CHAPTER I - Introduction

Background of the Study

As e-learning becomes ubiquitous, disruptive technology influences institutions to establish digital transformation in educational development [1]. It allows schools to restructure m

the unified framework of educational constructs through quick development in adoption of technology. Digital transformation supports a shared vision in increased learning outcomes and teaching strategies that are closely above the technological advancement [2]. This atechnological competency developed by students can address the rise of innovations to meet the needs of future generations.

Digital learning expands the teaching and learning opportunities of students and teachers. It shows that e-learning incorporates favorable impact on students' views, analytical and interpersonal abilities, academic standards, and autonomy in learning [3]. E-learning constitutes a diverse electronic use of digital tools that is primarily effective to integrate technology-driven environment. It developed certain skills in the involvement of digital technologies.

According to Ainsworth & Scheiter [4], visual representations improve learning efficiency by providing definite models that diminish the need for abstract reasoning and speed up the process of forming conclusions. It comprises text, photos, videos, and animations. Grouping identical data in visual representations enhances perception by facilitating exploring, identifying, and inferencing through innate perceptual methods. Visuals benefit the memory processes by transferring knowledge that lessens the cognitive burden and simplifies tasks like problem-solving. Integrating visual components in interactive learning experiences could significantly boost users' understanding and involvement, which tends to establish an increasingly interactive and easily accessible learning environment.

In connection with visual representations, e-learning engages learners to understand the learning resources clearly through visual aids. Interactivity also has a beneficial effect on the effective student learning process. It bolsters self-motivation, absorbs the concepts or information, and extends attentiveness to learning activities [5].

Simulation facilitates hands-on learning experience in producing realistic models that reflect in an actual settings. It is based on a type of e-learning technique called simulation-based learning. According to Campos et. al. [6], simulation-based learning supports training courses by experiential learning and principles to develop a professional advantage. It imparts problem-solving and evaluative thinking skills that aid in the cost-effectiveness of both learners and educational institutions. Laboratory activities are a key part of simulations that enrich instructional materials. This can be regarded either as a partial replacement for the school's curriculum or as an addition to more conventional teaching techniques [7]. For this reason, online simulation-based learning gains student confidence and learning outcomes which resemble an educational development and motivation.

In the creation of the interactive website, three-dimensional modelling is developed for the design pattern and objects of the user interface. The software application serve as an guiding tool for implementing the interactive animation that most likely utilized for creating models and optional embedding it through the website. It illustrates a visual framework that uses a game engine for generating animation, design patterns, and other components for interactivity of the e-learning [8]. One of the popular game engines is Unity, which is accessible to developers for simplicity, adaptability, effectiveness, and energy use. It supports 2D and 3D immersive tools for designing and is adopted in different sectors like engineering and automotive [9]. This tool can connect the IT sector to build advanced e-learning systems to benefit diverse industries.

Automotive Industrial Management centered on the online delivery of learning materials that motivate students to facilitate learning innovation [10]. It delves into pioneering digital teaching methods for students to learn without going to campus. Auto mechanics' students have different technical expertise that maintaining and repairing vehicles. Exposure to training and vast knowledge of different tools can achieve the skillset in auto mobile industry [11]. In relation Philippines' K-12 education, the Technical Vocational and Livelihood track or TVL is a strand under industrial arts for students who want to learn automotive servicing. The study shows that auto mechanics generate a transformative effect on digital expertise which develops the world's auto-mechanic industry [12].

Various countries adopted the ever-changing digital learning to acquire the necessary resources for the students' learning outcomes. The automotive servicing course is recommended in in-person classes but if the implementation of the e-learning system produced growing opportunities, auto mechanics builds global change on the educational sector. As a result, technical education, such as TVL, serves as the foundation for career readiness with reindustrialized tools that improve teaching and learning quality education practices [13].

Reference Studies

The Automotive Technology Courses in State Universities and Colleges in the Philippines to Cater the Industry Needs, 2023 [14]

The study conducted by Torres states that automotive technology affects other countries through advancement and efforts of educational programs. Although experienced automotive mechanics are declining, the implementation of training and program regarding the automotive mechanics in state universities and colleges will aid in meeting the community's requirements in automotive

sector. A government agency from the Philippines known as TESDA or Technical Education and Skills Development Authority oversees relevant technical know-how that covers the Automotive Servicing NC III developed in 2020. The curriculum regulates training and skills acquisition that strengthen the efficiency of learning and experience. It immersed the students in essential expertise that interlinked to both school and industry. Certification in Automotive Servicing is a beneficial asset for individuals to prove that specifications in performing technical tasks gain global competitiveness in the workplace. Still, there is a need for revision or enhancement of the curriculum for relevant outcomes.

Effectiveness of Online Learning in Technical And Vocational Education and Training (TVET): A Meta-Analysis Study from a Malaysian Perspective, 2022 [15]

Online-based learning comes with strategic tools and techniques in accommodating Technical and Vocational Education and Training (TVET) students. Interactive learning, including videos, generates successful understanding in the student's learning. The efficacy of online learning can potentially be maximized by integrating interactive components with educational resources or learning media. Kahoot is one of the common game-based learning to actively engage students in mode of exercises in which students can gain points. The advantages of this type of learning incorporate effective engagement and boost self-confidence in school. Additionally, it sets the flexible benefit of digital learning through the motivation and readiness of TVET students.

E-Learning as a Supporting Study in the Field of Vocational and Automotive Engineering, 2020 [16]

The goal of automotive competency in the field of vocational education is the ability to work on car repairs, maintenance, and upkeep on a regular basis. As a result, creating e-learning designs that encourage experiential learning in tandem with practical experience is imperative. The

e-learning design for the practice's vocational field needs to be more organized, user-friendly, appealing, and suitable for actual work environments.

Interactive e-Learning Tools and Pedagogy for Engaging STEM Education and Skills Development in the Digital Era: Challenges and Opportunities, 2019 [17].

This study explores the significance of integrating virtual worlds for automotive technology with gamified e-learning modules in STEM strand education. Introducing a comprehensive e-learning program aimed at enhancing knowledge and practical skills related to engines, internal combustion, and different vehicle structures. The system integration, particularly v-Lab, demonstrates virtual experiments using distinctive tools and resources to create a smooth connection between interactive learning and detailed activities. This promotes a thorough comprehension of internal engine design, enabling future engineers and technicians to explore operational principles in great detail through virtual means.

Gap Analysis

The Electude is an engine simulator that students can learn and practice automotive diagnosis [18]. It is an e-learning system designed for automotive mechanics students which contains lessons and exercises in an interactive way. Electude encompasses four stages: topic introduction, discovery and assessment, experimentation, and hands-on application to provide e-learning solutions. However, the gap in Electude is the unorganized complexity of learning modules that are not structured in user’s needs. The Electude’s learning modules should align sequentially in the student’s curriculum. To solve the gap, Electude establishes a student’s

learning levels to allow the framework to be consistent. It should be arranged in fundamental to advance level in using this e-learning system.

According to Cheng [19], the work on smart vehicle inspection instruments employing Freeman chain coding and case clustering shows potential for overcoming standard fixture design inefficiencies. While reaching high levels of precision in mathematical matching of features is a significant benefit, a lack of study of real-world constraints is a disadvantage. The focus on quickness is advantageous, but choices such as the user experience and scalability remain unexplored. The study emphasizes a reduction in design time as an advantage, but it ignores possible implications for total cost-effectiveness and practicality. Future study should address these issues to improve the method's reliability and applicability.

According to Vair [20], E-learning efforts aim to engage and improve learners' comprehension of automotive electrical topics. The proposal contains mockups of the homepage, interactive activities, learning games, and an evaluation exam. The program's intended purpose is to contribute to the improvement of automotive education by offering a dynamic and effective online course for learners looking to expand their understanding of electrical theory in the automotive environment. The weakness of the system's drawback is that it does not identify the resources and functions for automotive circuit training that were used to develop the user experience (UX) design. It proposes that it look into the compatibility tactics for expanding e-learning systems so that students may adjust their involvement to the system's effectiveness.

From the study conducted by Rohman et al. [16], e-learning is the use of computers and networks to streamline the learning process and increase user performance. Today's technical advancements stimulate the usage of e-learning in all fields that provide learning and training

activities. However, the system provides minimal attention to the development of psychomotor abilities since it focuses too much on cognitive components, particularly in practical vocational fields such as automotive engineering. To solve the gap, the system should place a greater focus on development and psychomotor abilities, particularly in actual vocational sectors such as automotive engineering.

As stated by Llopis-Albert [21], The study delves deeply at major components of the automotive business, such as linked and self-driving mobility as a service, online resources for automobile purchases, and the influence of big data. The report emphasizes the revolutionary transition while also addressing the gradual adoption of electric cars, which is being driven by environmental rules and directives boosting the use of renewable energy sources. The analysis of risks and possibilities in market growth and services contributes to the suggestion of strategically developing the global automotive industry as a recommended solution. The purpose of this growth is to achieve an advantage in competition, manage risks, and eventually improve the industry's competitiveness and customer experience.

Table 1 shows the list of gathered existing studies and systems to explore the gaps and its solutions.

Existing Studies / Systems	Identified Gaps	Solutions Upon Implementation
Electude [18].	A more detailed explanation regarding the specific topics covered will enhance Electude's focus on automotive technology. Complementing their curriculum with supplementary materials could therefore establish advantageous for academic establishments in search of a more comprehensive e-learning platform. Consequently, the platform should offer a precisely designated structured framework that is tailored to the content requirements of its users.	The system can provide focused access to educational resources, enabling a thorough examination of significant topics that span from basic engine mechanics to advanced learning levels of mechanics in emerging automotive technology. This allows users to navigate according to their individual learning levels, promotes improved comprehension and facilitates the learning process.

Intelligent Vehicle Inspection Tool Design Based on Freeman Chain Code for Automatic Annotation of 3D Models [19].	The study claims to have excellent precision in geometrical matching of features and annotation, however it does not provide a thorough examination of potential constraints and obstacles in real-world circumstances.	A more in-depth examination of these issues will greatly contribute to a more thorough and informative presentation of the suggested intelligent inspection tool design technique.
E-Learning Electricity A Web-Based Training System: Applied to Teaching the Fundamentals and Function of Electrical Theory as it relates to Direct Current Automotive Circuits [20].	The system does not exactly specify the tools and features for automotive circuit training that was utilized in implementing the system and the user experience (UX) design. Moreover, its scalability platforms does not provide the details and the effectiveness in implementing the e-learning program.	The study should investigate compatibility strategies for scaling e-learning platforms so that students can adapt to their engagement with the platforms' effectiveness. Particular learning considerations should also be chosen in accordance with the technological apparatus owned by the intended consumers.

E-Learning As A Supporting Study In The Field Of Vocational And Automotive Engineering [16].	The system lays little emphasis on the development of psychomotor skills since it places too much attention on cognitive components, especially in practical vocational subjects like automotive engineering.	The system should expand more on the emphasis development and address more on psychomotor skills, particularly in practical vocational fields like automotive engineering.
Impact of Digital Transformation on the Automotive Industry [21].	The automotive industry constitutes to growing markets and services which poses risks on small and medium-sized enterprises (SMEs).	It will be solved by expansion of the global automotive sector in cost-effectiveness, collaboration, and innovation to gain competitive advantage to customer experience.

Table 1. Gap Analysis Matrix.

Research Questions

This study attempts to answer the question, “How does the implementation of the interactive 3D model-based e-learning system Edu Mechanic affect learners' acquisition of automotive servincing NC 1 skills?” The resolution of this query will be examined and addressed upon the completion of the system.

Objective of the Study

The goal of this study is to develop a 3D interactive e-learning system called Edu Mechanic, to use as supplementary material for students' learning of car maintenance in Preventive Maintenance Service.

- To develop the web application that will cater users from Grade 9 and 10 students under Automotive Mechanic course in their subject Automotive Design Technology.
- To identify the core competencies listed in the syllabus of Automotive Servicing NC I specifically in the maintenance of manual car engine, drive train, brake system, suspension system, steering system in the application of Preventive Maintenance Service (PMS) through 3D modeling.
- To implement a 3D car automotive mechanic tool in simulation interactivity in creating 3D model layout through Blender software with a supporting tool of Javascript in integrating the 3D model in the website.
- To test the interactivity of the 3D simulation in the implementation of Preventive Maintenance Service (PMS) through functionality testing of the system.
- To test the level of security risks of the potential access like data extraction and tampering of grades of the created e-learning system using Common Vulnerabilities Scoring System (CVSS).
- To evaluate the usability of the developed 3D web application system using the User Experience Questionnaire (UEQ) in measuring attractiveness, efficiency, perspicuity, dependability, stimulation, and novelty to know mechanic student’s user satisfaction and quality of the overall e-learning system.

Scope and Delimitation

Scope

The proposed system for the user will cover the mechanical equipment tools in an e-learning system that utilizes a 3D interactive model to provide an educational experience to automotive industry. It focuses on teaching the utilization process of various tools and diagnostic gadgets often used in automobile service and maintenance. The information from the website adopts the curriculum of TESDA, specifically the core competencies of the Automotive Servicing NC I, which includes the following topics:

- Perform pre-delivery inspection,
- Perform periodic maintenance of automotive engine,
- Perform periodic maintenance of drive train,
- Perform periodic maintenance of brake system,
- Perform periodic maintenance of suspension system,
- Perform periodic maintenance of steering system

The main characteristic of an interactive model is that it has a function that enables users to use auto mechanic tools in every task on simulation and analyze the structure of the equipment. Refer to the Appendix section on the list of mechanic tools. For instance, users can select and view the equipment and obtain details by observing its component structure, dragging, and choosing a specific tool that will be applied for the specific repair.

The type of vehicles that cover this topic is manual car transmission. It also learns the Preventive Maintenance Service (PMS) to expose the students in the inspection of the car. It will be created through five simulations of the PMS interactive system to explore the 3-dimensional features. The five (5) simulations with the tasks of users included in the 3D interactive learning

system are the following:

1. Engine Oil Replacement
    - changing engine oil such as emptying the old oil
    - changing the oil filter for manual vehicle
    - adding a new oil to the manual transmission engine
    - changing diesel engine oil for vehicle
2. Service/replacement of Spark Plug
    - identify and remove the old/damaged spark plug
    - replacing new plugs performing the right tools
3. Engine Tune Up
    - inspect and replace components
    - altering ignition timing
    - optimization of carburetor setting
4. Suspension System Components Replacement
    - removing the wheels
    - identify the damaged components
    - inspect and replace the particular component
    - lubrication and assembly
5. Brake Pads and Rotors Replacement
    - removing the wheel to access the break components
    - changing the old rotors and break pads
    - replacing new and cleaned rotors and break pads

There will be step-by-step instructions for each task to be completed on the simulation activity. Moreover, the study focuses on automobile mechanic students under the Technical and Vocational Education and Training (TVET) in Don Bosco Technical Institute of Makati, Inc. which is one of the TESDA-accredited schools in the National Capital Region.

In the application of 3D in the e-learning website, the study used Javascript for the components to be interactive. It uses the three.js to implement the interactivity of the simulation activity within the website. It promotes realistic graphics which gain 3D modeling for hands-on experience of e-learning.

For the vulnerability assessment, the system will used Nessus in the discovery of weaknesses to establish security in the system. Common Vulnerabilities Scoring System (CVSS) are examined to evaluate the vulnerabilities exposed in the website. The result will aid in fixing the risk of cyber threats and comply with the best practices in the system.

Delimitation

The system narrows only addresses the fundamental maintenance procedures instead of complex repair methods, and an internet connection is required in order to access the system. From the curriculum of TESDA, the study excludes the Automotive Servicing NC II, NC III, and NC IV. It is due to the complex and advance competencies in the application of automotive mechanics. The e-learning system cannot guarantee the assurance of compatibility across all systems, as optimization is only possible for particular devices and utilization of advance animation techniques may not be considered in formulating the mechanical figures. Moreover, it is important to point out that the e-learning system functions as an additional instrument and cannot be considered a replacement for practical, physical engagement with authentic automotive repair machines.

Existing Process Flow

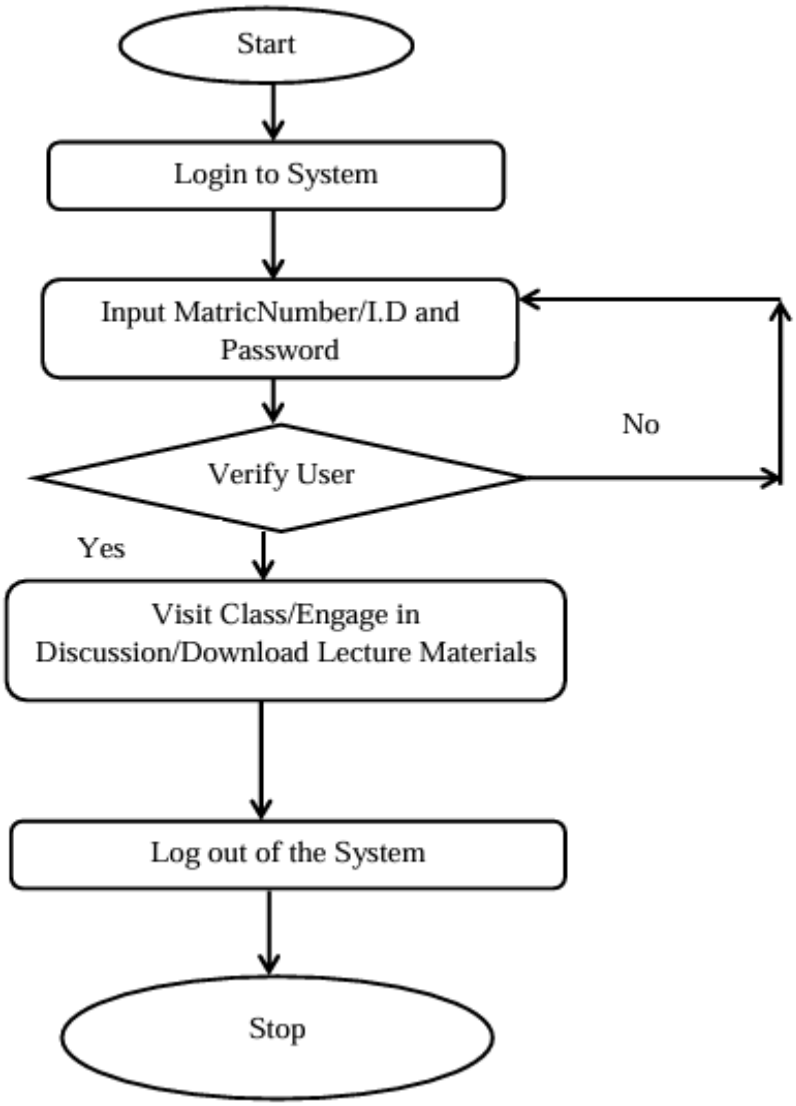


Figure 1. Data Flow System

A program flow analysis pertaining to the implementation of an e-learning system for tertiary institutions is illustrated in the figure above [22]. The study project incorporated a comprehensive web-based learning system that allows students access to an application interface containing a variety of resources, including the course schedule, assignments, and learning materials. In order to gain access to the proposed system, the user must provide the necessary

credentials or create a personal account in accordance with the institution's specifications. The illustrates the user's interaction with the website as they explore its various components, beginning with the login function and ending with the logout system [22]. Consequently, the application provides students with a standardized learning experience in which numerous learning materials can be incorporated into courses in accordance with the school's curriculum.

Proposed Process Flow

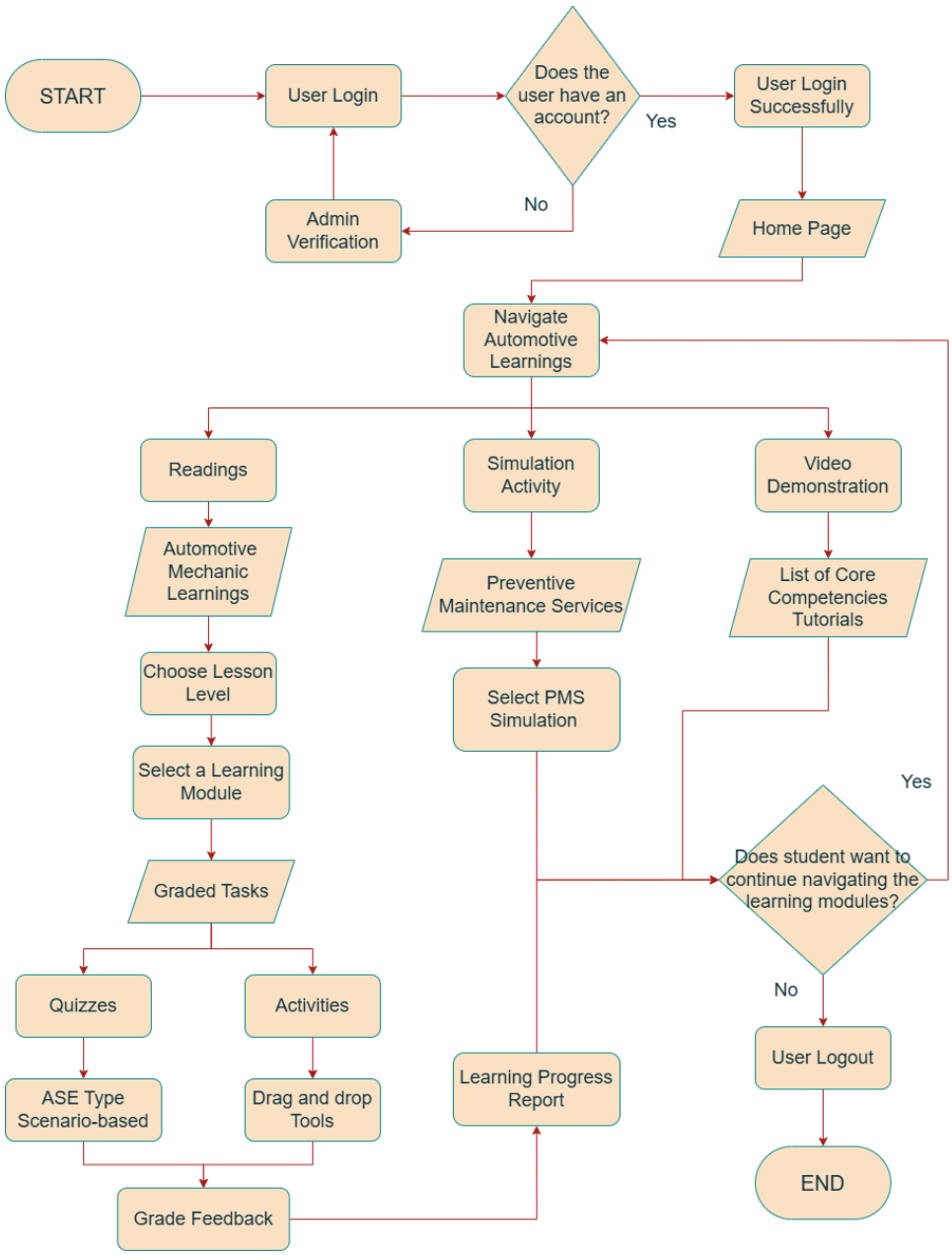


Figure 2. Edu Mechanic Flowchart

The Edu Mechanic system consists of different functionalities such as User Login, Home Page, Readings, Video Demonstration, Simulation Activity, Quizzes, Grade Feedback, and Student's Learning Progress. The user should login and input their credentials to proceed to the homepage. There are mechanic interactive tools and equipment where users have a variety choices of auto mechanic equipment that has realistic simulation model. When users have already selected the equipment, it will provide a brief descriptions where it will be applied. Another entity is the quizzes which is the evaluation to ensure a constant understanding and application of the automotive industry. Lastly, a video demonstration exhibits an actual application of a chosen equipment in a real-world scenario. If the user wants to choose another tool, it will go back to the tools selection to pick another one. Otherwise, the system will be terminated.

