garvin's Theory of Quality (GTQ). This was used in the collection of data in this particular study. The questionnaires were answered by the automotive practitioners and automotive technicians from the different service centers.

The instruments were validated by six external experts. The evaluators included two (2) from the car industry service manager (e.g., Toyota, Mitsubishi, Nissan, Ford, and Hyundai Motors), two (2) from the Technical Education and Skills Development Authority (TESDA-assessor), and two (2) from the academe (e.g., Ph.D.TM, DTE, or Technology Professor). In addition, they looked into the content and content accuracy, appropriateness and relevance, and clarity of the materials.

Rating scale on acceptability of the autotronics simulation model were constructed on the basis of the five-point Likert-Scale.

**Table 2: Range of values and description for data analysis**

| Scale | Range | Description |
|---|---|---|
| 5 | 4.21 – 5.00 | Very Highly Acceptable (VHA) |
| 4 | 3.41 – 4.20 | Highly Acceptable (HA) |
| 3 | 2.61 – 3.40 | Acceptable (A) |
| 2 | 1.81 – 2.60 | Less Acceptable (LA) |
| 1 | 1.00 – 1.80 | Not Acceptable (NA) |

### *2.6 Data Gathering Procedure*

Upon the approval of the proposal, the data were collected following these phases.

*Phase 1*. The service manager was requested to fill out a consent form that allows his/her practitioner's technicians to participate in the research study. A written letter of consent was given to all practitioners and technicians, informing them of the study's task, scope, and importance and requesting them to participate in the research thoroughly.

*Phase 2*. The researcher collected the completed consent letter request and started evaluating the acceptability of Autotronics Simulation Model. The survey was done in 2 methods, physical and virtual; during the physical survey, the researcher brought the trainer model; he then introduced and demonstrated the device in front of the respondents for that to witness its functionality. After the demonstration, the researcher gave the research questionnaire to the respondents for them to answer. Due to the location, the virtual method was used where the researcher record himself performing and demonstrating the trainer model. During the survey he presented the video presentation to the respondents and employ the questionnaire.

*Phase 3*. The researcher collected the questionnaire and the evaluation result answers, checked them, tabulated, recorded them, and subjected to statistical analysis.

### *2.7 Data Analysis*

The researcher used descriptive statistical methods in the analysis of the data, including frequency and percentages to describe the demographic profile of the respondents and mean and standard deviation to describe the level of acceptability of ASM in terms of Performance, Conformity, Reliability, Aesthetics, and Serviceability

## 3. RESULTS AND DISCUSSION

The results presented in this section sought to answer the research question of this study which was intended to determine the profile and level of acceptability [2] of the ASM in terms of performance, conformity, reliability, aesthetics and serviceability.

### *3.1 Demographic Profile of The Respondents*

This section determined the demographic profile of the respondents which includes age, sex, length of service, and skills training attended for the last 5 years. The respondents of the study were one hundred (100), automotive technicians and practitioners randomly selected wherein most of them were baccalaureate degree holders and certified as competent technicians by TESDA which is a holder of national certificate levels 1 and 2. Based on my interview most of the respondents particularly in the big automotive servicing center like Mitsubishi motors are a graduate of automotive technology courses, yet some of them are my students before. And the rest are coming from vocational courses and automotive training center that is accredited by TESDA.

**Table 3: Profile of the respondents**

| | Profile | Frequency | Percentage |
|---|---|---|---|
| Age | 62 and above | 0 | 0 |
| | 51-61 | 10 | 10 |
| | 40-50 | 9 | 9 |
| | 29-39 | 36 | 36 |
| | 18-28 | 45 | 45 |
| Sex | Male | 100 | 100 |
| | Female | 0 | 0 |
| Length of Service | 1-12 mos. | 31 | 31 |
| | 1-6 yrs. | 49 | 49 |
| | 7-12 yrs. | 16 | 16 |
| | 13-18 yrs. | 0 | 0 |
| | 19-24 yrs. | 2 | 2 |
| | 25 & above | 2 | 2 |
| Skills training attended | none | 39 | 39 |
| | 1-3 training | 37 | 37 |
| | 4-6 training | 16 | 16 |
| | 7-10 training | 5 | 5 |
| | 11 & above training | 3 | 3 |

### *3.2 The level of acceptability of the Autotronics Simulation Model*

The level of acceptability of the ASM in terms of Performance, Conformity, Reliability, Aesthetics, and Serviceable was assessed using the descriptive method of research.