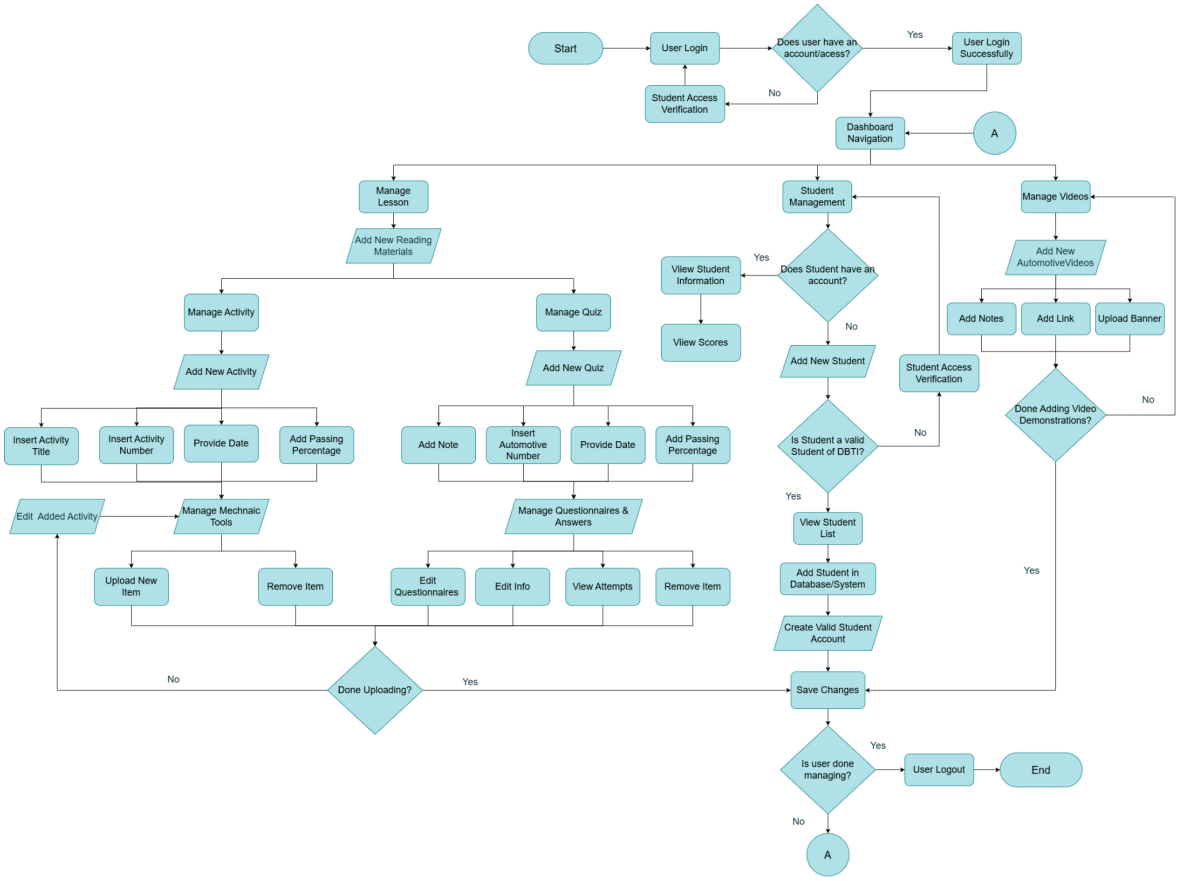


Figure 3. Edu Mechanic Admin Flowchart

In this Figure presents the administrative process for accommodating the students learning modules for managing the system features. It begins with a login feature, where selected users have the access where access is verified before navigating to the main page of the system; followed systeam feature where admin manages the reading materials section through adding activities and quizzes, by inserting the learning title, number, information, and passing rate. Additionally, the student managing feature allows administrators to view their personal information and scores based on activities. The administrator can add new automotive videos based on the core competencies by filling up the process of adding its notes, links, and uploading image banner. Furthermore, after adding the necessary video materials the process continues in adding videos; if not, the admin may leave the program. If a student doesn't have a account, they

are added, after verifying their validity as a student based on the student list provided. Once validated, they are included in the student list, and a valid student account is created before saving the changes. If the administrator is not finished in utilizing the system, they can return to the dashboard for further navigating and doing their tasks; otherwise, they log out, ending the process.

Process Rules

1. User Sign Up

   Individuals create usernames for utilizing auto mechanics website throughout the registration procedure. Users give relevant details during sign-up to receive approved access to automotive-related courses, components, and interactive material.

2. User Login

   The authorized point of entry where registered clients log in to their respective accounts. To obtain access to the e-learning system, users must provide their credentials, which are commonly a username and password. User Login provides safe access to tailored material, monitors their progress, and enables users to continue or restart learning activities inside the automotive learning system.

3. Home Page

   After signing in, it serves as the major landing and navigation interface for users. It gives an overview of the Edu Mechanic website. The Home Page is intended to be user-friendly, with quick access to features such as Explore Modules, Readings, Videos, and Simulation. This core portal serves as a jumping off point for users to explore,

interact with, and manage their educational experience inside an automotive e-learning system.

4. Readings

The readings show the overview of the car mechanic modules. It contains 6 Preventive Maintenance Services modules from the core competencies adapting the Automotive Servicing NC I Curriculum (Refer to Appendix A). The modules are also organized in terms of level of difficulty: Beginner, Intermediate, and Advanced. The first part is the objectives on understanding the learning outcomes. The second part is the content where reading materials are in pdf format that users can view, print, and save. The content covers maintenance, diagnosis, repair, and general information of every PMS. This will give user's comprehension in understanding a specific to general part of car maintenance.

5. Video Demonstration

A video demonstration depicts the actual use of auto mechanics tools. It shows the actual video presenting a car equipment's functionality in an automotive industry for around 5-10 minutes. The video from the website is the researchers guided by a professional teacher specialized in automotive, and conducted from Don Bosco Technical Institute of Makati, Inc. The following video demonstration that are the approved by the school (See Appendix B and C):

- Service/Replacement of Spark Plugs - removal of spark plug using the spark plug remover

- Suspension System Components Replacement - compression of coil spring and assembly and reassembly of suspension
- Brake Pads and Rotors Replacement - removal of brake pads, rotors, and wheels.
- Coolant Cleaning - cleaning the coolant system by filling the water.
- Cleaning Air Filter - removing the air filter and proper cleaning technique of air filter using air compressor

The materials, such as the camera, are provided by the researcher. The researcher is also responsible for taking the video, editing it, and uploading it to YouTube. This page will contain YouTube videos where users can watch the real-life maintenance of a car like changing the spark plug into a new one.

6. Simulation Activity

There are manual car engines present for the simulation that will cover five Preventive Maintenance Service (PMS) that users can explore in a 3D setting. Toyota is the brand model of 3D car used in the simulation.

From the implementation of simulation activity, the study uses Javascript for the interactiveness and its 3D environment of the e-learning website. The Javascript library used in the study is the three.js that will be the foundation of integrating 3D models and simulations. Blender is utilized for the 3D modeling of the car engine, car components, and mechanic tools and equipment. The Preventive Maintenance Service is the major lesson of mechanical students that offers 3D walkthrough of the procedures on specific PMS in completing a task in the simulation page.

The user can manipulate the movement of the 3D simulation using the “W” key in moving forward, “A” key in moving to the left, “S” key in moving backward, and “D” in moving to the right using the keyboard. User interaction also involves play, pause and reset buttons, which will aid in user control on focusing the 3D simulation.

The Preventive Maintenance Services (PMS) present in the simulation activity in the e-learning are the following:

- Engine Oil Replacement
    - 3D model creation of an engine oil replacement is to design a car engine, car lift, oil filter, dipstick, funnel, motor oil, ratchet, oil filter chain wrench and oil drain plug.
    - The 3D simulation of engine oil replacement will help user walkthrough in the following tasks:
        - changing the engine oil such as emptying the old oil and drain it to the oil drain plug,
        - changing the oil filter through the use of oil filter chain wrench, and
        - adding a new oil to the manual transmission engine in a 3D environment.

- Service/replacement of Spark Plug
    - 3D model design includes a car engine, spark plug, ratchet, spark plug remover, engine cover, and ignition coil.
    - The 3D simulation of spark plug replacement will help user walkthrough by process of:
        - removing the car cover where the spark plugs are located,

        - replacing spark plugs using ratchet and spark plug remover, and
        - adding new spark plugs
- Engine Tune Up
    - 3D model design includes car engine components, such as camshaft, sparkplug, ignition wires, front exhaust, catalytic converter, middle muffler, exhaust pipe, rear muffler, and exhaust manifold, and Dyno tuning machine.
    - In a 3D environment, students learn to identify engine components through:
        - the installation of camshaft, sparkplug, ignition wires, front exhaust, catalytic converter, middle muffler, exhaust pipe, and rear muffler, and
        - using a Dyno Tuning device for knowing the statistics of tuning a car.
- Suspension System Components Replacement
    - 3D model design of the suspension system in manual transmission includes car engine, suspension system (contains spring, shock absorber), and the mechanic tool used is the combination wrench for removing bolts.
    - In this 3D simulation, user can walkthrough the process of the following:
        - changing the suspension system into a new one, and
        - using a mechanic tool called combination wrench for removing bolts from the suspension system.
- Brake Pads and Rotors Replacement
    - 3D model design created in brake pads and rotors replacement consists of wheels, brake pads, rotors, car oil fluid extractor pump, lug bolts, brake lathe, and brake fluid.
    - Users will walkthrough on 3D environment through the following procedures:

- extracting the brake fluid inside the engine,
- properly removing the wheel's bolts or lug nuts through the utilization of tool called tire wrench,
- removing the brake caliper, brake pads, brake disc, and wheel,
- using brake lathe machine for grinding the brake disc,
- installing the brake caliper, brake pads, brake disc, and wheel, and
- filling in the brake fluid.

7. Quizzes

Quizzes are important tools for measuring students' knowledge and reinforcing key topics during the learning process. These brief examinations give learners the chance to check their comprehension and allow them to take the quizzes depending on the teacher's customized number of attempts. It encompasses two sections which are scenario-based and drag and drop questions. Quizzes that are well-designed not only test information retention but also encourage active recall and critical thinking abilities.

The two types of quizzes are as follows:

- Drag and drop is a type of interactive quiz used by dragging the mechanic tools and equipment into a matched question. It presents various mechanic tools and equipment such as plier, multimeter, tire pressure gauge, and other tools that are draggable to be placed in its designated area. There are numerous boxes containing each mechanic tool and equipment, created in 3D model, where students can match the name of the mechanic tool. For example, in the lists of

mechanic tools and equipment present, the user will drag the tire pressure gauge to be placed in the appropriate place.

Some of the basic mechanic tools and car parts categorized per modules (PMS) are the following:

Module #1

- Air Compressor
- Multimeter
- Cross Wrench
- Wheel Balance
- Jumper Cable

Module #2

- Air Filter
- Car Radiator
- Motor Oil
- Exhaust Manifold
- Turbo Charger

Module #3

- Gearshift
- Crankshaft
- Car Engine
- Piston
- Spark Plug

Module #4

- Car Disc
- C-Clamp
- Pedals
- Car Jack Stand
- Plier

Module #5

- Car Suspension
- Shock Absorber
- Rims
- Bolts
- Nuts

Module #6

- Electric Drill
- Car Muffler
- Wrench
- Chassis
- Fuel Nozzle

- Scenario-based is a question that contains situational content related to practices in the automotive industry. It draws an analysis of the mechanic tools and equipment with regard to the hypothetical scenarios that encounter the role of auto mechanics. It also adapts the ASE certification format on the quizzes as it is designed to evaluate a mechanic student's ability to solve problems, make decisions, and integrate previous expertise and experience to new or challenging situations in dealing with mechanic tools and equipment.

8. Grade Feedback

Grade feedback is a principal element of the learning process, giving students with insights into their academic achievement which contain student's progress. Constructive feedback emphasizes strengths and areas for growth while clearly explaining evaluation standards. This feedback is a key communication channel, inspiring students to actively participate in their learning experience and encouraging continual growth.

9. Student's Learning Progress

The student's learning progress is under admin side where teachers oversee the current learning and completed tasks of students. It shows the progress chart and diagrams in the dashboard page which is crucial for the system in order to monitor student's status in every activity.

Significance of the Study

The Automotive mechanics educational sector can significantly aid with the Edu Mechanic website in ensuring students' learning outcomes with the access to their technology. It develops the technical knowledge in the intricacy of auto mechanic equipment to integrate into visual interactive website. Another benefit of implementing this research and its website is facilitating the need for cutting-edge technologies to generate knowledge for students' expertise in automotive mechanics. In this case, digital transformation can elevate the expertise of people in the field of automotive servicing.

CHAPTER II – Review of Related Literature

Related Terms

E-learning

E-learning, also known as digital learning or online learning, corresponds to the rich media that contains specialized knowledge within a particular profession. It converged to IT where both technology and users synchronize to generate education for students. E-learning consists of digital content which uses computer network tools with courses present on it through the development of Internet Communication Technology [23].

Technical Skills

Technical skills are qualities possessed by professionals and students with exposure to trainings or work-related environments. Applying these skills acquires mechanics student on different diagnosis on the tools and machines, safety handling of tools, and maintenance to interpret the failure or problem. The downside of automobile mechanics students is the ineffective utilization of technical skills which faced challenges in coping with modern vehicles [24].

Automotive Mechanics

Automotive Mechanics is a job relevant to industrial arts. It is a field involving specialized skills of the automobile industry. An auto mechanics is a profession containing a scientific competence including operating, designing, repairing, and keeping that all parts of the car are well-maintained [25].

Mechanical Skills

In the field of automobile mechanics, strong mechanical abilities are essential for success in a fast-paced, rapidly developing business. This study reveals a disturbing trend in which technical college graduates concentrating in Auto-Electrical maintenance of systems have a significant lack of mechanical abilities. As the automotive industry undergoes fast technological transitions, knowledge of current car structures, such as computer and electronic parts, becomes increasingly important. The demand for genuine or prototype contemporary autos and cutting-edge technology in classrooms emphasizes the necessity of hands-on training in developing the practical mechanical knowledge required in the industry [26].

Interactivity

As e-learning evolves, various interactive tools reshape the learning and teaching techniques in delivering adaptive and convenience to educational institutions [27]. Interactivity also allows the exchange of data in variation of input actions where the interplay takes place between the user and the system, and among the systems. Interactivity promotes e-learning which encompasses the active participation, technological capacity, amount of time spent, and satisfies satisfaction by learners continued engagement in an e-learning environment [28]. The role of interactivity fosters learners in the content, interface, and the system feedback with the perception and learning process using various interactive digital technologies.

Related Studies

Understanding The Role of Digital Technologies in Education: A Review, 2021 [29]

The digital technologies have become a driving force of transformative learning systems. Students primarily engage with extensive technology resources that promote e-learning to achieve accessibility and affordability in education. E-learning enhanced the students' life with various digital technologies to equip their skills for their professional success. Optimizing online learning through digital technologies enables students with dynamic channels of educational information such as flexibility, innovative contents, interactivity, etc.

Digital learning tools form an enriching learning experience where students can learn at home. It is linked to the internet for ease in transporting learning contents globally that improves the conventional education system. This type of learning constitutes productivity in learning new skills, building skillset, and receiving different opportunities to dealing with the gaps for economic and educational success. It allows to adopt life-long learning in which both teaching and learning produces a learning style through freedom of studying. With the advancement of digital learning, e-learning systems can eliminate physical boundaries and alter teaching approaches to facilitate innovative lesson approaches. It also stimulates creativity and perception of success in embracing remote access of learning.

The limitation of the study is the insufficient discussion of the constraint of using digital tools towards the traditional style of learning. It surmises that modern technologies provide better

learning environments without referring to internet connectivity. As the interaction between computers and the internet collectively impacts e-learning, there are still some students from other countries who do not have access to education due to the digital divide. This discrepancy is a critical challenge for institutions to easily adapt to rapid changes in digital learning throughout the generation.

From the cases above, additional information about the comparison to traditional tools and techniques in learning can be lacking as the study strives to elaborate on the advantages and applications of digital technologies in education. It is also necessary for sustainable development goals to refine the plan to fill the gap on educational issues towards the success of quality education across the world. By implementing online education that is applicable to all, technologies will help revolutionize economic and social development in the long run.

Teacher Perceptions of the Use and Implementation of Online Learning in Secondary Career and Technical Education Program, 2023 [30]

The vocational education program focuses more on hands-on training with laboratory areas to obtain theoretical and practical expertise. Despite the effectiveness of physical classes, online sessions also made a pervasive engagement in instructional technologies through hybrid learning opportunities. In this case, conducting e-learning offers skills in preparation for a job with a variety of learning styles for improved learning opportunities. Instructors and students yield an environment to positively implement digital learning strategies to further prospect an active participation in school.

The integration to e-learning assists the vocational programs such as carpentry, culinary arts, automotive services, and other CTE programs to deliver effective workforce development in

boosting vocational fields. One of the approaches for experiential learning of students is simulation. Digital simulation has earned a reputation in educational institutions and can be practiced by students even outside their schools. Through the immersive setting provided by digital simulations, students can leverage their theoretical understanding and gain actual experience through the involvement of simulation processes in virtual mode.

Regardless of the popularity of digital simulation and interactive tools, the pitfalls behind the learning experience are that students need to be aware of using instructional tools. Guidance and practice are necessary to operate the system in e-learning. Another limitation is the complexity of vocational programs in supporting diverse access to technologies, making it difficult to apply all the instructional tools to achieve e-learning method. It also varies on the program offered on CTE, which some have an elevated academic focus with theoretical considerations that could be used in online learning environment. All CTE courses do not have online simulations to acquire the necessary practical training. It depends on the region, country, and kind of CTE program offering the digital simulations or visual interactive system.

The instructional technologies from vocational courses need to be state-of-the-art in accordance with industry standards. It ensures that CTE programs foster professional development in both onsite learning and e-learning. Moreover, the instructors should assist the students in the proper use of digital tools with strategic action to fully understand the concept of e-learning like familiarity with the features of digital simulations.

The Use of Interactive Educational Forms in a Technical University, 2022 [31]

Higher education uses interactive technologies in facilitating student's learning process. It supports the e-learning concept that aims to critically solve the traditional technique through

interactive learning methods. Utilizing interactive learning can provide cognitive potential in transporting information into skills. Interactive education made e-learning grasp motivation, self-growth, and social life.

In modern education, interactive learning involves in applying theoretical techniques to immerse the students in real-life situations in exploring different circumstances and information exchange. Both knowledge and capabilities are molded in a variation of theoretical and practical lectures through interactive forms. Students benefit from interactive methods of activities for nurturing problem-solving, boosting motivation, and increasing the communication mechanism. The confidence cultivates the students with active involvement to understand and perform tasks through interactivity. With the growing interactive technologies, students can enhance their productivity and integrate their professional abilities from e-learning systems.

The challenges from the study lie in distance learning where uneven access to equipment and the internet blocks the use of interactive learning. Inequality in educational resources inhibits the competency of students in improving crucial skills. Another challenge is the conformity to the student engagement. Some students may pose unassertive trait to use digital tools for their learning process, leading to ineffective learning outcomes. It also does not scrutinize and enumerate interactive learning tools such as systems used by the students.

To fully integrate the interactive learning technologies and student's motivation, the system has features on interactive learning that simulate the student's performance, increase enjoyment, and ease of support. It should add engaging content to enhance interactivity while learning. This can resolve in carrying out the real life scenarios in the interactive learning.

Effect of Computer-Assisted Instruction on Students' Academic Achievement And Retention of Auto-Mechanics Technology in Technical Colleges, 2022 [32]

Computer-Assisted Instruction (CAI) gains an advantage to the e-learning of auto-mechanic students. It establishes digital techniques in maintenance and other services to conquer expertise in automobile vehicles. The advancement of CAI to digital learning incorporates quality education that contributes to teaching and learning development in school.

The study elucidates the auto mechanic profession and its relation to CAI. Auto-mechanics consists of various scientific education involving the design and operation of diverse forms of motor vehicles. It requires knowledge in diagnosing and testing the vehicle parts to deliver remedies. CAI is computerized instruction that can be learned asynchronously. It carries innovative thinking in the progression of teaching and learning techniques. This educational approach become widespread as flexibility promotes an active learning setting for students. Additionally, applying the CAI signifies a considerable improvement in the quality of education. It also reveals that student retention interconnects with enhancing academic achievement in utilizing CAI.

On the other hand, the hindrance of the CAI to instructors is the lack of competence or unfamiliarity to the functionality of application which lowers the performance of teaching. It also impedes when overly using multimedia components used in application that distract the students to be more focused on multimedia rather than the primary content. ICT infrastructure is observed in CAI for its implications to digital learning resources. Balancing the CAI principles and the information can optimize the effectiveness of CAI to be useful in learning.

CAI resources need to be relevant to the learning objectives of the students. By removing distractive elements, students can view the essential content. Training programs for instructors enforce auto mechanic skills in employing schools. Modification in automotive servicing curriculum should increase effort in applying effective teaching methods to strengthen the e-learning of educational institutions.

Assessment of the Extent of Auto-Mechanics Teachers' Utilization of Instructional Materials For Teaching in Technical Colleges in Edo and Delta States, Nigeria, 2020 [33]

The instructional materials are embraced by instructors in conducting classes for learning initiatives in school. Auto-mechanics course has a viable impact on digital learning in application to the instructional materials. It implies that instructors are equipped to address practical challenges to machinery and tools from automotive servicing methods. Electronic instructional material increases the engagement and interactivity that accelerates the competencies towards the success of e-learning and learner's cognitive abilities.

Auto-mechanics initiate complex tasks in manipulating engine parts. Because of the intricacy of car designs, instructional materials of learners are diverse and entails pertinent resources in promoting teaching and learning support. It is contingent on different cases where the instructional materials are utilized effectively. In relation to digital learning, electronic instructional materials are prominently deployed in vocational education, including individualized and mass instructions. The learner's academic performance in utilizing electronic instructional materials aids in quality education to meet the learning objectives, procedures in learning competencies, and provide student's positive behavior in learning outcomes. As auto-mechanic students use academic and technological understanding, the effectiveness of

instructional materials are based on the creation of curriculum, accessibility of materials, breadth of learning delivery, suitability of materials on student's ability to learn, etc. It captivates the complexity of auto mechanics in strategic action to distinct instructional materials.

The limitations that arise from the study is the lack of digital literacy in electronic instructional materials which use phones, computers, and internet to initiate learning experience. Due to inadequate knowledge of ICT, graduate students produce low expertise in work routines. It also hinders the current industry practices for acquiring electronic instructional materials. Therefore, a moderate extent on the uses of electronic instructional materials results to the auto-mechanic learning processes of both instructors and students.

Sufficient technological skill requires auto-mechanics students and instructors to embrace digital trends to cope with modern automotive technology and its new techniques in the work environment. It encourages learners to seek digital inclination and interest, especially in the electronic instructional materials for e-learning. This can harness the potential of auto mechanic students in enhancing the academic performance of the students.

Assessment of Autotronics Servicing Skill Needs among Roadside Mechanics for the Use of Auto Scan Tools, 2023 [34]

This literature analysis lays the groundwork for the investigation of Autotronics Servicing Skills requirements among Kano State Roadside Mechanics and Master Trainers who use auto scan instruments. The synthesis of current information emphasizes the need of meeting increasing needs in automotive engineering, which will lead to the improvement of regional skills and training programs.

The study area of Kano State gives a regional component to the research. Kano, with its numerous local government districts, acts as a microcosm for the larger issues and possibilities that Roadside Mechanics and Master Trainers encounter. The literature recognizes the value of localized research in addressing individual demands and complexities in the automobile repair industry.

While the material presented is thorough, one possible shortcoming is the lack of explicit references to current literature or research on Autotronics Servicing Skills among Roadside Mechanics and Master Trainers. Authors would improve the review by rooting it in existing study and enable readers to follow the growth of expertise in this topic. Future research in growing automotive innovations and investigating advanced training initiatives, meetings, and industry assets will be essential for future consumers in the arena of Autotronics Maintenance Talent among Roadside Mechanics and Master Trainers.

Technical Skills Requisites of Auto-Mechanics Students in the Maintenance of Modern Vehicles in Nigeria, 2019 [35]

The study discovered that auto mechanics students' technical skills are insufficient for effective repair and maintenance of modern vehicles; as a result, craftsmen graduating from auto mechanics' programs find it difficult to successfully use devices in carrying out automobile recognition and repairs.

The study recommend that the technical college's auto mechanics curriculum and the syllabus for training automobile teachers be reviewed on a regular basis in order to equip teachers with the necessary technical and educational abilities to expose students to the necessary skills. Similarly, the research recommend the organization of retraining classes and training

sessions for auto technicians in order to improve their abilities in the successful maintenance of current automobiles.

According to Isaac and Igwe et al., the Advanced National Technical Certificate (ANTC) and National Technical Certificate (NTC) products lacked the fundamental abilities necessary for meaningful work in today's car sector. Their findings demonstrated that the school's curriculum was both inadequate and inappropriate in terms of providing adequate skills to tackle the issues inherent in keeping track of modern vehicles on Nigerian roads. The inclusion of new technology into current vehicles, along with new subsystem and system components, has changed the way they work and made maintenance a more difficult operation.

Students studying automotive mechanics must be able to comprehend new and constantly evolving automotive technology. Because vehicles are becoming more computer-oriented, mechanics must comprehend computer technology. Mechanics must also be knowledgeable about repair tools, vehicle components, and vehicle systems. Due to the numerous skills needed, mechanics are typically required to complete specific schooling and obtain certification. A skill indicates expertise or ability acquired by training and experience shown by a person to carefully use manual skills in a specific vocation.

Strategies for Enhancing Roadside Motor Vehicle Mechanics on Basic Computer Skills for Effective Manipulation of Automotive Digital Diagnostic Tools in Nsukka Urban of Enugu State, 2020 [36]

Three research questions led to the investigation. The study used a descriptive survey research approach. The Cronbach alpha test yielded a reliability value of 0.95. The data gathered was analyzed using the mean and standard deviation. The study's findings indicated that wayside

motor vehicle mechanics lack the computer skills required for successful operation of automotive digital diagnostics instruments, posing obstacles to the diagnosis, repair, and maintenance of modern automobiles.

The study reveals a significant lack of computer skills among roadside car mechanics working in the metropolitan setting of Nsukka, Enugu State. This deficiency is a severe impediment to the smooth manipulation of automobile digital diagnostic instruments, limiting mechanics' ability to perform correct diagnosis, efficient repair, and upkeep practices customized to the complexity of current cars. The consequences of this deficiency are visible in suboptimal maintenance practices that fall short of worldwide best practices for the competent use of automobile digital diagnostic instruments. As a result, roadside technicians face a daily decline in business from clients driving newer automobiles.

The lack of knowledge of computers to roadside motor vehicle mechanics in Nsukka Urban, Enugu State, is evident in their unsuitable digital literacy, poor capacity to interpret diagnostic data, insufficient technical proficiency for digital tool manipulation, difficulties in solving during diagnostic processes, resistance to adapting to advancements in technology, a scarcity of continuous learning opportunities, and struggle to seamlessly integrate insight

Standardization of Quality Testing and Inspection Tools for Product Quality Improvement in a Selected Automotive Assembly Organization in South Africa, 2023 [37]

The investigation is grounded in the recognition that product quality within the automotive sector is intricately tied to the control of variations in the manufacturing process, underscoring the pivotal role of inspection and testing instruments in ensuring product quality. As per the existing literature, an effective quality system in the automobile sector necessitates the

deployment of appropriate and regulated testing and inspection instruments. The automotive industry is renowned for its multitude of such instruments integrated into manufacturing processes, prompting an exploration into their regulation for optimal quality outcomes.

However, it is beyond the purview of this study to delineate the gaps or current lacunae in the available literature. The research delves into the advantages of standardized quality examination and testing instruments concerning the progress of product quality within a specific South African automobile assembly organization. The findings challenge the longstanding notion that uniformity inherently leads to heightened product quality. This sets the stage for a critical examination of the deficiencies or shortcomings in the prevailing understanding of how standardization influences product quality in the realm of car assembly.

In essence, the study contributes to the existing body of literature by elucidating the merits and drawbacks of standardized quality inspection and testing methods for achieving high-quality outcomes within the intricate context of a South African automobile assembly organization. The study questions the assumption that standardization invariably results in enhanced product quality, presenting a nuanced perspective that considers the intricate interplay between standardized equipment, cost implications, and actual enhancement of product quality within the erudite automobile industry.

Quality Control Basic Tools in Automotive Industry, 2022 [38]

The research navigates the terrain of managing quality within the industrial sector, with a particular focus on the automobile industry, recognizing the competitive and complex nature of Quality Control. The literature emphasizes the need for implementing quality control

fundamental tools within this fast-paced and demanding industry by highlighting the need for a tool-based approach for efficient quality control.

Furthermore, the literature study briefly discusses the distinctions between quality control alongside quality assurance, noting the possibility for misunderstanding. A more detailed discussion or clarity on how these variances affect the automobile business, especially Hirschmann automobile, might offer readers a greater understanding.

To accomplish the paper's ultimate purpose, the literature review will examine the current seven core quality control instruments that serve as the foundation for maintaining and improving quality in the process of manufacturing. It will emphasize the critical relevance of these instruments in the context of a worldwide automotive firm, as demonstrated by Hirschmann Automotive's operations.

Furthermore, while the research concentrates on Hirschmann Automotive's procedures, there will be no specific discussions on the applicability of its conclusions. Addressing the ability to transfer the described quality tools and procedures to other automobile firms or other industries will broaden the paper's relevance and practical value beyond the case study.

Simulation-Based Learning in Higher Education and Professional Training: Approximations of Practice Through Representational Scaffolding, 2022 [39]

The study improves our understanding of the efficiency of simulation-based learning methodologies. Nonetheless, one significant weakness noted in the examined literature is the apparent lack of consistency in evaluation measures throughout these investigations.

A systematic study of the long-term results in simulation-based learning is lacking in the literature, which is a major gap that impedes a thorough knowledge of skill preservation and application over lengthy periods of time in the domains of higher learning and professional training.

The study of simulation-based education can benefit from a range of methodological techniques and expand beyond its core focus on cognitive procedures and consequences to examine the many types of indicators of processes and learning outcomes. Furthermore, it found a potential area for future research in selecting and customization of practice representations incorporated in simulations via representational scaffolding.

Engineering Education goes Lifelong Learning: Modularized Technical Vocational Education and Training Program for the Automotive Sector, 2023 [40]

In today's information society, a combination of technical and vocational training, and continued professional growth has become critical for ensuring the successful implementation of Industry 4.0 and 5.0 tools, processes, and technologies in the automotive sector. Industry 4.0 promotes the incorporation of digital technology into production, such as IoT, AI, and robots, but Industry 5.0 expands on this by stressing human-machine cooperation, customization, and sustainability in manufacturing operations. Lifelong learning ideas, which pervade both the professional and private spheres, emphasize the need of individuals constantly adapting to technology changes. The automobile industry's requirement to traverse ecological and digital transformations is particularly difficult, necessitating engineers with the competence to actively drive this dual revolution. There is a substantial body of literature on the need of ongoing

instruction and education, particularly at postgraduate levels, in meeting the changing demands of automotive professionals.

The goal is to show how postgraduate education, governed by specific departments like life long learning, can fulfill the evolving educational demands for technical professionals in the ever-changing automotive sector. The research not only contributes to the current body of automotive knowledge, but it also underlines the practical application of effective Technical and Vocational Education and Training (TVET) programs in encouraging sustainable continuous development for workers in the automobile industry.

On The Applicability Of Hybrid Systems Safety Verification Tools From The Automotive Perspective, 2023 [41]

The current study looks at the official validation of hybrid discrete-continuous networks as part of automobile safety assurance methods. It calls into question the conventional dependence on comprehensive vehicle testing, stressing its limits in the face of modern automotive systems' increasing complexity.

The research has been a notable change in the academic sector, with the introduction of unique methodologies particularly geared for official validation in hybrid discrete-continuous systems. However, there is a significant gap between academic breakthroughs and industry understanding. Tools created in academic environments are rarely tested in real applications for cars, and their usefulness in this sector is understudied. The major goal of a joint research endeavor among Ford and RWTH is to bridge this gap by assessing the possibilities for technological and scientific transfer.

This study has two aims. For starters, it aims to provide a thorough and easily understandable review of current state-of-the-art advancements in academia formal verification. This presentation is intended for future users who are interested in learning more about these improvements. Second, the report offers findings from practical testing of several formal verification techniques in the automobile industry. The goal is to reach significant findings that may be used to provide suggestions for future factors, particularly in the quest of improved safety assurance procedures in the automobile sector.

Introduction of the Indian Automotive and Auto Ancillary Industry, 2023 [42]

The study looks into the worldwide dynamics of the automobile industry, which is often regarded as one of the most industrialized industries due to the huge distribution of its goods across the world. Despite its apparent global character, the business is largely dominated by a small number of multinational firms, highlighting major players' concentrated power. This research dives into the regional vs global characteristics of the automobile industry, revealing the confusing tendency that, despite advancement, the business retains a significant regional identity.

The study in this subject throws light on India's automobile industry's exceptional expansion, which may be linked to a succession of government-driven programs launched during the 1990s. The Automotive Mission Plan of 2016, the most recent landmark in this trajectory, reflects a deliberate governmental commitment to encouraging growth of the automotive sector. The report examines the complex influence of these policies in bringing the Indian automobile sector into the world scene.

The Automotive Component Manufacturers Association of India (ACMA), founded by the Indian government in 1959, is an important part of the Indian automotive scene. This

organization plays an influential function in promoting and regulating car component manufacture in the country. The report investigates ACMA's role in developing the Indian automobile ecosystem, giving insights into its genesis, goals, and contributions to promoting a vibrant auto component manufacturing industry. This study tries to improve our understanding of the delicate interplay between governmental actions, industry initiatives, and the growth of India's automotive sector by a detailed assessment of the literature.

The Effect of Simulation Technique on Academic Achievement: A Meta-Analysis Study, 2021 [43].

This study contributes to the field of education by conducting a comprehensive examination of the beneficial and significant effects of simulation techniques on students' academic development. It discusses the potential benefits of simulation-based methods for supporting the development of twenty-first century competencies, including but not limited to logical thinking, problem-solving, and innovation. It provides useful guidance in the formation of interactive technologies.

A meta-analysis was employed in this study, which is an intensive and methodical approach utilized to analyze and integrate data from multiple studies. This methodology facilitates the combination of similar questions in order to offer a comprehensive understanding of the topic. A significant quantity of data was gathered in the study as a result of the meta-analysis's thorough examination of 91 studies. The accuracy of the findings improve alongside the results can be extended to larger populations due to the immense sample size. It determines disparities in the impact sizes of the investigation based on a range of factors, including the level of education, the subject matter, the sample size, and the duration of application. In addition, a particular approach called funnel plot analysis was used to investigate

the presence of publication bias in the research findings of the study. Also, the meta-analysis research is considered reliable due to the absence of prejudice.

The study employed Thalheimer and Cook's taxonomy to evaluate the effectiveness of simulation methodologies through the examination of impact sizes. However, it is crucial to recognize that the method of categorization could contain basic limitations and lacks universal acceptance. Consequently, the Funnel Plot is employed to assess publication bias, it overlook effectively taking into consideration potential biases that may exist throughout the specific studies themselves, such as researcher prejudice or funding mechanisms. Moreover, the study's scope is predominantly limited to Science and Health Sciences courses, thereby constraining the generalizability of the findings to alternative academic disciplines.

In order to improve the practicality of the study, additional investigations should include a broader spectrum of participants. There is a need for more comprehensive examinations of the application and effectiveness of simulation approaches across a variety of factors to deal with visual interactive tools and other aspects of e-learning. Further comprehensive investigations are suggested to analyze the effectiveness and utilization of simulation approaches in various domains, so as to offer a more complete understanding of their impact on academic achievement.

Production Planning And “Define, Measure And Analysis“ Tools In Automotive Industry As Prerequisite Of Automation: A Case Study, 2023 [44]

The study indicates a flaw in the existing manual collecting of production data. During a two-month monitoring period, a significant amount of projected time for production on nine observed machines, which ranges from 14 to 52 percent, goes unreported. This discovery promotes an analytical study, revealing that the stated downtime on individual computers greatly understates the real downtime, exposing a huge gap in the current data gathering approach

Furthermore, the study considers the "control" phase, recommending statistical comparisons of prior and new state indicators to assure long-term improvements in manufacturing planning. The lack of automated data gathering is noted as a barrier to obtaining this degree of control, emphasizing the urgency and need of transitioning to an automated method.

The lack of accuracy in manual data gathering becomes a focus of the research, leading it to the important development of data collecting technologies. In the "improve" phase, the research suggests a shift toward automation of this process, highlighting the need of using current technology resources for maximum efficiency.

Digital Twins for Online Training of Automation Techniques, 2019 [45]

The study provides a valuable contribution to the field of automation industrial education by promoting a cost-effective solution to particular findings of vulnerabilities associated with traditional practical laboratories and following server architecture supporting a Web Based Training (WBT) server instructing by utilizing programmable automation equipment. It allows the targeted audience to engage in systematical assessments in a remote control platform with an implemented 3-dimensional model for automotive structure.

The study emphasizes the implementation of 3D modeling and simulation in automation engineering education, especially the development of digital twins with tools such as NX CAD. The enhancement of user experience improves the comprehensive knowledge in a virtual community. Consequently, interactivity fosters the effectiveness of system behavioral analysis with accessible contents between the navigation of learnings and supplementary tools, understanding the practical control of feature mechanisms, and logical adaptation of automotive solutions.

On the other hand, the study forgot to mention the drawbacks regarding the possible restrictions of the actual implications of hands-on experience that replicate the interaction of physical laboratories. Students may wonder about the particular features that may not apply in the interactive virtual simulation process. Furthermore, specific requirements are needed in establishing server applications like the WBT, which provide complexity for instructors with a possible absence of server deployment in an organization or institute.

The literature needs to explore the test and evaluation of the system's effectiveness that employs the student's engagement with the virtual interaction system and its learning outcomes to understand if its users can easily retain the module contents. Moreover, providing technical automation techniques for a more extended period of deployment and production for the systematical approach for the continuous impact of improvement in training automotive engineering students.

A Novel Method to Generate Auto-Labeled Datasets for 3D Vehicle Identification Using a New Contrast Model [46]

The study emphasizes the importance of investigating alternate auto-labeling strategies, such as semantic division or area proposal networks. This would provide a more detailed knowledge of labeling approaches for 3D object identification. To achieve robust findings, a detailed review of evaluation criteria is required, as is an assessment of the suggested methodology's applicability to varied situations. Addressing real-world implementation issues, such as changing weather conditions and technology limitations, is critical for practical use. Implementing these precise methods will increase the study's contribution to the field of self-driving car perception systems.

The study lacks a detailed investigation of alternative auto-labeling strategies, a focused review of evaluation criteria, and an assessment of the suggested methodology's applicability to a variety of situations. Furthermore, real-world implementation issues, such as changing weather conditions and technology limitations, have not been fully addressed.

The Research of 3D Modeling between Visual & Creativity, 2019 [47]

The purpose is to improve the study by conducting a thorough investigation of other auto-labeling strategies, including semantic segmentation and area proposal networks. This would allow for a more detailed knowledge of 3D object identification labeling approaches. To improve the study's rigor, a focused review of evaluation criteria and an evaluation of the suggested methodology's applicability to various situations are required. Furthermore, tackling real-world implementation issues such as fluctuating climate conditions and hardware limits is critical to ensure that the suggested auto-labeling approach is realistic.

The study examines how important 3D modeling is to e-learning industries and other sectors. It describes how 3D technology is developing quickly and stresses the relevance it can be for the creation of animation. It also become a part of modelling technique that popularly used in virtual reality and computer graphics.

The study demonstrates the development of Computer Generated Imagery (CGI) influencing 3D for digital visualization, with animation companies at the forefront of the push for 3D content creation and working with outside partners to purchase innovative production tools. It also mentions the various applications and softwares like Autodesk 3ds and Blender. Designers are becoming increasingly powerful than ever since the advent of automated technologies which render their jobs simpler to create immersive scenarios with animated characters and maximize

visual impact. Additionally, 3D modeling has expanded beyond its initial uses in robotic guiding and visual inspection.

The limitation of the study involves the inability to gain accurate results in forming 3D model due to the complexity of structures. 3D is a tedious process in building a model the needs more resources in dealing with this model. It set hurdles by manipulating the object to achieve the 3D model. It also more on character production using 3D modelling which human form have the major discussion of the study. Despite major developments in 3D modeling tools, generating capabilities and realistic results can remain scarce particularly when working with complex sceneries or detailed components.

The absence of ethical considerations of 3D in the study is one of the missing adoptions of 3D modelling. The problems and restrictions with the revolutionary modeling 3D techniques, including the inability to precisely replicate specific surfaces or components, should be investigated in deeper studies. Moreover, the study should comprehend on the detailed description of animating 3D model that has visual impact in developing characters.

Related Systems

Mechanic Simulator [48]

Players in this mobile game Mechanic Simulator may be required to diagnose and repair a range of vehicle or vehicle-related issues. This could include replacing parts, diagnosing mechanical problems, fine-tuning engines, and ensuring that the cars perform smoothly overall. The game may emulate working as a mechanic by integrating chores and challenges involved with car repair.

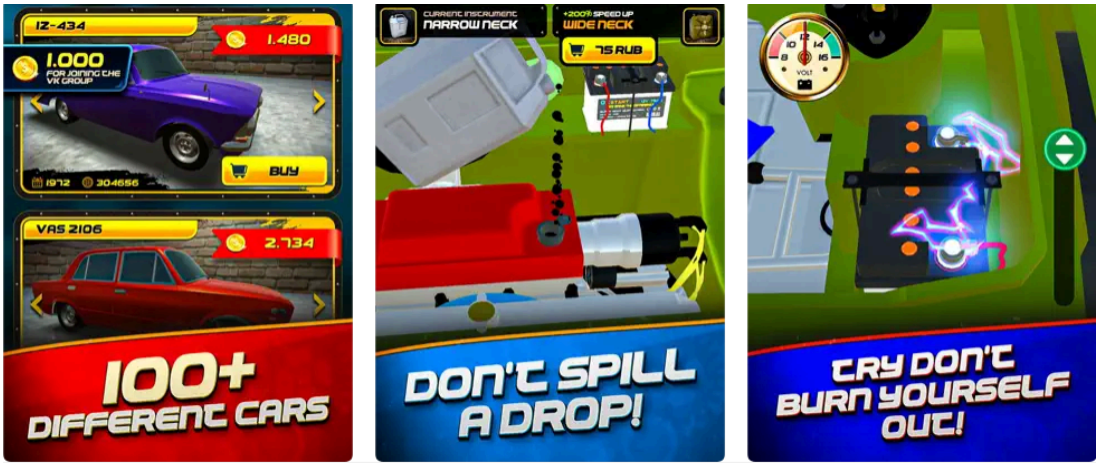


Figure 3. Mechanic Simulator

Hardware Tools [49]

This application displays a thorough catalog of hardware tools, with names and photos for each. It is a helpful resource for persons who are unfamiliar with vital tools, providing an opportunity to gain knowledge and expertise in their use. The program, which acts as a manual, enables learning and understanding with a wide range of physical tools, improving users' comprehension and skills.

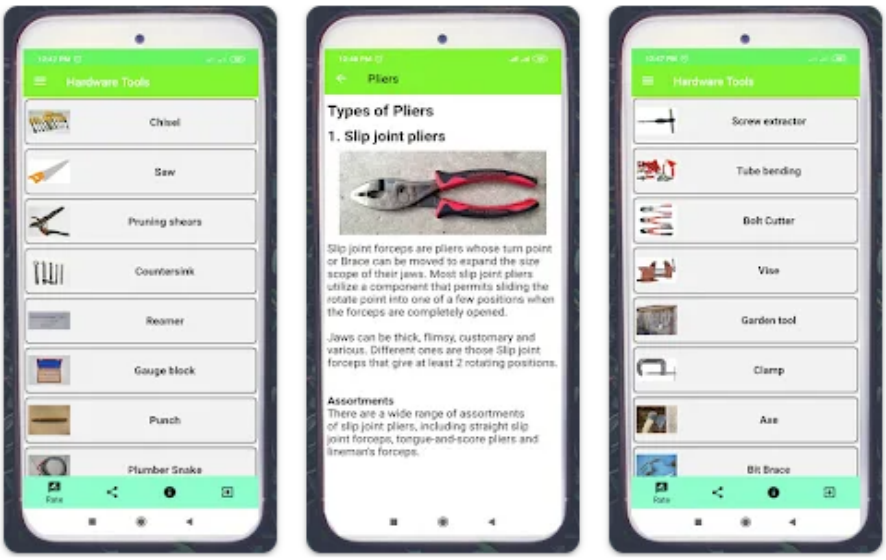


Figure 4. Hardware Tools

Car Mechanic Simulator 21 Game [50]

Drive, fix, paint, tune, and sell vehicles in this realistic car mechanic simulation game. Restore legendary automobiles from ancient barns or customer orders, performing extensive engine, brake, exhaust, gearbox, and suspension repairs. After addressing concerns such as dirt and rust, applying filler, and repainting, each vehicle is tested on a track.

Figure 5. Car Mechanic Simulator 21 Game

Retro Garage - Car Mechanic [51]

Perform as a vehicle mechanic specialized in restoring classic USSR cars, with over 50 parts divided into three different groups (body, frame, and engine) with the possibility to sell, acquire, or join drag races and track records after restoration.

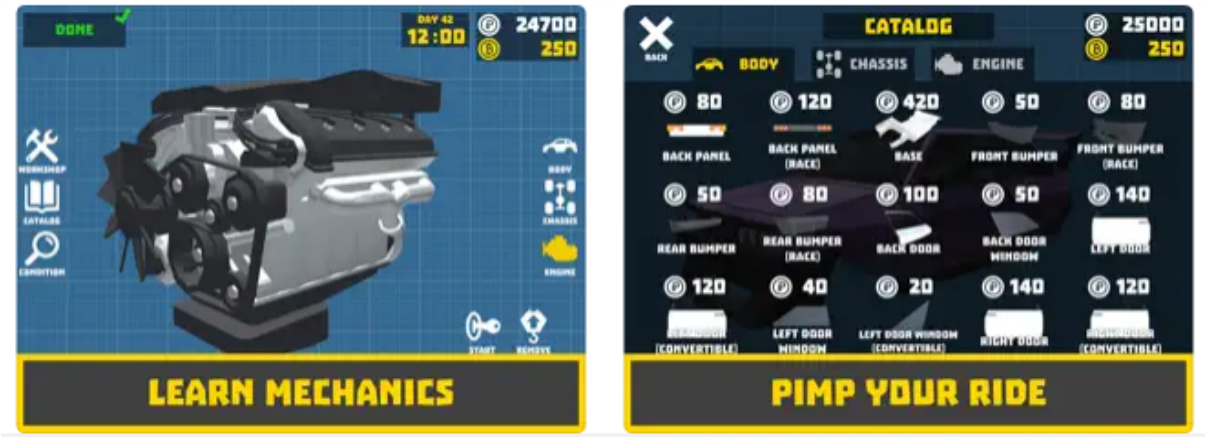


Figure 6. Retro Garage - Car Mechanic.

Car Mechanic - Restore Cars [52]

This clever match-3 game combines enjoyable puzzles with a comprehensive examination of the delicate art of automotive maintenance and assembly. Players are welcome to enter the realm of vehicle mechanics, where they will be able to restore and repair numerous car types. Players get insights into the complexity of each vehicle component and build a greater grasp of the smart use of equipment in the repair process as they go through the game. The game provides a hands-on tutorial, making it a one-of-a-kind and educational gaming venture.

Figure 7. Car Mechanic - Restore Cars

Benchmarking

Table 2 shows the comparative review of the existing systems for benchmarking. It will display the features, which will be the attributes of each system in automotive mechanics e-learning.

Features	**Mechanic Simulator**	**Hardware Tools**	**Car Mechanic Simulator 21 Game**	**Retro Garage - Car Mechanic**	**Car Mechanic - Restore Cars**	**Edu Mechanic**
Realistic Audio Support	✓			✓	✓	
Tutorial	✓		✓	✓		✓
Reading Materials of Mechanical Equipments		✓				✓
Interactive System	✓		✓	✓	✓	✓
IOS and Android Compatibility			✓	✓	✓	✓
Realism and Authenticity				✓	✓	✓
Utilization of specific Mechanical Tools		✓			✓	✓

Table 2. Benchmarking.

Chapter III – Research Methodology

Software Methodology

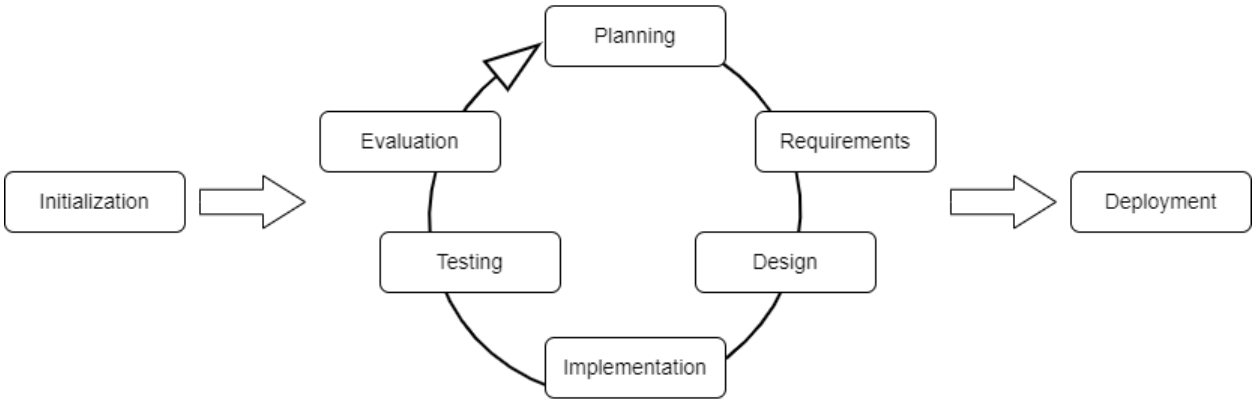


Figure 8. Iterative & Incremental Approach

Initial Planning

The initialization planning phase assesses the problems involving the auto mechanics learning resources that cover the performance, perspective, and development of student's learning capabilities in automotive mechanics. It is a critical stage in dealing with the constraints or gaps from the study in building an educational website. Listing the objectives can understand the purpose of achieving the goal of the study. It also captures the attention of how feasible in producing an automotive mechanics e-learning system in the learning delivery of the site.

Planning

In this phase, identifying the scope, target respondents, specific learning modules, and other crucial requirements are established. Planning adheres to various disciplines of research in

expounding the reference studies of an auto mechanics' background, education, and profession. It also distinguishes the barriers and benefits in producing a website relevant to the field of expertise. Comparing the online tools or application related to auto mechanic incorporate to the creation of the Edu Mechanic system. The respondents and location are also considered which are specialized to the skills of an auto mechanic.

Requirements

Once the planning phase is completed, it will transition to requirements gathering and collating information. The utilization of a code editing software application, such as Visual Studio Code, to develop the primary website utilizing programming languages including HTML, CSS, and JavaScript. For login, MySQL and PHP are used for database purposes. However, other technologies may facilitate the program are introduced during this phase. In contrast, software animation for the primary feature of the website will employ a Unity game engine to develop the e-learning system. Finding a school or training center for automotive servicing course allows to collaborate with the teachers in enhancing the website's feature. It also has a survey containing the learning outcomes on using the e-learning system, which administers to the student taking the automotive mechanics. Managing the requirements yields better organization of tasks and workflow in building an auto mechanics website.

Analysis and Design

The Analysis and design phase presents the structural components on the e-learning system including the system's functionalities, user interface, and other attributes in the formation of the website. All the collected requirements are analyzed and combined to understand the target users, learning delivery, and the content of the automotive mechanics. The use of right

multimedia content such as images, videos, and sound effects gains engagement to users by providing interactivity to the site. It is included for better simulation, where learners can improve their understanding through visual elements while manipulating the object. The layout and design are assembled using a 3-dimensional web design technique in adapting simple with artistic design in the flow of the website.

Implementation

After the proposed design, the implementation phase is the preparation of writing codes, creation of user interface, utilization of the algorithm, and arrangement of different web components for auto mechanics e-learning. The detailed specification from the document covers backend and frontend development to integrate it into the website. From the design creation, the guide for building the auto mechanic website is the prototype. Implementation should be consistent with specifications and objectives to ensure the accessibility and behavioral aspects when users use the site.

Testing

The proposed system will execute a comprehensive evaluation of the efficacy and instructional influence of an interactive e-learning system based on 3D models that is customized for the purpose of instructing mechanical tool equipment. Our study will thoroughly examine the complexities of the system's design, including an examination of its user interface, interactive components, and overall instructional approach. The study of the proposed system will be assisted through the utilization of a group representative of the intended audience, with the assistance of professional mechanical engineers who will provide guidance on how equipment usage can be integrated into an interactive system approach.

Evaluation

The pre-evaluation analysis may be conducted subsequent to the iterative and incremental process, provided that the proposed system that has been developed for initial testing with the relevant participants for preliminary evaluation. The procedure analysis will provide support for various methodologies that are founded on the investigations of specific prior studies in order to provide a comprehensive knowledge regards to the efficacy of interactive system e-learning in the fundamentals of mechanical learning. Furthermore, data correctness would be applied for maintaining its reliability of the proposed system, while assessing the potential vulnerabilities or flaws to address the problem and improve the iterative process.