**Performance**

Performance refers to a product's primary operating characteristics. For an automobile, performance would include traits like acceleration, handling, cruising speed, and comfort. Because this dimension of quality involves measurable attributes, brands can usually be ranked objectively on individual aspects of performance. Overall performance rankings, however, are more difficult to develop, especially when they involve benefits that not every customer need [15].

The result of the data analysis revealed that the ASM is very highly acceptable in term of performance *(M= 4.83, SD= 0.45)*. This implies that the general performance rating of the trainer model among automotive technicians and automotive practitioners in terms of acceptability would greatly improve their knowledge and skills in the modern technology of the vehicle.

**Table 4: Level of Acceptability of ASM in terms of Performance**

| Performance | *M* | *SD* | *Description* |
|---|---|---|---|
| 1. The device displays an excellent understanding of the basic concepts of trainer model, | 4.83 | 0.43 | VHA |
| 2. The learners can easily perform the actual activities due to its compact design. | 4.79 | 0.54 | VHA |
| *Continuation...* | | | |
| 3. The 360-degree camera is functioning properly. | 4.8 | 0.53 | VHA |
| 4. The parking assist sensor gives accurate signal to the user. | 4.87 | 0.39 | VHA |
| 5. All the lights and switches are functional | 4.88 | 0.36 | VHA |
| **Over-All Mean & SD** | **4.83** | **0.45** | **VHA** |

**Conformity**

According to [16] conformity/conformance is the degree to which a product's design and operating characteristics meet established standards. The two most common measures of failure in conformance are defect rates in the factory and, once a product is in the hands of the customer, the incidence of service calls. These measures neglect other deviations from standards, like misspelled labels or shoddy construction that do not lead to service or repair.

The table below shows the level of acceptability of ASM in terms of conformity. The data analysis revealed that the respondents confirmed that the ASM is very highly acceptable *(M= 4.82, SD= 0.42)*. It is noteworthy to discuss that the least mean is "The ASM is made up of light weight and locally available materials" *(M=4.77, SD= 0.53)*. On the other hand, the item that has a highest mean is "The ASM has a high definition monitor display" *(M=4.89, SD= 0.32)*. In terms of conformity, the majority of the respondents extremely accept the trainer model.

**Table 5: Level of Acceptability of ASM in terms of Conformity**

| Conformity | *M* | *SD* | *Description* |
|---|---|---|---|
| The ASM…….. | | | |
| 1. is equipped with functional 360-degree camera | 4.88 | 0.33 | VHA |
| 2. has Parking assist sensor can give accurate distance. | 4.82 | 0.46 | VHA |
| 3. has a high definition monitor display | 4.89 | 0.32 | VHA |
| 4. are equipped with modern technology lighting system and it is all functioning. | 4.82 | 0.48 | VHA |
| 5. is made up of light weight and locally available materials. | 4.77 | 0.53 | VHA |
| Over-All Mean & SD | 4.84 | 0.42 | VHA |

**Reliability**

Garvin's theory explains reliability as the probability of a product malfunctioning or failing within a specified period. Common measures include mean time to first failure, mean time between failures, and failure rate per unit of time [16].

The table below shows the ASM's level of acceptability in terms of reliability. The data analysis revealed that the ASM is very highly acceptable in terms of reliability *(M= 4.85, SD= 0.42)*. The results imply that all the respondents accept that the trainer model is reliable for improving their skills and learning the modern electrical and electronic equipment of the automotive world.

**Table 6: Level of Acceptability of ASM in terms of Reliability**

| Reliability | *M* | *SD* | *Description* |
|---|---|---|---|
| The ASM…….. | | | |
| 1. development is reliable for learning of new technology. | 4.88 | 0.36 | VHA |
| 2. develops for reliable learning experience. | 4.88 | 0.38 | VHA |
| 3. is made up of durable materials. | 4.82 | 0.44 | VHA |
| 4. developed for conductive learning and least maintenance cost. | 4.81 | 0.49 | VHA |
| 5. electrical and electronic components are reliable to use. | 4.86 | 0.43 | VHA |
| **Over-All Mean & SD** | **4.85** | **0.42** | **VHA** |

**Aesthetics**

Aesthetics is a purely arbitrary aspect of quality. A product's appearance, feel, sound, flavor, or aromas are subjective judgments and expressions of personal choice. It could be challenging to satisfy everyone on this quality metric [16].