Deployment

The implementation technique of the system will prioritize ensuring the accuracy and absence of any difficulties in order to demonstrate reliability to users, facilitating a seamless process of interactive learning content for mechanical learning courses. Consequently, based on the comprehensive analytical phases, the study aims to fully comprehend and ascertain the precise results about the adaptability of e-learning process on the target audience. Additionally, the proposed project necessitates the implementation of a server to accommodate many users across various branches of TESDA schools, enabling them to access the educational resources, and considering a compatible system through different systems.

System Analysis

1. System Architecture

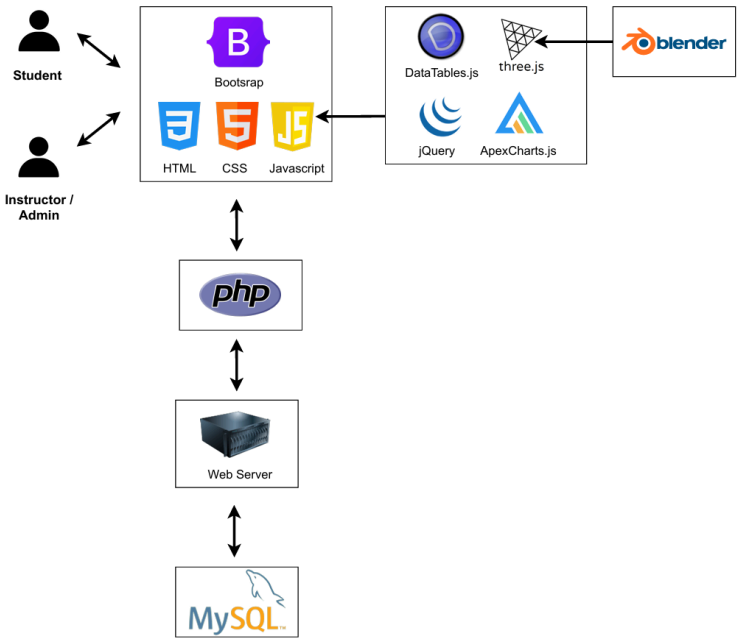


Figure 9. Edu Mechanic's System Architecture

The system architecture of Edu Mechanic system shown in figure 9 represents the framework in developing the e-elearning platform. It is composed of two users who use the website which are the student and instructor or administrator. To interact with the website, users should have a device, like computer or laptop, with an internet connectivity in utilizing the features of the e-learning platform. In deeper level of how it formed and worked efficiently, the Edu Mechanic e-learning platform is build through front-end and back-end development. Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), and JavaScript (JS) programming languages are employed in front-end development. For the e-learning system to be responsive and acquire built-in design layout and other elements, it uses Bootstrap version 5 to

cater student and teacher's devices in terms of responsiveness. The system also used different libraries of JavaScript (JS) which ensures smooth interaction of visual elements such as charts, tables, and 3D models. The libraries comprises DataTables.js, jQuery, three.js, and ApexCharts.js. The DataTables.js creates a table that has increased capabilities in managing data like searching and sorting of the table. jQuery are compatible through various browser that has manipulation and event handing feature. Three.js is part of the integration approach of created 3D models and simulations from Blender. In back-end development, PHP is used as programming language, while MySQL serves as the database of the e-learning system.

2. Network Architecture

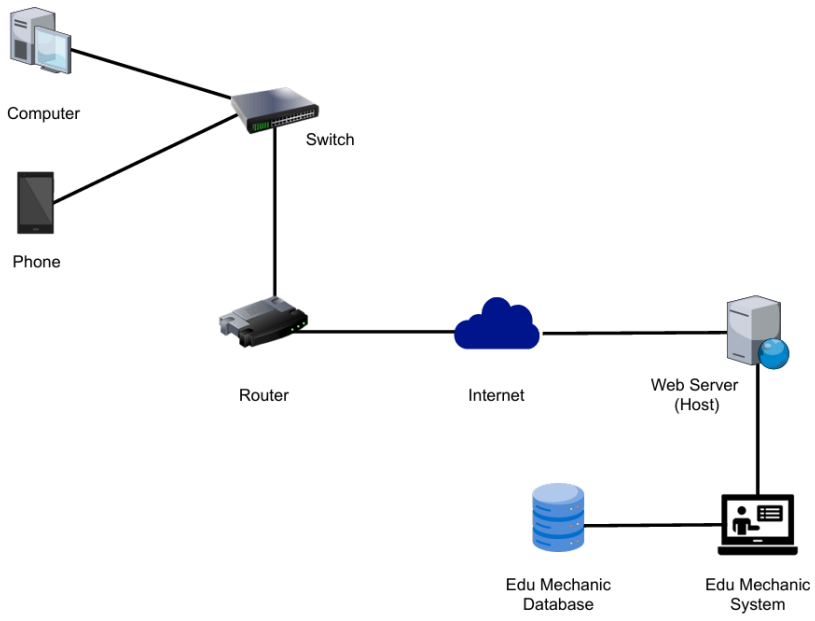


Figure 10. Edu Mechanic's Network Architecture

The network architecture of Edu Mechanic system shown in figure 10 illustrates the networking capabilities on how student and instructor's interaction to the platform is being

processed on the network. The starting point of the network architecture is the device used such as personal computer or phone. These devices are linked to local network in transmission of traffic of data from switch to router until it traveled to the internet. The request will process in web server hosting the Edu Mechanic System for establishing connection between the student and instructor's capabilities from the website. It also communicates using a database on fetching grades, user credentials, and more. This architecture allows the learning materials of students delivers effectively, facilitates smooth navigation of different web pages, and ensures that the logic and method contributes to the level of performance of the platform. A secure and robust network architecture aid to adapt learnings of students digitally in enriching learners facilitate enhanced outcomes.

3. Entity Relationship Diagram

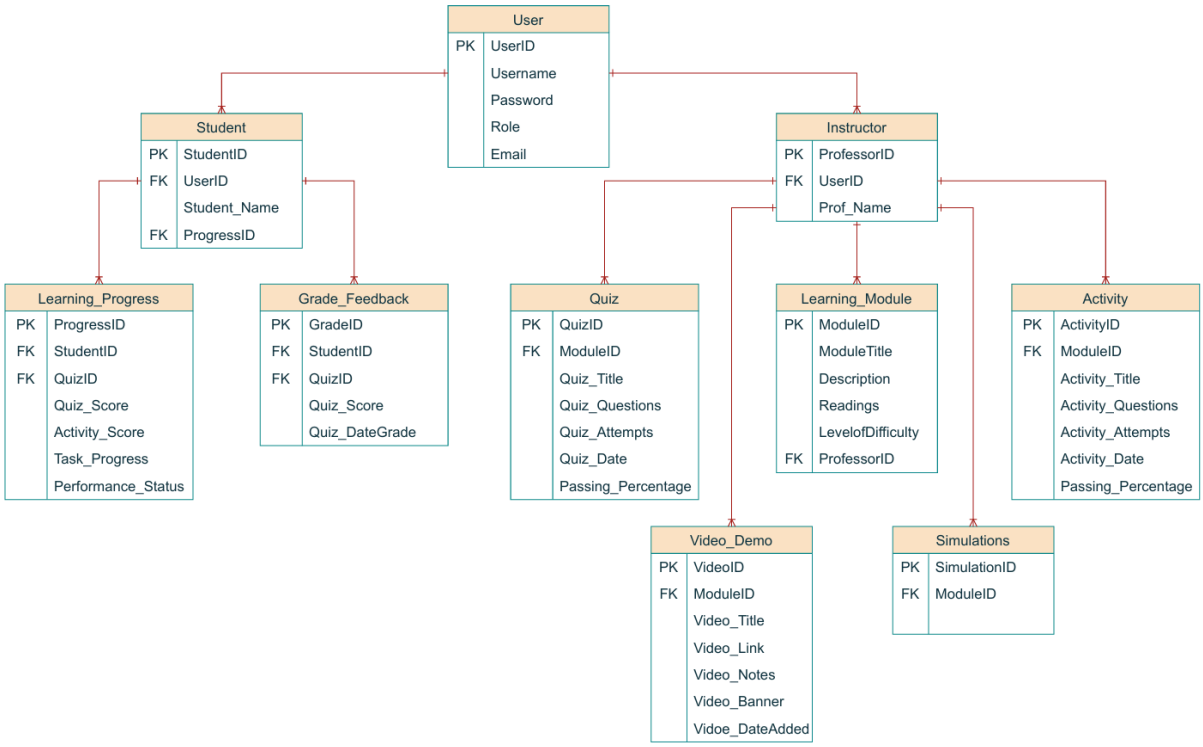


Figure 11. Edu Mechanic's Entity Relationship Diagram

Edu Mechanic e-learning web-based platform is architected through interconnection of students and administrator or professor. It is a framework with intertwined entities, which encompasses management of learning materials, tests, activities, and educational growth. There are two roles revolves from *User* based on roles rights and access, namely student and instructor entities. The *Student* entity is mapped to *ProgressID*, which integrates the level of performance of students from their scores and various progress from tasks like 3D interactive activities. Students engaging with several assessments can gain scores to have *Grade Feedback*. Tracking of progress and feedbacks on assessments of students is made to establish one-to-many relationship as it captures individual assessment results and task completion. On the other hand, *Instructors*, identified by a unique *ProfessorID*, can administer learning materials such as modules, quizzes, activities, videos, and simulations. It corresponds to *ModuleID*, linking as one-to-many modules the integration of multiple learning resources into a single teaching component for adapting student's expertise. The *Quiz* and *Activity* entities capturing student's assessments on managing questionnaires, number of attempts, and percentage of passing rate. *Video_demo* and *Simulations* also essential entity of e-learning on uploading educational or instructional videos and playing the simulation activities. All entities are imperatively linked on dissemination of educational requirements coming from instructor to students in adapting scalable and organized interactions of users in an e-learning platform.

4. Use Case Diagram

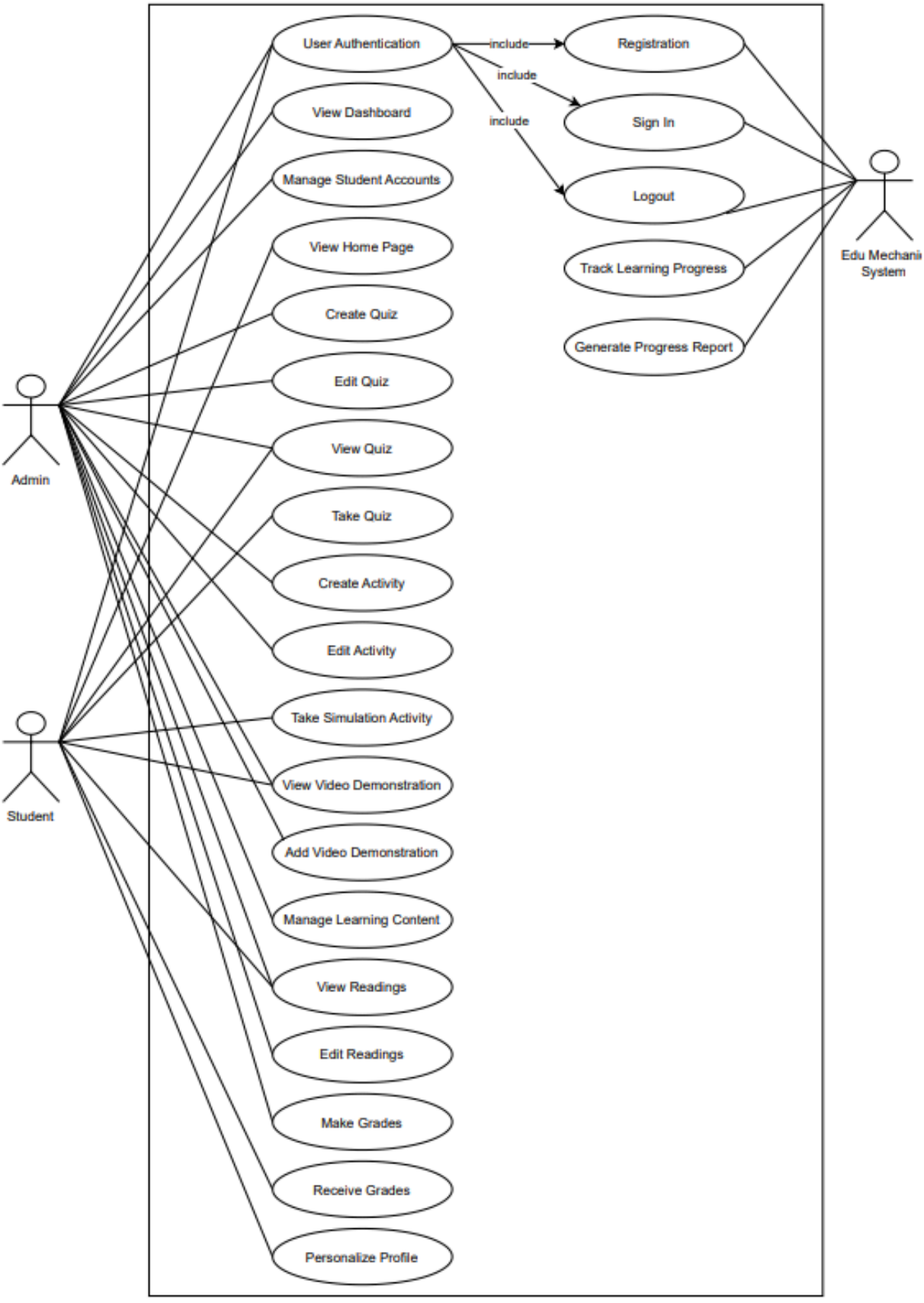


Figure 12. Use Case Diagram of the Edu Mechanic System

In Figure 12, the relationships between various user roles and system features are depicted in the Edu Mechanic System Use Case Diagram. The student and the administrator are the main players. The administrator has the ability to create and modify quizzes, monitor student progress, manage student accounts, and provide progress reports. Additionally, they manage user authentication, which encompasses sign-in, log-out, and registration. The student has the ability to manage learning materials, watch and add video lectures, take quizzes, engage in simulation exercises, and customize their profile. Through a variety of use cases, including activity management, access to learning resources, and grade retrieval, both actors engage with the system. The system's function in supporting interactive learning, effective progress monitoring, and all-encompassing academic administration is highlighted in the diagram.

System Design

Student & Admin Login Page

The system's login page, which offered users a safe authentication interface, was shown. It had email and password entry boxes, as well as a dropdown menu for choosing user roles like administrator. The Edu Mechanic logo was placed at the top of the page's dark-themed login panel, which strengthened the system's branding. After inputting proper credentials, users can access their accounts thanks to the "Login" button that was positioned beneath the input fields. All users could easily navigate and understand the design because of its neutral background and minimalistic style.

The picture displayed the system's login window, where users had to authenticate before they could access instructional materials. Three main components were shown: (1) a user role

selection dropdown that let users select roles like Student; (2) email and password input fields that guaranteed safe platform access; and (3) a login button that verified the user once they entered valid credentials. Reinforcing the system's branding, the Edu Mechanic logo was prominently placed at the top of the login screen to make navigation easier. In order to ensure clarity and usability, the page also kept a neutral background and a minimalist style.

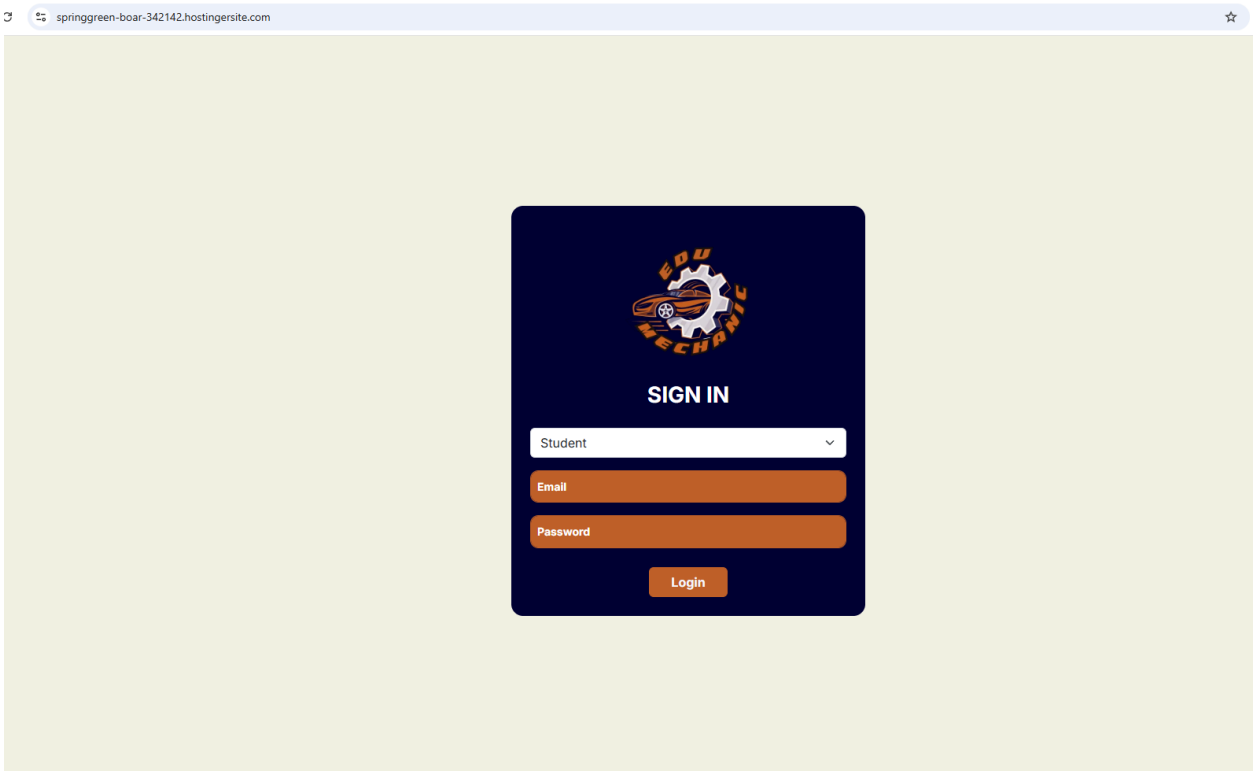


Figure 13. Student & AdminLogin Page

User Type: Student

Student Home Page

An overview of the system's homepage interface was shown in the picture, which offered students a variety of educational resources such as readings, videos, simulations, and grades. It featured lessons and interactive 3D training for modules on preventive maintenance services (PMS) and vehicle mechanics. Furthermore, the interface gave users access to crucial materials meant to improve their industry knowledge and proficiency.

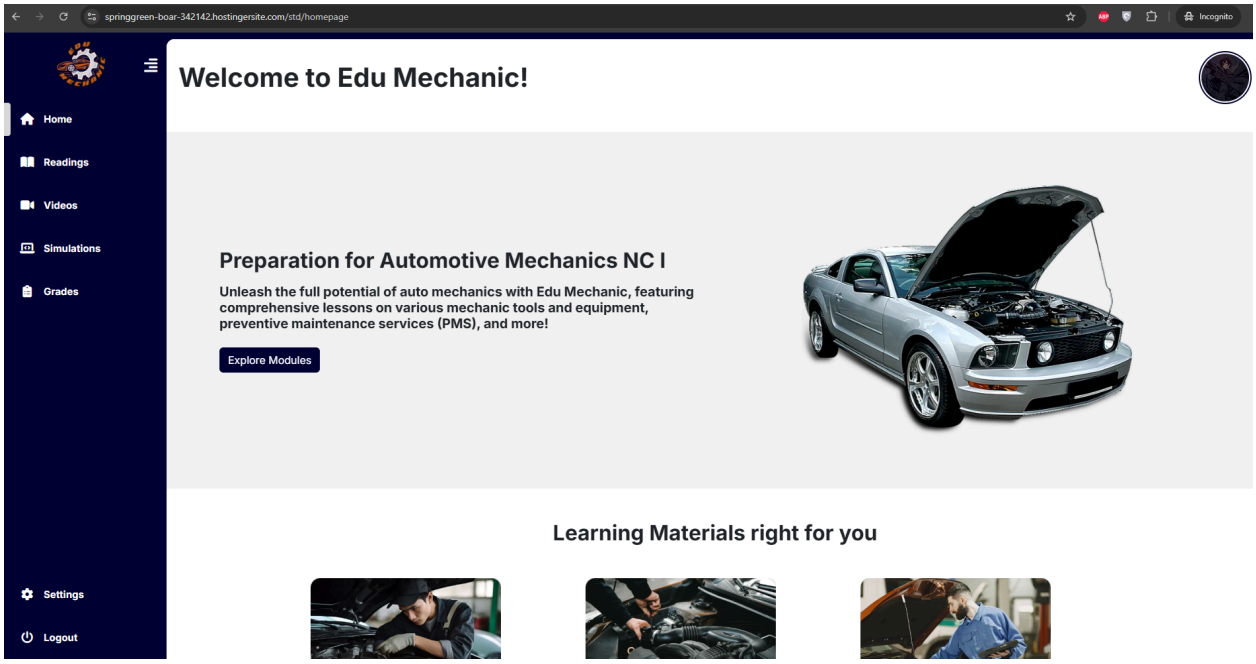


Figure 14. Student Dashboard

The system's homepage interface is shown in the figure, where students can access and navigate a variety of educational resources. Three primary elements were presented: (1) Readings, which included crucial modules on automobile mechanics; (2) Videos, which gave tutorial-based instruction on mechanic tools and preventative maintenance services (PMS); and

(3) Simulations, which allowed for interactive 3D training to improve practical abilities. To enable smooth access to various parts, the left sidebar featured navigation buttons for Home, Readings, Videos, Simulations, Grades, Settings, and Logout. Furthermore, a search bar feature made it easy for visitors to find particular educational resources. Additionally, users were able to rapidly discover certain learning resources thanks to a search bar capability.

Student Readings Page

The Readings section's interface, where students may access learning modules centered on automobile mechanics, was shown in the figure 15. Users could filter content into Beginner, Intermediate, and Advanced levels using the categorized navigation bar that was displayed. Pre-delivery Inspection, Periodic Maintenance of Automotive Engine, Periodic Maintenance of Drive Train, Periodic Maintenance of Suspension System, Multiple Lessons Sample, Periodic Maintenance of Steering System and lastly the Periodic Maintenance of Brake System. Every module had a right-side menu button to view the complete content and an image clip for visual context. To provide seamless system navigation, quick-access links for other parts were located in the left sidebar.

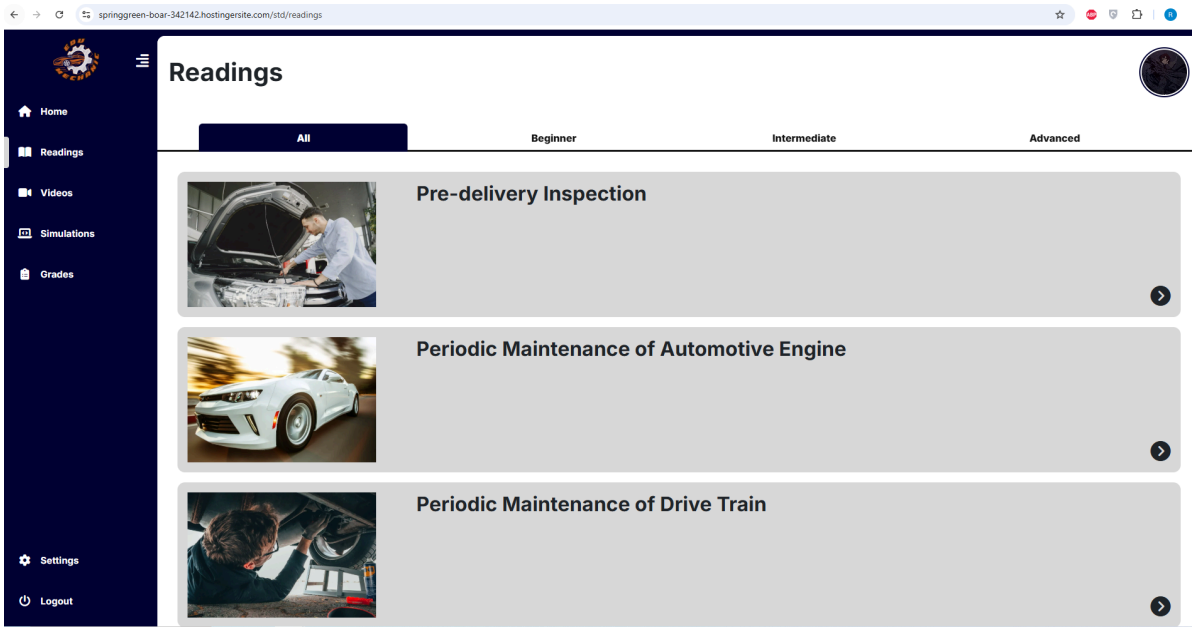


Figure 15. Student's Readings

The Texts section, which featured a classified collection of educational resources pertaining to automobile mechanics, was open for students to peruse. To assist visitors in sorting classes according to difficulty levels, the page included a filters menu with options marked All, Beginner, Intermediate, and Advanced. Three reading modules were shown below, each with (1) a title that describes the lesson's subject (e.g., Pre-delivery Inspection, Periodic Maintenance of Automotive Engine, and Periodic Maintenance of Drive Train); (2) a thumbnail image that demonstrated the lesson visually; and (3) a navigation button on the right side that allowed access to the entire content.

Student Video Demonstration Page

The system's Video Demonstration component, shown in figure 16, gave students access to educational movies about auto repair and maintenance. Five video modules were shown in a grid configuration on the interface, each with a thumbnail image and a title label explaining the

subject. Engine oil replacement, spark plug replacement, engine tune-up, suspension system component replacement, and brake pad and rotor replacement were all addressed in the films that were accessible. For easy identification, each video thumbnail had a black overlay with white lettering at the bottom. Students were able to search and choose particular examples that were pertinent to their training with ease because of the organized style.

Students were able to view and receive crucial video examples of car maintenance because of this figure. Each video module was presented in a grid format on the interface, with (1) a thumbnail image that represented the process and gave a visual preview of the lesson; and (2) a title label at the bottom of each thumbnail that indicated the particular topic covered, such as replacing the engine oil, spark plug, engine tune-up, suspension system components, brake pads and rotors. Students were able to choose the appropriate movie for their study because of the organized arrangement, which guaranteed simplicity of navigation.

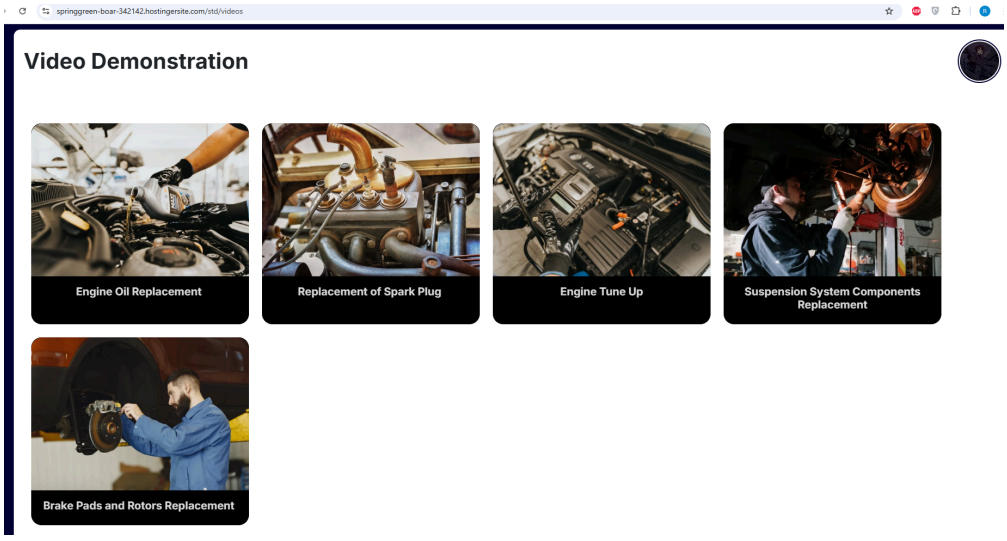


Figure 16. Student Video Demonstration

Student Simulation Page

The picture showed the simulation interface for the Spark Plug Replacement system, which gave users access to an interactive 3D training environment. To help customers visualize and participate in the spark plug replacement process, a simulated car with an open hood was placed in the middle. To ensure that the training module was clear, the interface had a brown header with the simulation's title. Two control buttons with the names Reset and Play were located beneath the car model, allowing users to start or stop the simulation as needed. A red cursor icon that indicated user involvement within the virtual training environment was also visible on the screen. Users' immersive learning experience was further enhanced by the background's genuine garage-like depiction.

The graphic depicted the system's simulation interface for spark plug replacement, where users participated in an interactive 3D training environment for auto repair. Three main components were shown: (1) an open-hooded virtual car model that let users see and replace the spark plug; (2) control buttons called Reset and Play that let users restart or start the simulation as needed; and (3) a red cursor icon that showed user interaction in the training module. The UI included a brown header with the simulation title to improve the learning experience and make the training module more clear. Additionally, the background showed a garage-like scene, giving consumers a realistic and engaging experience.

Figure 17. Student Video Demonstration

Student Grades Page

The report on progress interface, which gave pupils an organized chart and visual representation of their academic progress. Under an activity label, the table featured a variety of duties, including Pre-Delivery Inspection, Periodic Maintenance of Automotive Engine, Periodic Maintenance of Drive Train, and other PMS modules. It had columns for Task Progress, which showed if a task was finished or not, and Performance Status, which displayed the student's accomplishment using question marks and checkmarks. The overall completion percentage was also graphically depicted in a pie chart on the right, which used color-coded portions to distinguish between activities that were finished and those that were not. Task listings could be filtered by status and task type using a search box and filter options.

Through an organized Progress Report interface, students were able to track their academic progress. (1) Task Title, which identified the assigned work, such as Pre-Delivery Inspection and Periodic Maintenance of Automotive Engine; (2) Task Progress, which indicated each task's completion status, labeled Completed in purple or Incomplete in blue; (3) Performance Status, which was indicated by two icons—a checkmark for completed tasks and a question mark for pending or ungraded tasks; and (4) Points, which represented scores earned for completed activities, were all displayed in the table under specific activities. With color-coded portions indicating finished and incomplete jobs, the completion rate was graphically summarized in a pie chart. Users could also filter results by task type and status using a search bar and filter dropdowns.

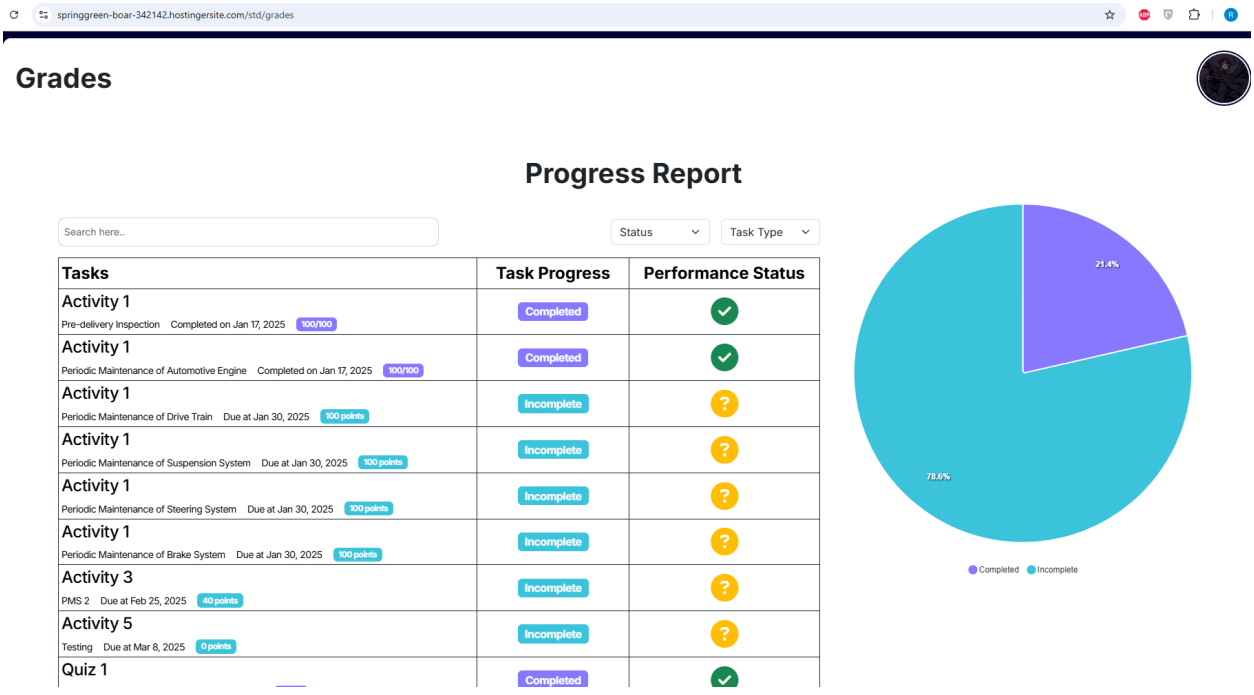


Figure 18. Student Grading System

Students Personal Information

The user profile management interface, which lets users see and change their password settings and personal data. A profile image and a distinct user ID were shown in the top portion. Editable fields for changing the first name, last name, and email address were included below. Password management fields, such as input boxes for the current password, new password, and confirmation of the new password, were located in the lower part. To complete the password update, a "Change Password" button was added. Before being saved, the system verified that any changes to personal information or passwords complied with security and validation regulations.

This made it possible for users to control their personal data via an organized profile interface. It showed (1) a Profile Picture that users could change to make their account more unique; (2) a User Identification Number that was sent to each user individually; (3) Personal Data Fields that allowed users to change their email, first name, and last name as needed; (4) a Password Management Section where users could enter their existing password and create a new one for security reasons; and (5) an Edit Password Button that made sure changes were saved after confirmation. The user interface offered a simplified method for users to safely preserve their account information.

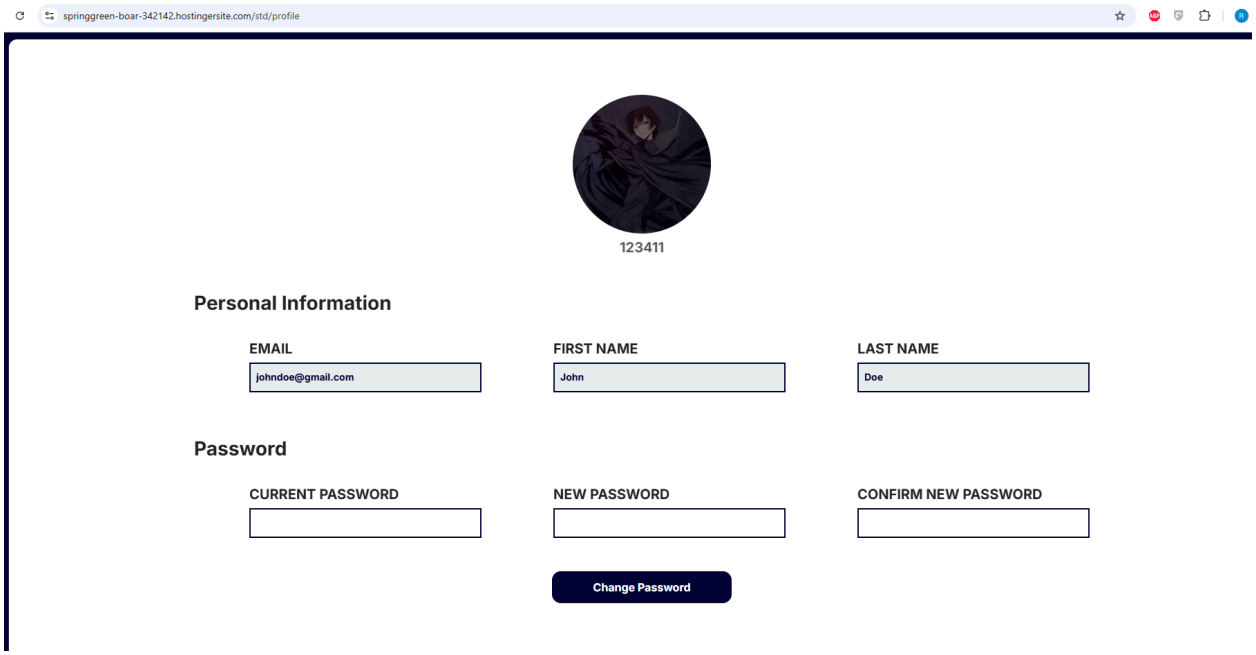


Figure 19. Student Personal Information

User Type: Admin

Admin Home Page

The Figure 21 depicts the overview of the admin dashboard interface of the system where it presents the key performance summarization of students performance based on the quizzes and activities. It previews a visual chart offering insights based on the modules created representing the progress or completion rates of the students. Furthermore, a table below presents the recent activities of the specific student, these list of details include its score, tasks, status, and timestamps.

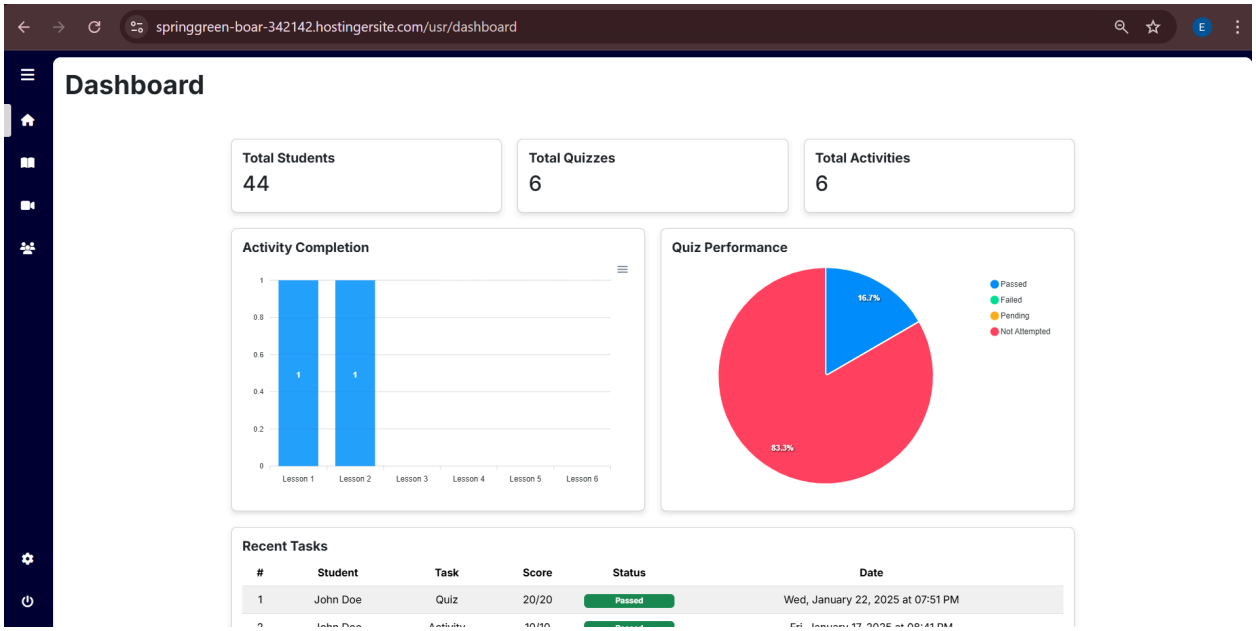


Figure 21. Admin Dashboard

Figure 22 allows the admin to view and organize the necessary learning modules. By selecting the "Add New Lesson" button, creates a particular lesson for students and display it below around the table listing, where it showcase the *(1) Title* to label necessary module materials; *(2) Lesson level* categorized as Beginner, Intermediate, and Advanced with color labeled; *(3) Date and Time* for timestamps; *(4) Options* for managing selected lesson for managing its activity and quiz. It includes a search bar function for locating the specific lesson that's listed or created below from the table.

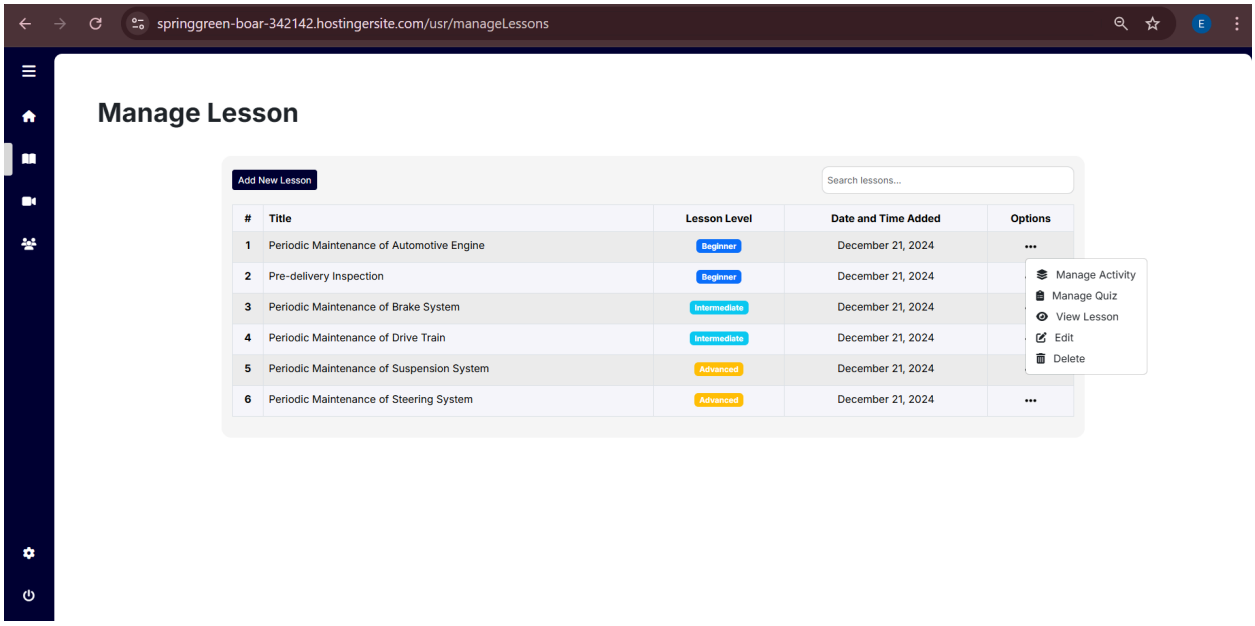


Figure 22. Admin Manage Lesson

Admin Manage Lessons

Figure 2 creates and upload new readings from the system. Presenting a form to insert fields, such as *Lesson Title* and *Lesson learnings* for labeled indications. Lesson level with a drop down menu button for selecting the appropriate levels. Moreover, uploading a banner by pressing the file location button to insert images for manual selection that comes with a supported various image file format. Lastly, admin will add the new lesson by selecting the browse user's file explorer, and submitting it to display the lesson.

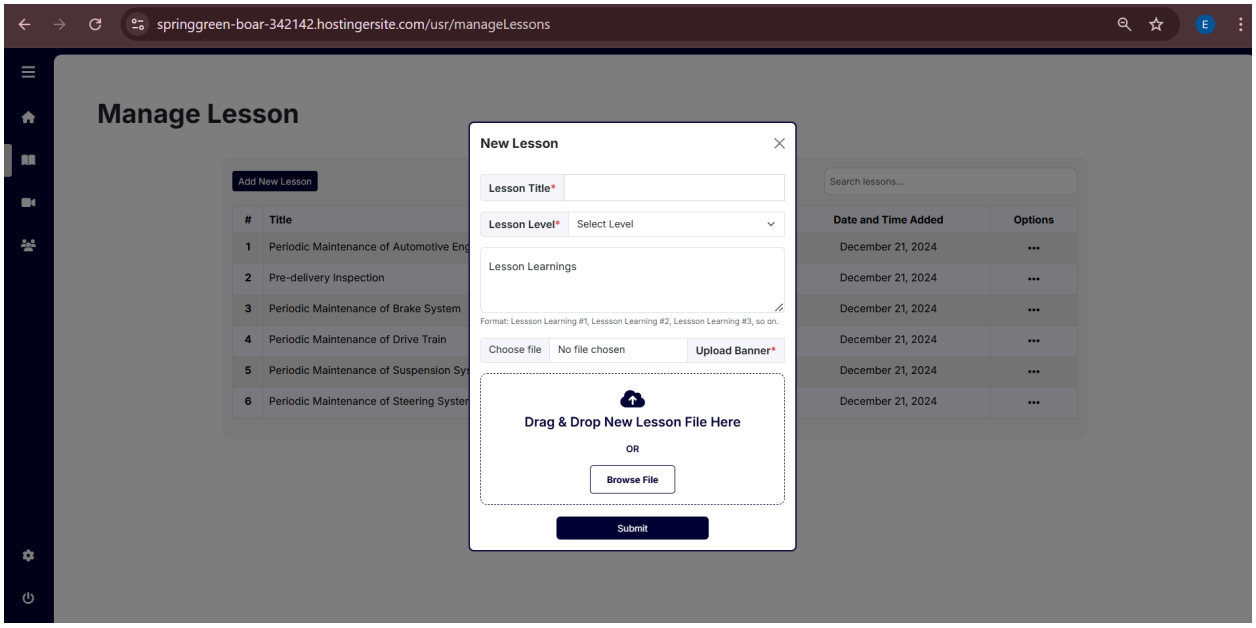


Figure 23. Admin Add New Learning Materials

Admin Manage Quiz

The functionality of Figure 24 demonstrates the quiz container of adding the listed fields of quiz title, number, duration, deadline, and questions and answers. The user can add multiple questionnaires by selecting “Add Question” button to input more fields, with choices in selecting the “Add Choice” method. The user will select the “Save Quiz” button to complete adding the necessary details in order to proceed adding its quiz.

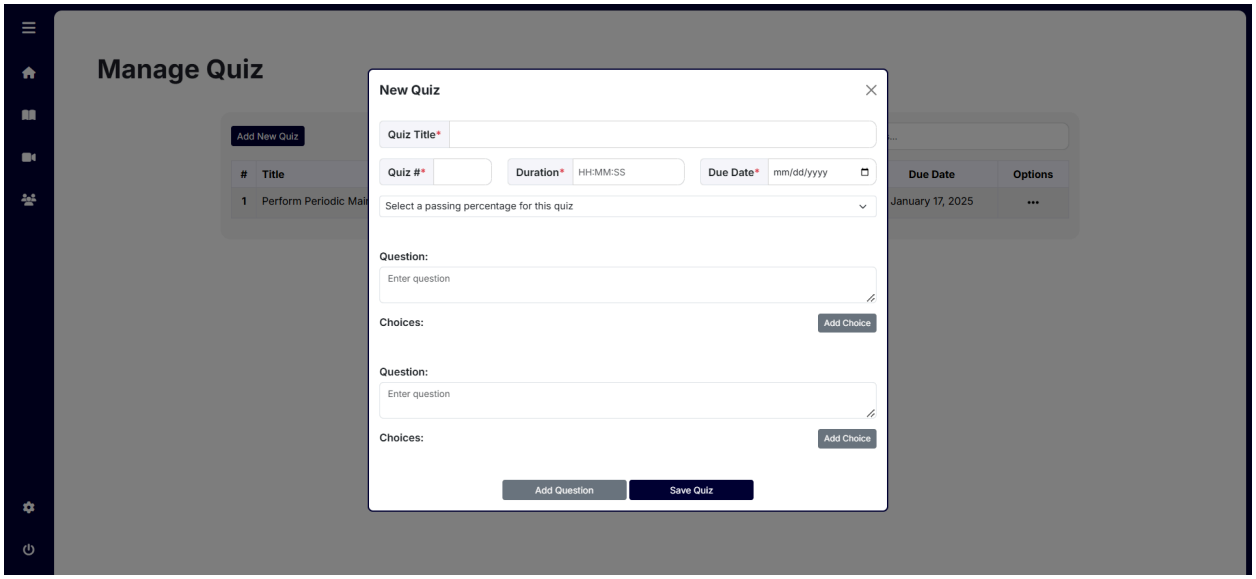


Figure 24. Admin Add New Quiz

Admin Edit Quiz

Figure X highlights the functionality that allows users to edit a specific quiz of their choice. This action can only be performed if a quiz has already been added to the table list.

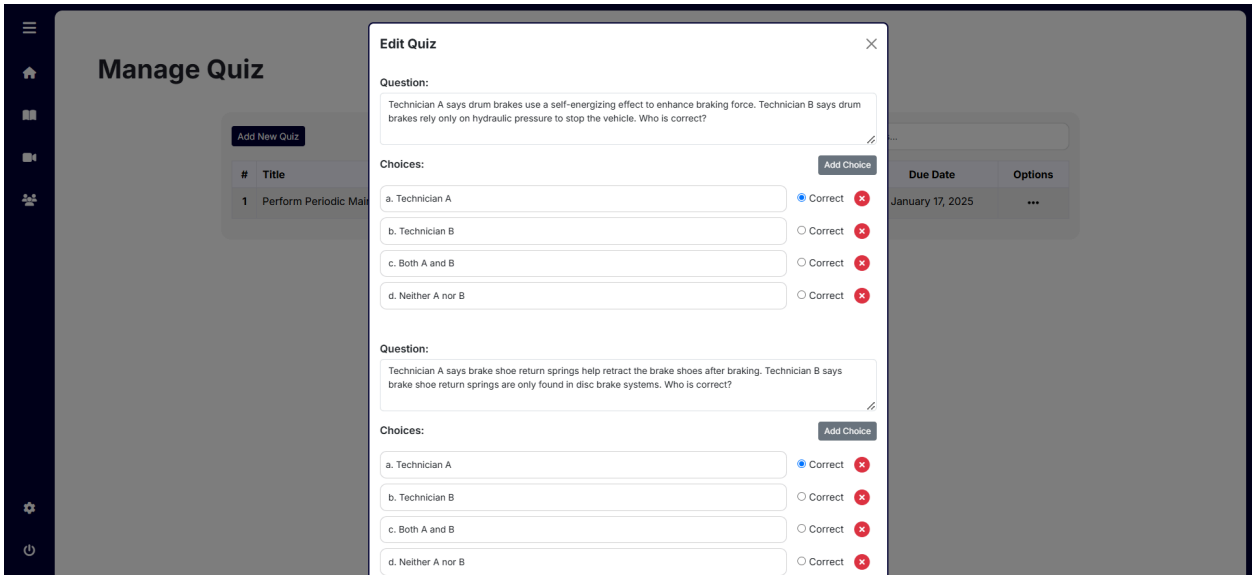


Figure 25. Admin Edit Quiz Information

Admin Manage Activity

The Figure 26 manages the functionality for adding a new activity. Users can input an activity title, activity number, due date, and select a passing percentage. Additionally, the interface allows to add items with an image to showcase the specific item inserted in the file, while it can be modified, provided with option to upload or removed certain items through the action button located at the “Option” menu. Once all changes were made, users could save their modifications using the "Save changes" button.