The table below shows the level of acceptability of the ASM in terms of aesthetics. Based on the data analysis it revealed that the respondents rated the ASM as very highly acceptable *(M= 4.81, SD= 0.45)*. This implies that the physical look and the overall design of the trainer model are very highly acceptable by the respondents and it has already been made and designed for commercialization.

**Table 7: Level of Acceptability of ASM in terms of Aesthetics**

| Aesthetics | *M* | *SD* | *Description* |
|---|---|---|---|
| The ASM…….. | | | |
| 1. has a state-of-the art design. | 4.85 | 0.41 | VHA |
| 2. design is user friendly. | 4.83 | 0.43 | VHA |
| 3. is presentable and commercially design. | 4.81 | 0.47 | VHA |
| 4. is neat and clean. | 4.83 | 0.45 | VHA |
| 5. color combination is attractive. | 4.73 | 0.51 | VHA |
| **Over-All Mean & SD** | **4.81** | **0.45** | **VHA** |

**Serviceability**

According to [16] he highlights serviceability as speed, courtesy, competence, and ease of repair. Customers worry about product downtime, service restoration time, appointment keeping, interaction with service workers, and lingering issues. Complaint handling procedures can impact customers' evaluation of product and service quality.

The table shows the level of acceptability of the ASM in

terms of serviceability. Upon analysis the data revealed that majority of the respondents rated the ASM as very highly acceptable *(M= 4.79, SD= 0.46)*. The result implies that among the 100 respondents, the majority of them agree that the serviceability of the trainer model is very highly acceptable, which indicates that this innovation can be used conveniently.

**Table 8: Level of Acceptability of ASM in terms of Serviceability**

| **Serviceability** | *M* | *SD* | *Description* |
|---|---|---|---|
| The ASM…….. | | | |
| 1. parts can be easily replaced when it becomes worn out. | 4.81 | 0.44 | VHA |
| 2. can be easily repair. | 4.76 | 0.52 | VHA |
| 3. is convenient to use and user friendly. | 4.83 | 0.40 | VHA |
| 4. has a cart wheel for portability and it can be transfer easily. | 4.78 | 0.48 | VHA |
| 55. electrical and electronic components cannot be easily breakdown. | 4.78 | 0.46 | VHA |
| **Over-All Mean & SD** | **4.79** | **0.46** | **VHA** |

**Summary of the Level of Acceptability of the ASM**

Table shows the summary of the level of acceptability of the ASM as to Performance, Conformity, Reliability, Aesthetics, and Serviceability. The ASM got an overall rating of very highly acceptable *(M=4.82, SD=0.44)*. The device's overall quality has a significant impact on automotive practitioners and technicians. This innovation also helps the learners to upgrade their knowledge and skills to adopt the modern technology of the vehicle. Furthermore, this device also addresses the problem of the lack of modern automotive equipment that is used for instruction.

**Table 8: Summary of Level of Acceptability of ASM**

| **Aesthetics** | *M* | *SD* | *Description* |
|---|---|---|---|
| Performance | 4.83 | 0.45 | VHA |
| Conformity | 4.84 | 0.42 | VHA |
| Reliability | 4.85 | 0.42 | VHA |
| Aesthetics | 4.81 | 0.45 | VHA |
| Serviceability | 4.79 | 0.46 | VHA |
| **Over-All Mean & SD** | **4.82** | **0.44** | **VHA** |

## 4. CONCLUSIONS

The ASM was developed in order to assess the current needs of modern instructional materials in the field of automotive technology. The researcher uses the Garvin's theory of quality to investigate the level of acceptability in terms of performance, conformity, reliability, aesthetics and serviceability. The study was participated by one hundred automotive practitioners and technicians. Based on the findings of the study, thorough analysis, and interpretation of the data gathered, it is concluded that Autotronics Simulation Model's performance, conformity, reliability, aesthetics, and serviceability was very highly accepted. The developed device fits the standards of respondents helping them to upgrade their knowledge and skills. This ASM plays a vital role in contributing to and upgrading the knowledge and skills of the individuals who are working in the field of automotive technology. Moreover, it also addressed the need for new technology training equipment in the automotive industry. Building creative designs that enable educational transformation processes to match current demands and future conditions can increase relevant teaching and learning greatly. Future researchers are encouraged to develop an innovative study that might support the automotive technology programs in higher education's [17] to be use in teaching pedagogy for the learners to adapt the modern technology.

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