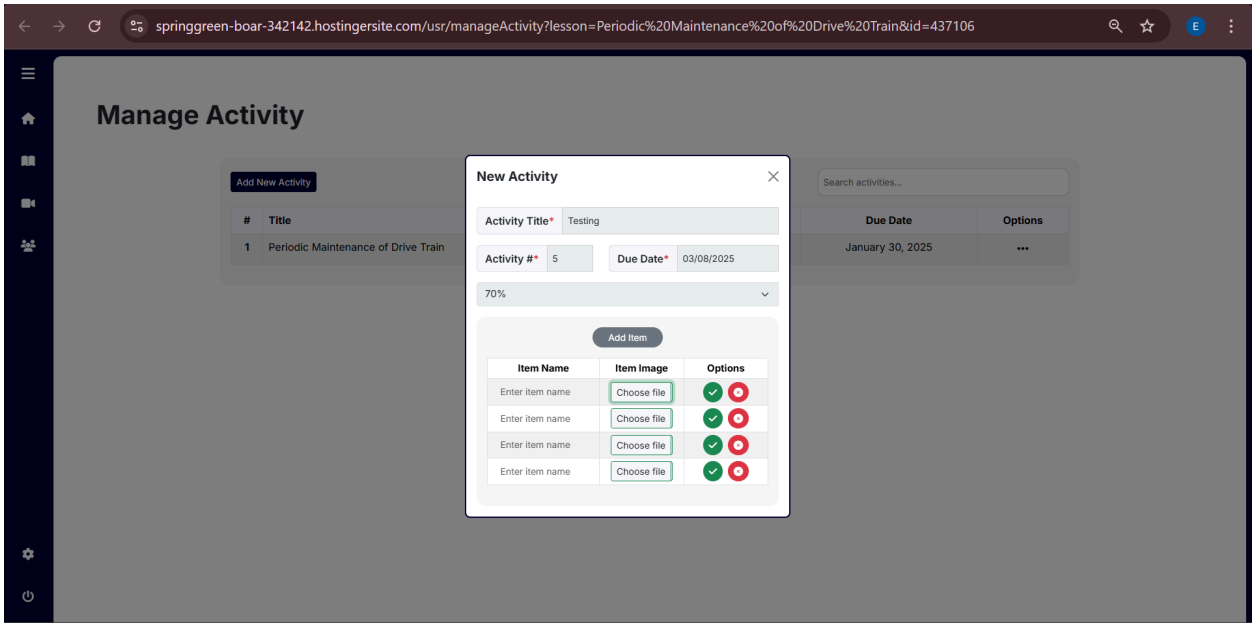


Figure 26.1. Admin Add New Learning Activities

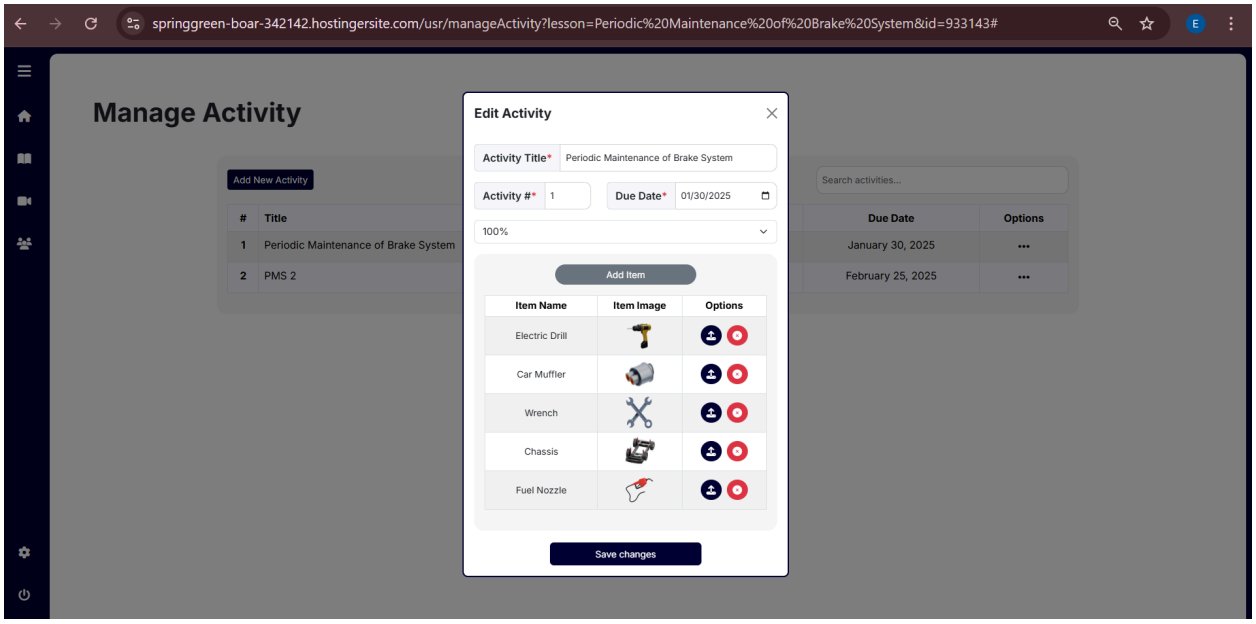


Figure 26.2. Admin Edit New Learning Activities

Admin Manage Videos

Figure 27 and 28 depicts of showcasing the added video lessons, allowing the user/admin to add new videos by selecting the “Add New Video” button. It displays the section field of adding title, banner, and URL link. The submission process ensured that all required fields were completed before saving the added video. Once submitted, the user/admin may have the option to modify the certain video by selecting the edit option form the “Option” menu. Additionally, a search bar was available for quickly finding specific videos within the list.

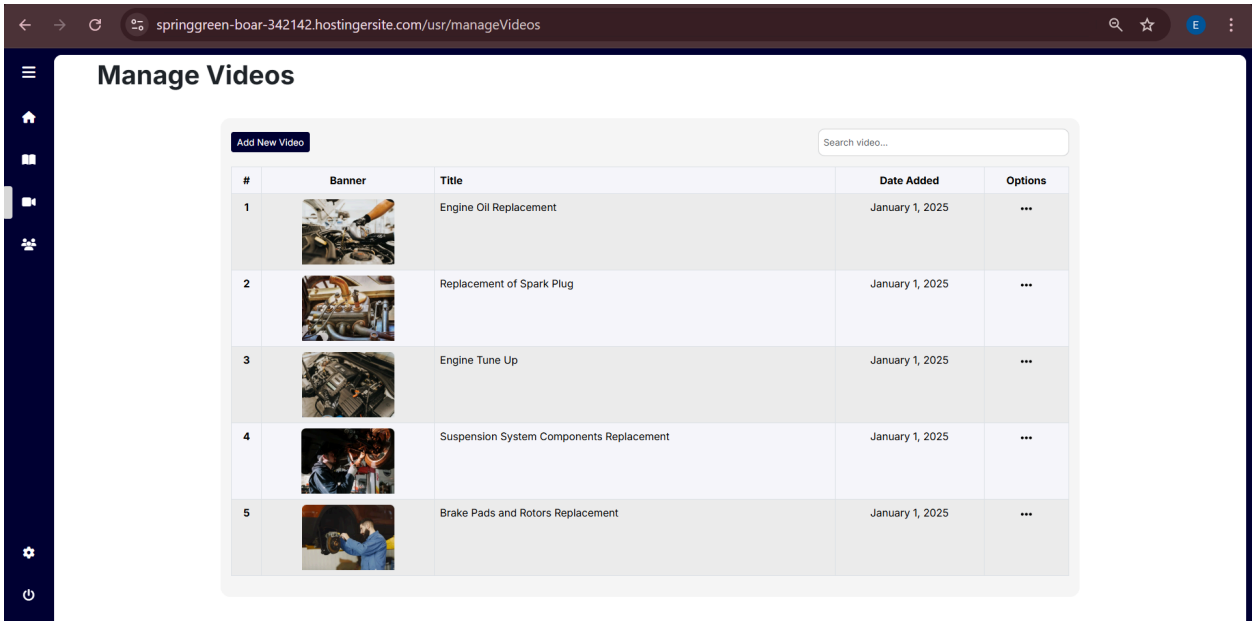


Figure 27.1. Admin Add Video Lectures

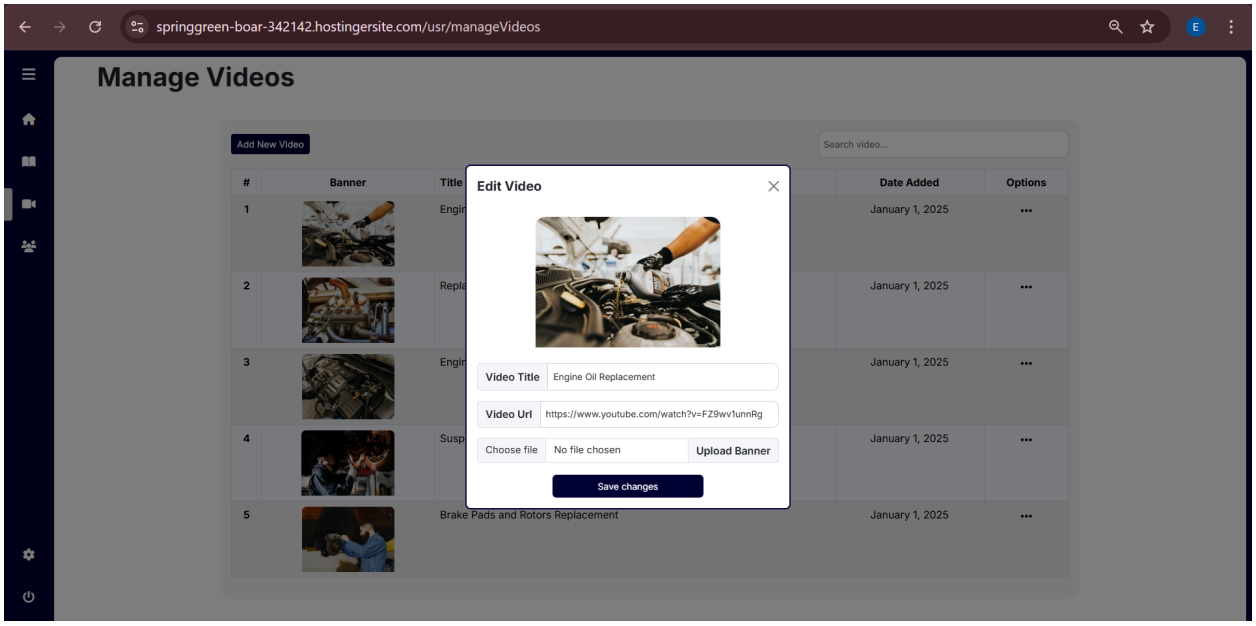


Figure 27.2. Admin Edit Video Lectures

Admin Manage Students

Figure 29 and 30 displays the list of students that was uploaded from the function of "Add New Students" by uploading a specific file. Each section displays the existing student profiles, including the display picture, Student Id, Email, Name, Date, and Option menu for viewing and modifying student personal records from the system.

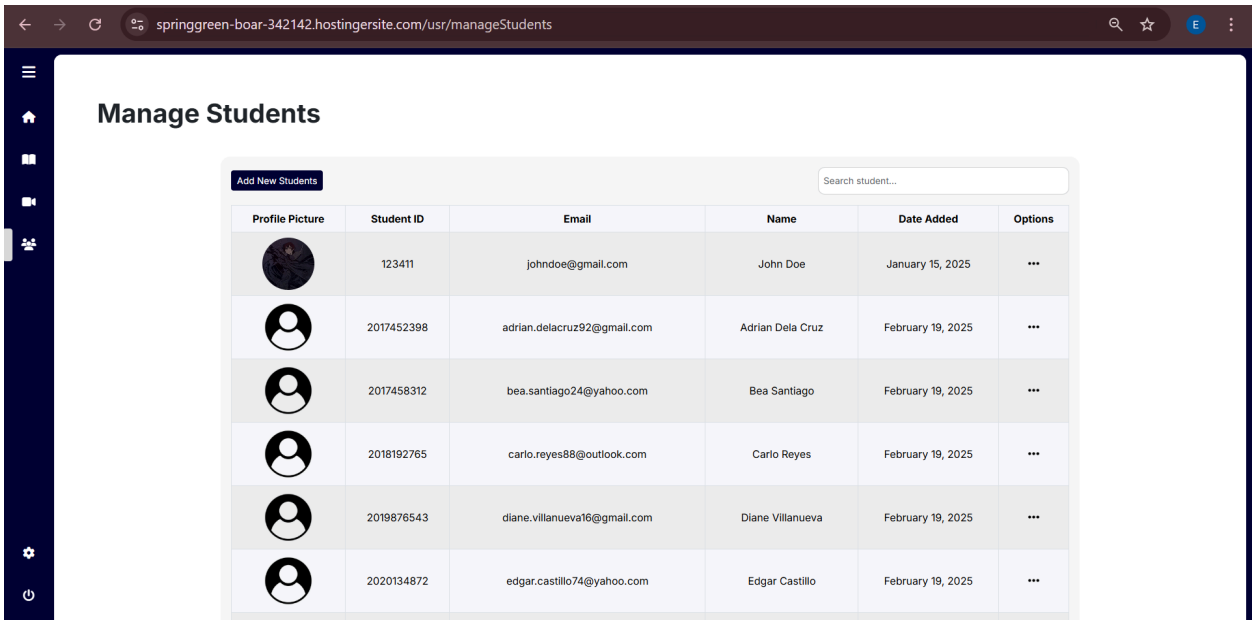


Figure 28.1. Admin Manage Student Lists

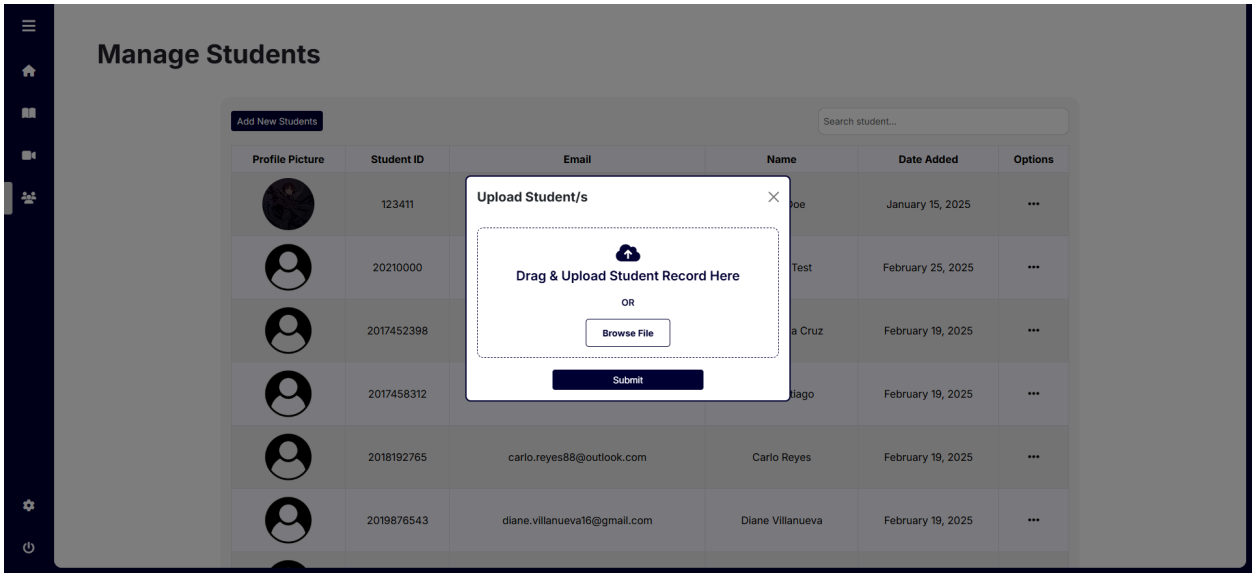
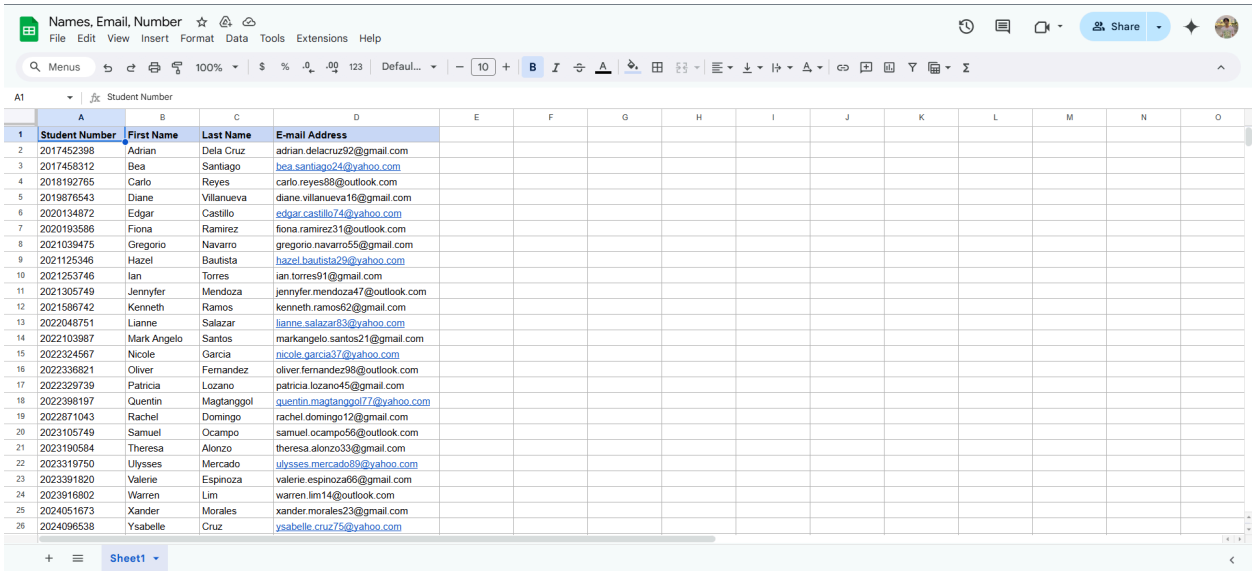


Figure 28.2. Admin Add Student Lists

Admin Add Students Sample File

The Figure 31 present a sample Google Sheet file that contains the sample St*udent Number, First Name, Last Name,* and *Email Address.* The data displays in a structured manner to ensure the proper import and syntax of the system to generate a user/student account for them to have access in the system.



Names, Email, Number

File Edit View Insert Format Data Tools Extensions Help

Share

Menus 100% $ % .0 .00 123 Defaul... 10 B

A1 Student Number

	A	B	C	D
1	Student Number	First Name	Last Name	E-mail Address
2	2017452398	Adrian	Dela Cruz	adrian.delacruz92@gmail.com
3	2017458312	Bea	Santiago	bea.santiago24@yahoo.com
4	2018192765	Carlo	Reyes	carlo.reyes88@outlook.com
5	2019876543	Diane	Villanueva	diane.villanueva16@gmail.com
6	2020134872	Edgar	Castillo	edgar.castillo74@yahoo.com
7	2020193586	Fiona	Ramirez	fiona.ramirez31@outlook.com
8	2021039475	Gregorio	Navarro	gregorio.navarro55@gmail.com
9	2021125346	Hazel	Bautista	hazel.bautista29@yahoo.com
10	2021253746	Ian	Torres	ian.torres91@gmail.com
11	2021305749	Jennyfer	Mendoza	jennyfer.mendoza47@outlook.com
12	2021586742	Kenneth	Ramos	kenneth.ramos62@gmail.com
13	2022048751	Lianne	Salazar	lianne.salazar83@yahoo.com
14	2022103987	Mark Angelo	Santos	markangelo.santos21@gmail.com
15	2022324567	Nicole	Garcia	nicole.garcia37@yahoo.com
16	2022336821	Oliver	Fernandez	oliver.fernandez98@outlook.com
17	2022329739	Patricia	Lozano	patricia.lozano45@gmail.com
18	2022398197	Quentin	Magtanggol	quentin.magtanggol77@yahoo.com
19	2022871043	Rachel	Domingo	rachel.domingo12@gmail.com
20	2023105749	Samuel	Ocampo	samuel.ocampo56@outlook.com
21	2023190584	Theresa	Alonzo	theresa.alonzo33@gmail.com
22	2023319750	Ulysses	Mercado	ulysses.mercado89@yahoo.com
23	2023391820	Valerie	Espinoza	valerie.espinoza66@gmail.com
24	2023916802	Warren	Lim	warren.lim14@outlook.com
25	2024051673	Xander	Morales	xander.morales23@gmail.com
26	2024096538	Ysabelle	Cruz	ysabelle.cruz75@yahoo.com

Sheet1

Figure 29. Sample Student File

Admin Manage Simulation

The graphic showed the Manage Simulations interface of the system, which enables administrators to manage and arrange simulation modules. A table with columns for banner images, titles, the date of addition, and an options menu for managing each entry was placed in the middle, listing all of the simulations that were already in place. Users might construct new training modules by clicking on the Add New Simulation button located at the upper left. A modal window named New Simulation was active in the foreground, with input fields for the file upload and simulation title. Users might upload pertinent photos and simulation files using the two buttons, Upload Banner and Upload Simulation. To enable the saving and integration of new simulations into the system, a Submit button was incorporated beneath these fields.

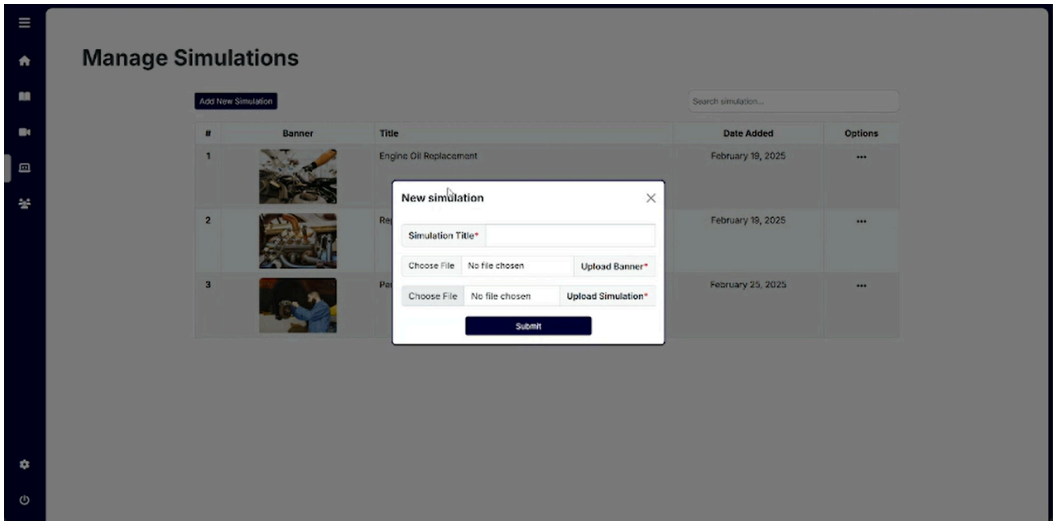


Figure 30. Admin Manage Simulations

Admin Information

The Figure 32 presents the personal information of the created admin, allowing them to update their preferred display picture and change their password while adhering to the standard requirements.

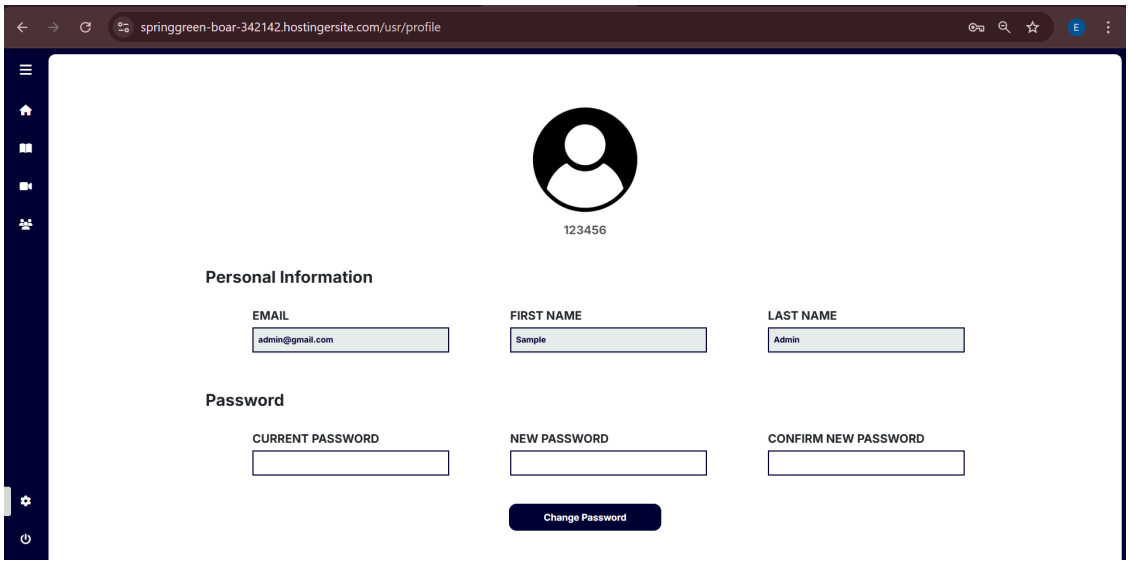


Figure 31. Admin Perosnal Information

Research Design

The study uses experimental quantitative design to establish the e-learning system for automotive mechanics from the effect of student's learning outcomes. It determines the effectiveness of Edu Mechanic website among the Grade 9 and 10 students in assessing the various features, learning content, and overall structure of the site. The independent variable serves as the automotive mechanics e-learning affecting the dependent variable, which measured by the performance and effectiveness of student's training on the system. Through this experimental design, the manipulation of variables yields to statistical analysis in generating the student's result from using the website.

Research Locale

The study will be conducted in the Don Bosco Technical Institute of Makati, Inc. who are Grade 9 and 10 students taking Automotive Design Technology, specifically Automotive Servicing NC I to administer the Edu Mechanic e-learning system. It is the chosen school as it is accredited by Technical Education and Skills Development Authority (TESDA). Collecting information regarding their online learning tools and delivery in auto mechanics students will be useful guidance for the implementation of the Edu Mechanic system. It also examines the learning modules or syllabus of the school's automotive servicing course as the major reference of the website's informational content and simulation-based environment.

Research Respondents

The respondent of the study covers (50) Grade 9 and 10 students that are under Automotive Servicing NC 1 curriculum, who are studying in Don Bosco Technical Institute of Makati, Inc. in Chino Roces Ave, Makati, 1230 Metro Manila. Students are chosen from this

specialized track to have a background in automotive mechanics in assessing the Edu Mechanic system. There will be a survey administered to students as part of the research. This will accommodate a variety of questions to know the strengths and weaknesses of the respondents using the e-learning website. It is significant that respondent's participation can aid in meeting the objectives and evaluating the overall effectiveness of the system.

Research Instrument

To determine the effectiveness and usability of the website, there will be a sample group to assess the functionality and learning content involving the auto mechanic course. For pre-test, the study will be utilized 5-point likert scale for the creation of own questionnaire in assessing the e-learning system used in Don Bosco Technical Institute of Makati, Inc.

Preliminary Assessment Questionnaire

The preliminary assessment questionnaire is composed of a 5-point Likert scale and open-ended question to ensure that the views, abilities, or experience of mechanic students are aligned before the interactions with the e-learning website. It optimizes the time as it solves usability issues beforehand.

In Table 3, the 5-point Likert scale is a diversified range of choices (answerable by Strongly Agree to Strongly Disagree) that precisely reflects the depth of students' emotions. It is categorized into three distinct questions which are the following:

- **Behavioral Questions**. The previous experiences of students are the main focus of this question. From the first part of the preliminary assessment questionnaire, the goal of the question is to gather behaviors of students to comprehend the familiarity in using

e-learning platform and 3D simulation. It aids in distinguishing the behavioral pattern of user engagement on the past action in assessing the efficacy of the e-learning system.

- **Attitudinal Questions**. The feelings, principles, and judgments are the emphasis of this question. It applies the Technology Acceptance Model (TAM) to knowing the tech capability of students in the e-learning and 3D simulations. From the second part of the preliminary assessment questionnaire, the goal of this question is to assess the student's perceptions, motivation, and attitudes toward the effectiveness and allurement of interactive educational games.
- **Preferential Questions**. This question focuses on the qualities or functionalities of the e-learning website and the 3D simulation feature. From the third part of the preliminary assessment questionnaire, the goal of this question is to measure the student's preferences in connection to the e-learning platform that needs to be implemented to accommodate the learning demands of mechanic students. It acquires the structural design features to be reflected in the system.

Question #	I. Prior Experience of E-learning Platform and 3D Simulations
Q1	I have studied a variety of academic fields using an e-learning system.
Q2	I have tried out different interactive games and virtual simulations in e-learning systems or other digital learning tools.
Q3	I can simply access my courses, assignments, or activities when using an e-learning system.
Q4	I have tested using 3D simulations or virtual tools on digital learning platforms before.
Q5	I enjoy using interactive activities or features of digital learning resources, such as virtual simulations and drag-and-drop activities.
	II.

	Perceptions of E-learning System with 3D Simulation Feature
Q1	I think learning is more interesting when there is a feature of 3D simulations used like 3D car engine.
Q2	I believe 3D simulations can effectively teach students through hands-on experience.
Q3	I think 3D simulations make learning more compelling and interactive.
Q4	I find 3D simulations make ideas easier for me to grasp.
Q5	I believe that using 3D simulations to study is like playing an educational game, which makes the lessons enjoyable.
	III. Student's Preference on E-learning System
Q1	I would like to see clear and detailed instructions for car repairs to be included in the system.
Q2	I hope the simulation provides realistic car engines and mechanic tools.
Q3	I expect a system that delivers evaluations such as quizzes or activities.
Q4	I prefer a system that will assist me in getting ready for actual automotive responsibilities.
Q5	I can't wait to use 3D simulations to study in a way that is more exciting game, which makes the lessons enjoyable.

Table 3. Preliminary Assessment Questionnaire

The open-ended question covers qualitative data that understand the detailed answers of students for freedom to express themselves. It encourages every student to share their perspectives and opinions on the 3D simulation towards their learning. Here is the created question for open-ended question:

- Do you think that 3D simulations would benefit you personally and your current learnings or curriculum (1-2 sentences)? *(It validates how the use of 3D simulation in*

e-learning platform affects student development as well as education in the effectiveness and usefulness of having a 3D simulation feature)

Post Assessment Questionnaire

User Experience Questionnaire (UEQ) is a popular testing tool that assess user's feelings or pleasure, which takes into account both non-technical and technical factors of e-learning system [53]. The study used User Experience Questionnaire (UEQ) in measuring the quality and consistency of the 3D simulation in terms of interactivity of mechanic tools and equipment in Preventive Maintenance Service (PMS). The user examines the interactive features of the web-based learning system through questionnaires, containing positive and negative statements [54]. It allows to understand the problem, enjoyment, user-friendliness, and innovativeness in internal and external factor of the e-learning system.

Another reason for using this UEQ is to deliver user feedback on how usable and efficient can 3D environment optimized the mechanic student's learning outcomes. It evaluates how user's perceived the e-learning in terms of the delivery of automotive mechanic learning content and its interface. In this case, the outcome of the User Experience Questionnaire contributes to the overall user's behaviour on the Edu Mechanic e-learning system, especially the assessment of interactive environment.

The survey is adapted from the Pratama et al. to obtain the effectiveness of the auto mechanics e-learning system using User Experience Questionnaire (UEQ) [53]. In post-test, the User Experience Questionnaire (UEQ) will be utilized for gathering statistical data through parameters such as [55]:

- Attractiveness: Measures how intuitive the system is. It considers characteristics like user's preferences, which attracts or deters people based on the system.
- Perspicuity: Measures the clearness of understanding of users based on how the system delivers the content and appearance.
- Efficiency: Evaluate the efficiency of the system with regard to helping users accomplish tasks like boosting productivity or hampering in performing tasks.
- Dependability: The system's ability to maintain and reliably fulfill expectations, complete tasks and maintain a high level of dependability. It includes consistency availability and predictability
- Stimulation: Pertains to the components, signals with the express goal or generating a recognizable reaction or producing defined behaviors when us
- Novelty: Assess the level of innovativeness based on the creativity and newness of the system.

The UEQ questionnaire allows to assess the quality of the Edu Mechanic system that does not only focus on functionality but also the user interface of the e-learning system. the Likert scale to analyze the data gathered from the participants. It contains 26 questions that will provide significant insight in assessing the system [53]. From this rating system, a seven-point rating scale is used to choose from seven options in each given question. The answers provided by the students who participated will affect the study's results.

Data Gathering

The data collected from the survey targets the auto mechanics industry in relation to car mechanic equipment website. It undergoes data collection to ensure the samples analyzed

significantly on the effectiveness persists when respondents use the e-learning website. The iterative and incremental approach is applies to the study as the process of e-learning initiate dynamic and vigorous implementation through a cycle. If there will be an error or adding new concept, it will be easier to make an adjustment in the progress of the system. It also aid in reduced cost and flexible creation of the system.

Samples and Sampling Techniques

The sampling technique used in the study is the stratified sampling method. It is used to divide the population into definite factors to allow comparison across diverse groups. The sample groups consist of 50 Grade 9 and 10 students who have the same strand. It categorizes into strata based on expertise to guarantee equal representation throughout the sample. The said demographic profile can possibly influence the effectiveness of the auto mechanic e-learning system.

Statistical Treatment

The initiative will collect data from a sample of 50 automobile mechanic students enrolled in the Don Bosco Technical Institute of Makati, Inc. partnered by TESDA. It will be using the following statistical treatment:

Statistical Paired Sample T-test

Paired sample T-test defines as the matched-pairs designs to determine the treatment impact, that contain measurements taken the group of participants both before and after treatment [56]. The key objective of the paired two-sample test, which is often used to discover treatment

effects, is to compare the means of the matched pairs in a similar group prior to and subsequent to the treatment being administered [56] [57].

FORMULA

$$T = \frac{mean1 - mean2}{\frac{s(diff)}{\sqrt{(n)}}}$$

Where:

mean1 and mean2 = The average values of each of the sample sets

s(diff) = The standard deviation of the differences of the paired data values

n = The sample size (the number of paired differences)

n−1 = The degrees of freedom

Statistical Formula for User Experience Questionnaire (UEQ)

The study used a stratified sample approach known as weighted mean to assess the views of students about the effectiveness of the proposed system. The formula will calculate based on the statistical data aspects of User Experience Questionnaire (UEQ) scaling the average item scales to calculate the respective mean scores of the students based on the study survey results [53].

FORMULA

$$\bar{X} = \frac{\Sigma\, \bar{x}\, [student]}{\sum item} \ldots\ldots \text{(i)}$$

Where:

$\bar{X}$ = represents the individual scale average

$\sum \bar{x}$ [student] = represents the total item scale

$\sum item$ = represents the number of items scale

Chapter IV – Results and Discussion

Functionality Testing

All of the e-learning system's essential elements have passed stringent functionality testing, ensuring smooth operation for both instructor and pupil accounts. In order to verify system dependability and usability, the testing procedure validated important components such as interactive learning tools, content management, quiz features, and authentication. See Appendix E for the reference.

Testing for the ***Sign-Up*** **and** ***Email Verification*** are both the instructor and pupil identities were created without any issues. Additionally, login functionality was verified, to prove safe authentication and suitable dashboard rerouting.

The ***View Readings/Lessons*** Instructors had no trouble adding, removing, or downloading readings or lessons in PDF format. Additionally, both user roles' Printing Readings were verified.

By successfully enabling the allowed teachers to ***Add Multimedia Content,*** the system improved student engagement throughout lessons. Immersion learning experiences were ensured by the ability of students to interact with 3D simulations.

The quizzes underwent extensive testing to verify a number of features:

- ***Viewing, taking or submitting quizzes***, specifically for multiple-choice and drag-and-drop quiz formats, were successfully accomplished by students.
- When the Quiz Scoring System was being implemented, teachers had the ability to ***Add, Delete, and View quizzes.***
- Further testing verified that ***teachers could control quiz timers, establish deadlines, and monitor students' submission dates and times.***

  Teachers were able to efficiently monitor each ***student's performance*** and evaluate learning outcomes thanks to the Student Progress Report feature.

The seamless session termination for *both Teacher and Student accounts was confirmed by testing the* ***Logout capability***, secure account security and thwarting unwanted access.

An overview of the passing rates for the various capabilities assessed for Teacher and Student accounts is shown in *Table 4*. In every examined area, the e-learning system showed strong functionality, confirming a smooth and effective experience for educators as well as learners. While interactive features including 3D simulations and visual material improved user interest, verification, managing content, and quiz functions operated as planned. The system's dependability for educational usage is further reinforced by the effective verification of its security and student progress monitoring capabilities.

In addition to demonstrating the platform's potential for future improvements based on consumer input and changing educational demands, this testing validates the platform's deployment readiness.

Table 4. Results of Edu Mechanic's Functionality Testing

FEATURES	USER'S CATEGORY	RESULT
Sign Up	Teacher Account	Passed
	Student Account	Passed
Email Verification	Teacher Account	Passed
	Student Account	Passed
Login	Teacher Account	Passed
	Student Account	Passed
View Readings/Lessons	Student Account	Passed
Add Readings/Lessons	Teacher Account	Passed
Delete Readings/Lessons	Teacher Account	Passed
Download Readings/Lesson	Teacher Account	Passed
	Student Account	Passed
Print Readings	Teacher Account	Passed
	Student Account	Passed
Add Multimedia Content (videos)	Teacher Account	Passed
Submit Quiz (Multiple Choice Questions)	Student Account	Passed
View Quiz (Multiple Choice and Drag and Drop)	Teacher Account	Passed
	Student Account	Passed
Add Quiz (Multiple Choice)	Teacher Account	Passed

Delete Quiz (Multiple Choice)	Teacher Account	Passed
Quiz Scoring System	Teacher Account	Passed
Add/Delete Quiz Timer	Teacher Account	Passed
Add Deadlines Quiz	Teacher Account	Passed
Date and Time Submitted Quiz	Teacher Account	Passed
View Student's Progress Report	Teacher Account	Passed
Interact with 3d simulations	Student Account	Passed
Log out	Teacher Account	Passed
	Student Account	Passed

Results of Functionality Testing

The findings of Edu Mechanic's 3D simulation's functionality testing verify that every evaluated feature effectively fulfilled performance requirements, as indicated in Table 5. With a result of passing, the Interactive Controls, which include button functionalities, ensured seamless user interaction. Similar to this, crucial simulation elements like replacing automotive parts (like spark plugs) and interacting with mechanical tools and equipment (such as utilizing a lifter to raise an automobile) were carried out flawlessly. Additionally, the fluid simulation showed flawless operation when the car engine was filled with gasoline. The simulation's ability to provide an engaging and dynamic learning environment was further supported by the successful validation of the Flow of Stages. These outcomes demonstrate how consistently the system delivers a thorough and authentic mechanic training experience.

Table 5. Results of Edu Mechanic's Functionality Testing on 3D Simulation

FEATURES	USER'S CATEGORY	RESULT
Interactive Controls (e.g buttons)	Student Account	Passed
Car Parts Replacement (e.g spark plug replacement)	Student Account	Passed
Mechanic Tool/Equipment Interaction (e.g lifting car using car lifter)	Student Account	Passed
Fluid Simulation (e.g filling gasoline in car engine)	Student Account	Passed
Back Navigation	Student Account	Passed
Next Navigation	Student Account	Passed
Pause and Resume Navigation	Student Account	Passed
Transition of Steps	Student Account	Passed

Browser Compatibility Testing

Table 6 describes the findings of tests conducted to see whether various web browsers used in the Edu Mechanic system are compatible. Every browser was examined to see if it could support the features of the platform. Microsoft Edge, Google Chrome, Opera, Brave, Safari, and Mozilla Firefox were among the browsers that were put to the test.

Every test received a "Pass" since every browser that was tested—Microsoft Edge, Google Chrome, Opera, Brave, Safari, and Mozilla Firefox—was capable of supporting the system. This suggests that the essential functions of the Edu Mechanic system are continually compatible with a variety of browsers, swearing a dependable user experience irrespective of the browser being utilized.

Table 6. Results of Edu Mechanic's Browser Compatibility Testing

BROWSER	BROWSER VERSION	TYPE OF OPERATING SYSTEM	RESULT
Microsoft Edge	133.0	Windows 10 / 11	Passed
Google Chrome	133.0	Windows 10 / 11	Passed
Opera	117.0	Windows 10 / 11	Passed
Mozilla Firefox	135.0	Windows 10 / 11	Passed

Pre-Test Likert Scale Results

Prior Experience:

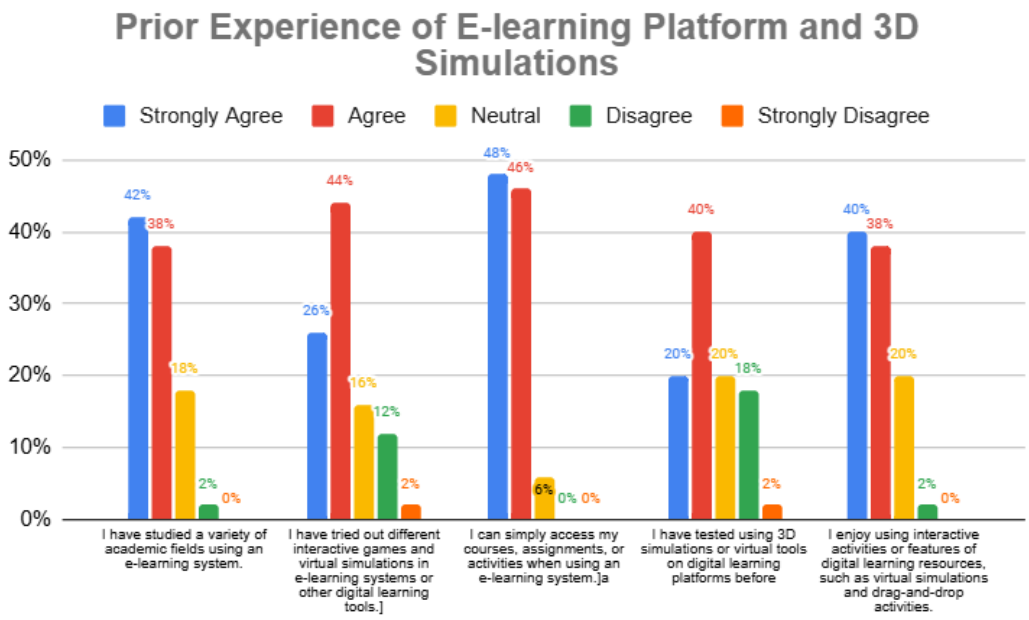


Figure 32. Prior Experience Graph Results

Q1: *I have studied a variety of academic fields using an e-learning system.*

The First bar graph indicates the target audience have studied a variety of academic fields using the e-learning system, with 42% strongly agreeing and 38% agreeing. This indicates that e-learning platforms successfully accommodates the respondents variety of learning experiences.

While, 18% of respondents remain neutral, which may indicate the respondents may not have encounter a particular platforms or may not delved into a broad spectrum of subjects.

Q2: *I have tried out different interactive games and virtual simulations in e-learning systems or other digital learning tools.*

The Second graph shows a significant data of respondents have participated in interactive games and virtual simulations within e-learning systems or other digital learning tools. Presenting a 44% agreed and 26% strongly agreed, showing that a majority of users have experience with these interactive features. On the other hand, 16% of respondents remained neutral, which may suggest that although they recognize these features, they might not use them regularly. Additionally, 12% disagreed and 2% strongly disagreed, indicating that a small segment of respondents either has not encountered or does not favor interactive learning tools.

Q3: *I can simply access my courses, assignments, or activities when using an e-learning system.*

The third graph the majority of students find it straightforward to access their courses, assignments, or activities within the e-learning system. Notably, 48% strongly agreed and 46% agreed, reflecting a highly positive response. This suggests that the platform is user-friendly and facilitates a smooth navigation experience for learners. Only 6% respondents remained neutral, probably they may not perceive access as difficult or didn't consider in effortless manner.

Q4: *I have tested using 3D simulations or virtual tools on digital learning platforms before.*

The Fourth graph data shows different opinions regarding the utilization of 3D simulations on online paltforms, understanding that 40% agreed and 20% strongly agreed, which indicates that users had engaged in this kind of tools. Moreover, a notable portion either remained neutral (20%) or disagreed (18%) this may pertain that some learners may have had

limited exposure to these kind of learning process or either haven't had access these kind of platform.

Q5: *I enjoy using interactive activities or features of digital learning resources, such as virtual simulations and drag-and-drop activities*

The Fifth graph shows the data have a strong appreciation of using digital resources for learning. A combined 78% of respondents either strongly agreed (40%) or agreed (38%) that they enjoy using interactive activities for user engagement and enjoyable experience enhancing their learning capabilities. However, 20% of respondents were neutral, which could imply that they may acknowledge the presence but not the essential of providing its learners the learning enhancement. While, Only 2% disagreed, and no one strongly disagreed, suggesting that interactive activities doesn't find them valuable insight.

Perceptions:

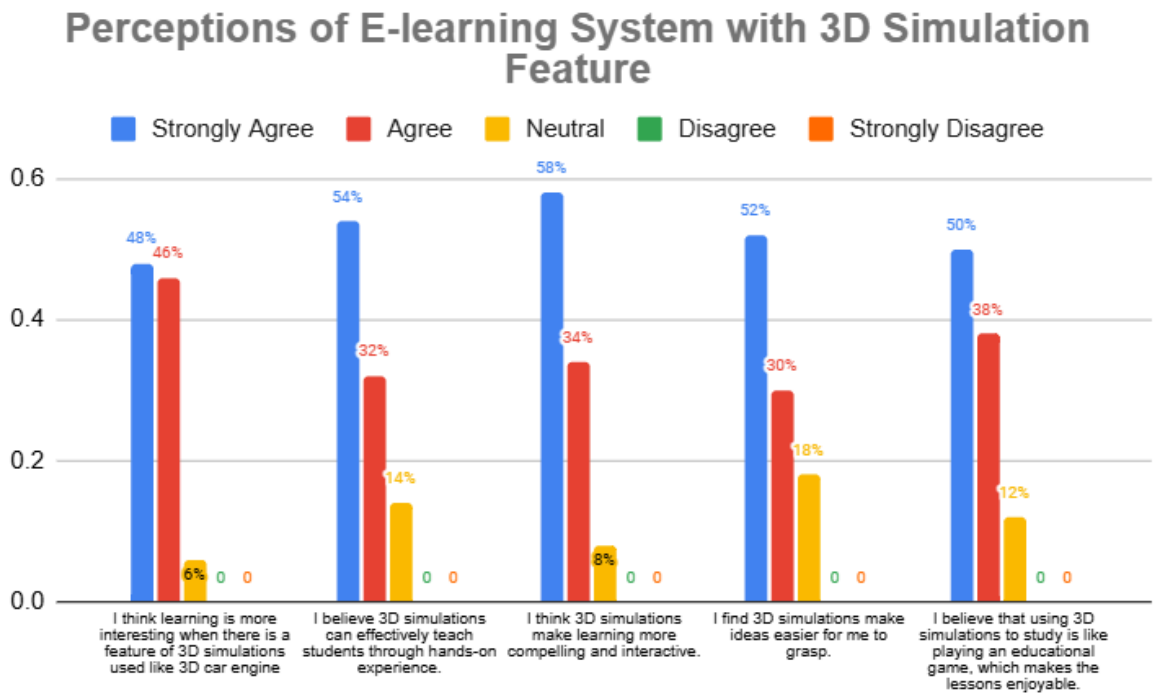


Figure 33. Student Perception Graph Results

Q6: *I think learning is more interesting when there is a feature of 3D simulations used like 3D car engine.*

The respondents mostly responded either agree and strongly agree which 94% are interested that the e-learning platform has a 3D simulations. For the breakdown of results, 48% choose strongly agree and 46% choose agree that they support high level of interest in the 3D simulations. 6% respond neutral and no respondents disagree which become largely accepted by the students on their learnings.

Q7: *I believe 3D simulations can effectively teach students through hands-on experience.*

Hands-on experience is one of the crucial part of students. However, by utilization of 3D simulations, there is strong positive perception where 43 out of 50 participants responded 54% for strongly agree or 32% for agree. The rest of the participants responded neutral, obtaining 14% of the respondents.

Q8: *I think 3D simulations make learning more compelling and interactive.*

The findings shows that the participants have a strongly positive perception of 3D simulations in making student's learning more compelling and interactive. A significant 92% of respondents, where 58% responded strongly agree while 34% responded agree, believe that 3D simulations enhance engagement and interactivity compared to traditional learning methods. Meanwhile, 8% of respondents remained neutral, possibly due to varying learning preferences or limited exposure to interactive learning tools. Notably, no respondents disagreed, reinforcing the universally positive reception of 3D-enhanced learning.

Q9: *I find 3D simulations make ideas easier for me to grasp.*

In total, 82% either strongly agree obtains 52% or agree obtains 30% that 3D simulations make ideas easier to grasp. This strong positive response shows a potential effectiveness of 3D simulations in enhancing comprehension. 18% of respondents remained neutral, indicating that they neither agree nor disagree with the statement, and no respondents disagreed, which reinforces the idea that 3D simulations can be a valuable tool for making complex ideas more accessible and understandable in educational contexts.

Q10: *I believe that using 3D simulations to study is like playing an educational game, which makes the lessons enjoyable.*

The data shows that 88% of the respondents either strongly agree receives 50% or agree receives 38% that using 3D simulations for studying makes lessons enjoyable and engaging. This shows a strong positive sentiment towards the use of 3D simulations in education. 12% of respondents had a neutral stance, and no respondents disagreed, which suggests a widespread appreciation for the ability of 3D simulations to make learning fun and interactive.

Student's Preference:

Figure 34. Students Preference Graph Results

Q11: *I would like to see clear and detailed instructions for car repairs to be included in the system.*

It indicates the strong desire of students wants a system that provides a informative and detailed description of mechanical repairs, showing **68% for Strongly Agree** and **32% for Agree**, which highlights the importance of providing a comprehensive supplementary system.

Q12*: I hope the simulation provides realistic car engines and mechanic tools.*

The model shows a graph of combined **100%** of respondents either **strongly agreed (72%)** or **agreed (28%)**, suggesting that learners have high expectations for the realism of these simulations to enhance their learning experience.

Q13: *I expect a system that delivers evaluations such as quizzes or activities.*

The Third graph presents the data of having agreed (52%) respondents and strongly agreed (40%) suggesting that learners value assessments as a key component of their digital learning experience. Meanwhile, 8% of respondents were neutral, which may indicate a less active interest in evaluations, but they still do not express strong opposition to the idea.

Q14:*I prefer a system that will assist me in getting ready for actual automotive responsibilities.*

The Fourth graph depicts of having a strong preference for a system that prepares users for real-world automotive responsibilities. A respondents had strongly agreeing (68%) or agreeing (32%), indicating that users highly value practical preparation for actual automotive tasks through the system.

Q15: *I can't wait to use 3D simulations to study in a way that is more exciting.*

84% responded either strongly agree (44%) or agree (40%) that they are excited to use 3D simulations for a more engaging study experience. This reflects a strong positive sentiment towards the idea. 16% of respondents were neutral, showing no strong opinion on the matter, while no respondents disagreed. This suggests that 3D simulations are widely appreciated for their potential to enhance the learning experience.

Usability Testing

In calculating the Usability testing, the Five-point Likert Scale and User Experience Questionnaire (UEQ) are used in collecting user's attitudes and perceptions that offers more accurate and general findings. The number of participants engaged in the survey is 50 participants, encompassing the Grade 9 students, Grade 10 students, and High School Teachers specialized in automotive. Both tests are used to aid in the balanced characteristics on statistical analysis to gauge the actionable insights of the respondents.

The User Experience Questionnaire (UEQ) is utilized on the survey questions which establish various aspects pertaining to the following attributes and results (See Table 7 and Figure 32):

- Attractiveness (2.024) obtains the second greatest mean score among the other aspects which students find enjoyable and pleasing when using the e-learning system. The variance score of attractiveness (1.19)
- Perspicuity (1.756) obtains moderate ease of familiarization of students in accessing the various features of the e-learning platform. The score of perspecuity (1.17) have some variability on learning the Edu Mechanic platform.

- Efficiency (1.823) obtains strong mean score that the student's learnings optimize the effectiveness in accessing and completing the activities and quizzes in the platform. The score of variance in efficiency (1.01) defines an e-learning system to be well-organized and swift interaction to both teachers and students.
- Dependability (1.646) obtains a slight decline on reliability of the system. However, some students give trust on the system as it ensures consistent performance without disruptions. The score of variance in dependability (1.14) is low, suggesting to give user trust and consistency to the e-learning platform.
- Stimulation (2.061) obtains the highest mean score among the other scale indicating the great user engagement and make students interested to the system. The score of variance in stimulation (1.11) displays wide consensus on the dynamic features of website to feel the excitement of students
- Novelty (1.451) obtains the minimum score on the impression of student towards innovation and creative creation of the system. The variance score of novelty (1.23) made it engaging to users as it ponders the expectation of students.

Table 7. UEQ Edu Mechanic Scales of Mean and Variance

UEQ Scales (Mean and Variance)		
Attractiveness	2.024	1.19
Perspicuity	1.756	1.17
Efficiency	1.823	1.01
Dependability	1.646	1.14
Stimulation	2.061	1.11
Novelty	1.451	1.23

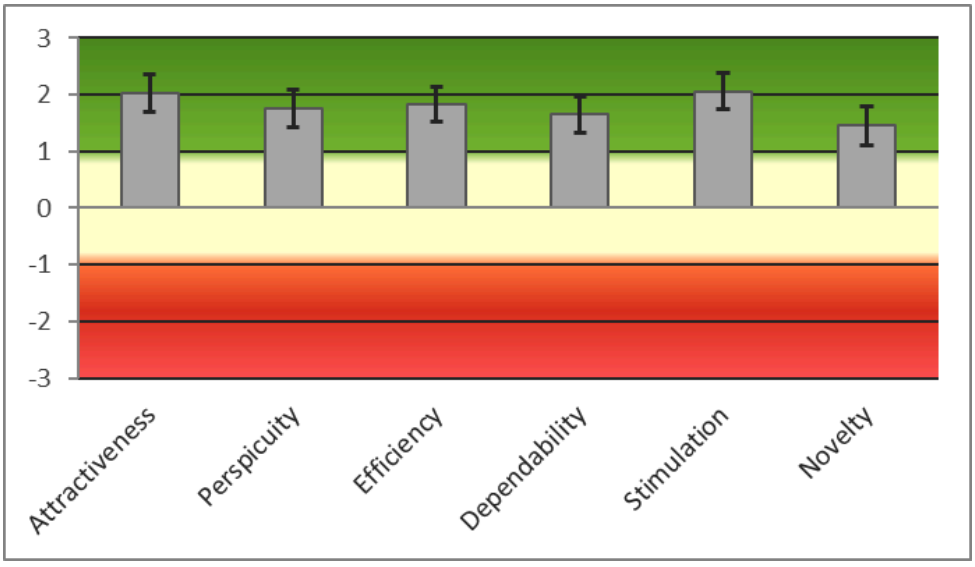


Figure 35. UEQ Edu Mechanic Graph of Mean and Variance

In Table 8, attractiveness score of 2.02 shows a student's high appeal on the website. The student's score could comes to the design elements and features to visually simulate the attention on every pages of the website like 3D simulation. Combining every aspect of the UEQ, they are categorized into two qualities: Pragmatic and Hedonic Quality. The results found that Pragmatic Quality gains 1.74 which encapsulates the Perspicuity, Efficiency, Dependability aspects of UEQ. It explains that the score can have a room for ease of use in swiftly familiarizing the system. On the other hand, the results of Hedonic Quality gains 1.76, which is somewhat higher than the Pragmatic Quality. It encompasses the stimulation and novelty for users in using e-learning to gain value and provide cutting edge system that can benefit the automotive schools. The Hedonic's score interprets that Edu Mechanic platform incorporating enjoyable and rewarding experience in the immersive outcome in playing the 3D environment of Preventive Maintenance Service (PMS).

Table 8. UEQ Edu Mechanic Pragmatic and Hedonic Quality Scale

Pragmatic and Hedonic Quality	
Attractiveness	2.02
Pragmatic Quality	1.74
Hedonic Quality	1.76

In Table 9 and Figure 33 shows the benchmarks of the aspects of UEQ and its findings. It analyzes the 50 respondent's answers to collate and examine the outcome. The Attractiveness (2.02) and Stimulation (2.06) shows an excellent benchmark comparison results among the other scales. Both receives top 10% of best results which students attracts and stimulates the overall satisfaction on the interface of Edu Mechanic platform. Perspicuity (1.76), Efficiency (1.82), Dependability (1.65), and Novelty (1.45) scored as good which have favorable impact to the learnability on how the students understand each feature of the website, expection of students and teachers on how they perceived the website's functionality, organization of the placement that can smoothly navigate and familiarize, and the state-of-the-art impression of the UI/UX of the Edu Mechanic website.

Table 9. UEQ Edu Mechanic Benchmarks

Scale	Mean	Comparisson to benchmark	Interpretation
Attractiveness	2.02	**Excellent**	In the range of the 10% best results
Perspicuity	1.76	**Good**	10% of results better, 75% of results worse
Efficiency	1.82	**Good**	10% of results better, 75% of results worse
Dependability	1.65	**Good**	10% of results better, 75% of results worse
Stimulation	2.06	**Excellent**	In the range of the 10% best results
Novelty	1.45	**Good**	10% of results better, 75% of results worse

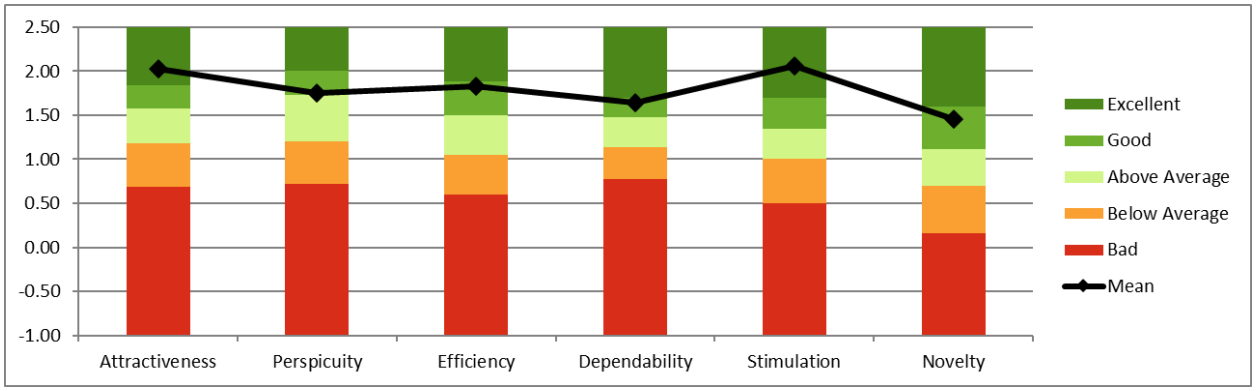


Figure 36. UEQ Edu Mechanic Graph of Benchmark

Vulnerability Testing

Utilizing Nessus for security evaluation, allowing for the identification of potential vulnerabilities, misconfigurations, and security weaknesses within the network infrastructure. However, the system is hosted by Hoststinger, which is benefiting from its comprehensive security measures that are applied to server and infrastructure security configuration across all servers, reinforcing protection against potential threats. It is safeguarded with advanced security measurements like with an embedded mod_security to prevent malicious external attacks and block unknown sites from the website, and Suhosin PHP hardened for effective protection of the systems database.

To quickly fix newly found vulnerabilities, it is crucial to set up a practice for routinely updating and fixing all software, including web servers, in addition to these particular steps. Implementing ongoing security monitoring will help identify and fix issues quickly. Security settings should be routinely examined and updated to conform to industry standards and best practices, and enhanced encryption techniques, such as robust algorithms for encryption and key lengths, should be implemented.

Chapter V - Conclusion and Recommendations

Conclusion

The Edu Mechanic e-learning system has proven to be a highly effective digital learning platform for students pursuing automotive servicing education. Through its integration of 3D simulations, interactive learning tools, and structured training modules, the system provides a realistic and engaging educational experience that enhances students' technical skills.

Comprehensive functionality testing confirmed that all essential features, including interactive lessons, content management, quizzes, and authentication, perform reliably. Additionally, browser compatibility tests verified seamless performance across multiple web browsers, ensuring ease of access for a diverse range of users.

Student feedback indicated a high level of engagement and satisfaction, with many respondents recognizing 3D simulations as a valuable tool for improving comprehension and hands-on learning. The User Experience Questionnaire (UEQ) results highlighted strengths in usability, efficiency, and overall appeal, reinforcing the system's ability to deliver an effective and interactive learning environment.

Recommendations

To further enhance the Edu Mechanic e-learning platform, several improvements are recommended. Expanding the range of training simulations to include more advanced automotive repair and troubleshooting scenarios will provide a broader skill set for students. Enhancing mobile compatibility will improve accessibility, allowing students to utilize the platform on tablets and mobile devices. Strengthening security measures through routine audits

and updates will ensure ongoing protection against potential cyber threats. Refining the user experience based on student feedback will optimize navigation, content organization, and overall usability.

Expanding the platform's course offerings to include Automotive Servicing NC II, NC III, and NC IV will accommodate students at various levels of expertise. Establishing partnerships with TESDA and industry professionals will ensure the platform remains aligned with real-world automotive service standards.

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APPENDICES

Appendix A - Automotive Servicing NC I Curriculum

TRAINING REGULATIONS FOR
AUTOMOTIVE SERVICING NC I

SECTION 1 AUTOMOTIVE SERVICING NC I QUALIFICATION

The AUTOMOTIVE SERVICING NC I Qualification consist of competencies that a person must achieve to perform pre-delivery inspection and periodic maintenance of automotive parts and components.

This Qualification is packaged from the competency map of the Automotive Industry (Service sector) as shown in Annex A.

The Units of Competency comprising this Qualification include the following

CODE NO.	BASIC COMPETENCIES
500311101	Received and respond to workplace communication
500311102	Work with others
500311103	Demonstrate work values
500311104	Practice basic housekeeping procedures

CODE NO.	COMMON COMPETENCIES
ALT723211	Validate vehicle specification
ALT832212	Move and position vehicle
ALT723213	Utilize automotive tools
ALT723214	Perform mensuration and calculation
ALT723215	Utilize workshop facilities and equipment
ALT723216	Prepare servicing parts and consumables
ALT723217	Prepare vehicle for servicing and releasing

CODE NO.	CORE COMPETENCIES
ALT723372	Perform pre-delivery inspection
ALT723373	Perform periodic maintenance of automotive engine
ALT723374	Perform periodic maintenance of drive train
ALT723375	Perform periodic maintenance of brake system
ALT723376	Perform periodic maintenance of suspension system
ALT723377	Perform periodic maintenance of steering system

A person who has achieved this Qualification is competent to be:

- ❑ Pre-delivery inspector / Check lister
- ❑ Periodic maintenance personnel/staff
- ❑ Periodic maintenance associate
- ❑ Junior technician
- ❑ Maintenance technician
- ❑ Auto – service personnel

Appendix B - Acceptance Letter for DBTI (1st Page)

February 12, 2025

Mr. Alfredo A. Lozanta, Jr., MAEd
Principal, High School Department
Don Bosco Technical Institute Makati
Chino Roces Ave, Makati, 1230 Metro Manila

Dear Mr. Lozanta,

We, students of Mapúa University, are writing to respectfully seek your approval for use of the shop facility at Don Bosco Technical Institute (DBTI) to perform a video demonstration utilizing specific equipment. This initiative, conducted under the guidance of Mr. Ray Mar Rosario as part of our thesis, aims to support our objective of developing an e-learning platform tailored to DBTI students pursuing an online NC1 certification approach that incorporates extensive use of a 3D model.

The proposed activities for the video demonstration include:

- Service/Replacement of Spark Plugs
- Suspension System Components Replacement
- Brake Pads and Rotors Replacement
- Coolant Cleaning
- Cleaning Air Filter

This demonstration will showcase the tools and equipment integrated into our system and highlight its potential benefits specifically for DBTI students, paving the way for a more innovative and engaging learning experience. Additionally, we plan to conduct surveys, including pre-test and post-test surveys, among Grade 9 and 10 students to gather valuable feedback and insights, ensuring the system's usability and effectiveness. The survey will be exclusive for DBTI and gathered information from students will be confidential and aligned to the Data Privacy Act of 2021.

We also kindly request access to relevant automotive educational resources, such as reviewers, lecture notes, or PowerPoint presentations, to serve as crucial data for our system. These materials will ensure the platform's accuracy and alignment with the DBTI curriculum.

The system will benefit the school by compliance with the industry standards and give opportunities to prepare students for future careers in automotive. It aids not only in improving their knowledge of the maintenance of cars but also in having fun while learning due to the 3D simulations feature of the website. In addition, we are willing to provide the whole program files to your school when the system is completed.

Appendix C - Acceptance Letter for DBTI (2nd Page)

We respectfully request your permission to access the necessary facilities and resources at the earliest convenience. As Mr. Rosario stated and recommended, there will be no utilization of consumables in performing the listed video demonstration or activities. Please rest assured that we will adhere to all institutional guidelines, maintain the integrity of the facilities, and uphold the confidentiality of any educational information shared with us.

Thank you very much for considering our request. We look forward to your favorable response and are open to further discussions or adjustments to meet your requirements

Sincerely yours,

Paul James L. Perez
Student, Mapua University,
(pjlperez@mymail.mapua.edu.ph)

Reympart P. Ambayon
Student, Mapua University,
(rmpambayon@mymail.mapua.edu.ph)

Ronnel Christian B. Langit
Student, Mapua University,
(rcblangit@mymail.mapua.edu.ph

Noted by:

Mr. Ray Mar T. Rosario
TCH, AMET

Recommending/Approved by:

Mr. Marlowe B. Ingles, MAT
APC

Approved by:

Mr. Alfredo A. Lozanta, Jr., MAEd
Principal

Page 2 of 2

Appendix D - Letter for Panelist (1st Page)

February 10, 2025

Dear Panelists,

Good day!

We are writing to inform you about an important change in our research study titled "Edu Mechanic: A Study on the Impact of a 3D Model-Based Interactive E-Learning Platform for Car Mechanic Equipment Training" After careful consideration and analysis, we have decided to change our respondents from TVET students to Grade 9 and 10 students who are currently enrolled in the Automotive Design Technology program in Don Bosco Technical Institute of Makati, Inc.

This change is driven by TVET Curriculum in Don Bosco Technical Institute of Makati, Inc. We believe that this change will give our study more pertinent data and align to our thesis objectives. If you have any inquiries or need further clarification, please feel free to reach out to us.

Thank you for your continued guidance and support.

Regards,

Paul James L. Perez

Ronnel Christian B. Langit

Reymart P. Ambayon

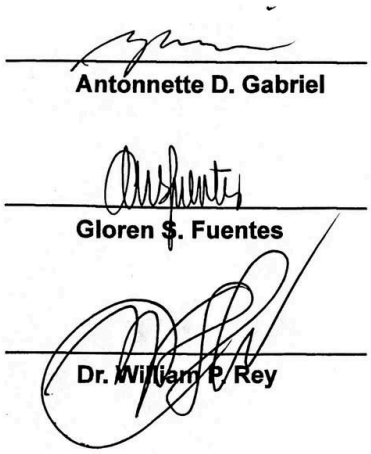
Approved by:

Mr. Ray Mar T. Rosario
Technical Cluster Head, AMET
High School Department
Don Bosco Technical Institute-Makati

Dr. Mary Jane C. Samonte
Thesis Adviser

Appendix D - Letter for Panelist (2nd Page)

Accepted by:



Appendix E - Systems Functionality Test Cases of Student & Admin

Student Test Cases				
Test Case ID	**Test Case Feature**	**Test Case Process**	**Expected Outcomes**	**Results (Passed or Failed)**
TC-Student-001	Register Student Information	1. Proceed to click the register button. 2. Input the required credentials 3. Click the “Sign up” button.	The student should be able to input the required credentials and successfully redirected to the home page.	Passed
TC-Student-002	Login Student Information	1. Proceed to the Login Page. 2. Input valid student credentials. 3. Click the “Login” button.	The student will be redirected to the home page with the credentials that were inputted.	Passed
TC-Student-003	Dashboard Navigation	1. Login with a valid student account.	The student should be able to navigate the features of the system.	Passed
TC-Student-004	Student Modular Readings	1. Select “Readings” from the navigation bar. 2. Navigate the readings page.	The student should be able to select their desired readings to view/find information about certain topics.	Passed
TC-Student-005	Student Modular Activities	1. Click a specific topic from the readings page. 2. Select a certain Quiz or Activity. 3. Press “Start Now”	The student should be able to view or answer the selected graded activity questionnaires.	Passed

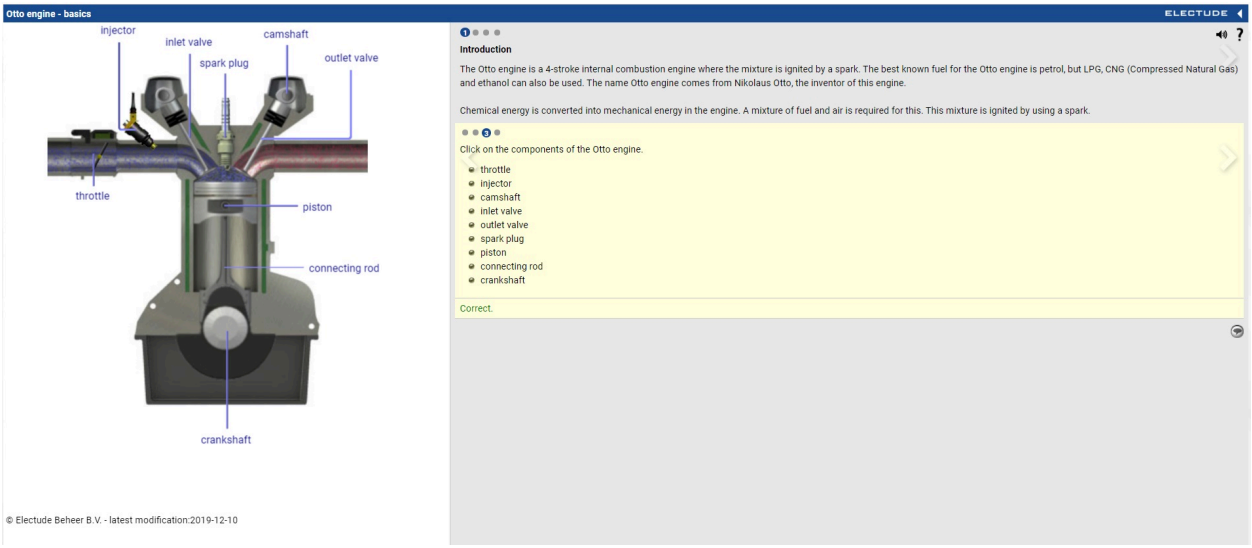
TC-Student-006	Readings Quiz Functionality	1. Click the “Start Now” button from the Quiz selected readings. 2. Answer the provided questionnaires.	The student can freely select certain answers, and move to certain questions by clicking the previous or next question until they finish the quiz.	Passed
TC-Student-007	Readings Drag & Drop	1. Click the “Start Now” button from the Activity section selected in the readings. 2. Select and position the right tools.	The student can choose a certain tool to drag it from a certain position to complete the activity.	Passed
TC-Student-008	Video Demonstration	1. Click the “Video Demo” from the navigation bar. 2. Select a certain video.	A student may select their desired video which would pop up from the screen and play.	Passed
TC-Student-009	Simulation Activity	1. Click the “Simulation” from the navigation bar. 2. Select the desired simulation activity.	The simulation page will start and students can view the instructions and navigate through the simulation/	Passed
TC-Student-010	Student Navigation Grades	1. Click the “Grades” from the navigation bar. 2. Navigate the grades page	The page will present the grades of the students so that they can view the tasks, grades, and status.	Passed
TC-Student-011	Edit Student Personal Information	1. Click the “Settings” from the navigation	The student may change/edit their personal	Passed

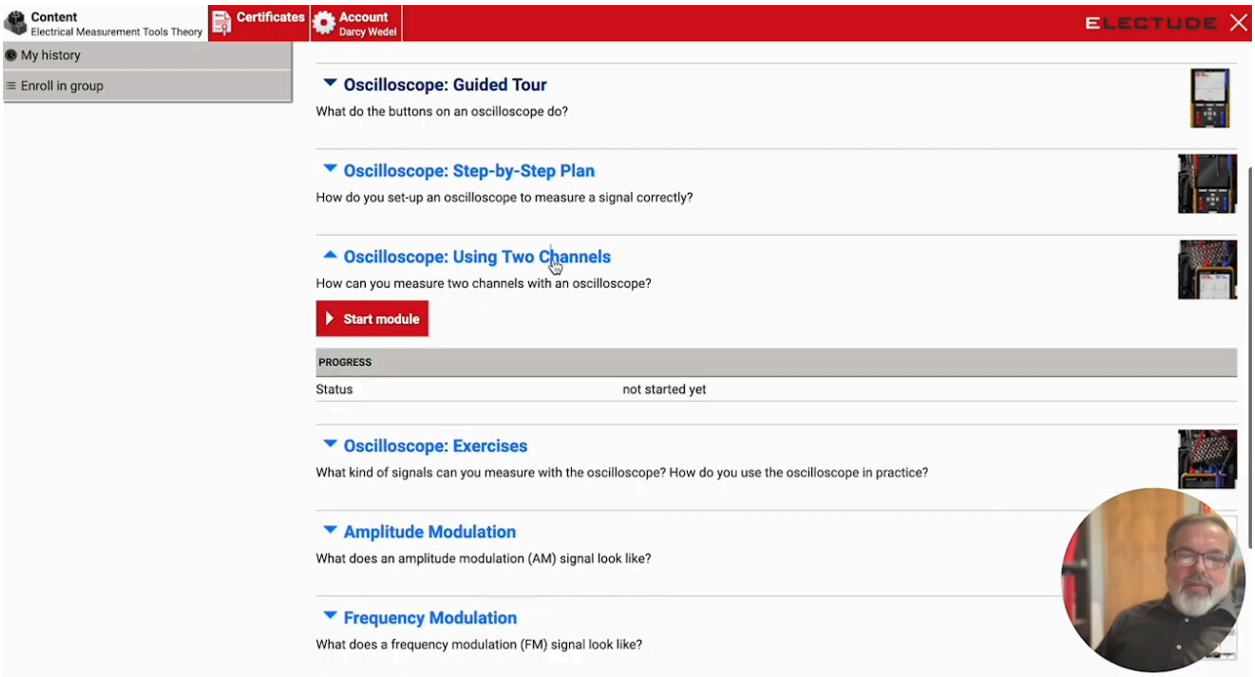
		bar or Profile icon. 2. Select specific credentials to edit. 3. Click “Save changes” to save the edited credentials.	information from the container boxes.	
TC-Student-012	Logout System	1. Login with a valid student account. 2. Click the Logout icon from the navigation bar.	The student will be logged out from the system and will display the sign-in option.	Passed

Admin/Professor Test Cases				
Test Case ID	**Test Case Feature**	**Test Case Process**	**Expected Outcomes**	**Results (Passed or Failed)**
TC-Admin-001	Register Admin Information	1. Proceed to click the register button. 2. Input the required credentials 3. Click the “Sign up” button.	The admin should be able to input the required credentials and successfully redirect them to the home page.	Passed
TC-Admin-002	Login Admin Credentials	1. Proceed to the Login Page. 2. Input valid student credentials. 3. Click the “Login” button.	The admin will be redirected to the home page with the credentials that were inputted.	Passed
TC-Admin-003	Dashboard Navigation	1. Login with a valid professor account.	The admin should be able to navigate the features of the system showing the number of students,	Passed

			quizzes, and activities.	
TC-Admin-004	Admin Navigation of Lessons	1. Click the “Lesson” icon or button from the navigation bar. 2. Navigate Lesson from its page.	The admin should be able to select their desired readings to view/find information about certain topics.	Passed
TC-Admin-005	Admin Add more Lessons	1. Select the “Add more Lesson” button from the “Manage Lesson” page. 2. Input lesson title. 3. Input the phrase and click “Select level”. 4. Select “Insert File” to add new lesson file. 5. Click “Submit” button to add its new lesson.	The admin can add a new lesson by providing the requirement for a certain lesson by inserting the necessary details.	Passed
TC-Admin-006	View Options into the Added Lesson	1. Select a certain added lessons from the Manage Lesson page. 2. Press the option icon in a certain lesson.	Admin can choose to navigate through the options like manage, edit, and delete a particular lesson.	Passed
TC-Admin-007	Lesson Manage Activity Functionality	1. Must have an added lesson. 2. Click the Options icon. 3. Select “Manage Activity” .	Admin will be redirected from the “manage activity” page. Having the options of viewing the attempts, edit, and delete on the created lesson.	Passed

TC-Admin-008	Lesson Manage Quiz Functionality	1. Must have an added lesson. 2. Select “Manage Quiz” from the options lists.	Admin will be redirected from the “manage quiz” page.	Passed
TC-Admin-009	Edit Manage Quiz Questionnaires	1. Must have a created Quiz 2. Select “Manage Quiz” from the options lists. 3. Click “Edit Questionnaire”	Admin can edit the questionnaires, answers, and timer. Also they may view the number of students that have taken the quiz and delete.	Passed
TC-Admin-010	View Lesson Manager	1. Select a certain added lessons from the Manage Lesson page. 2. Click “View” from the option lists.	The admin can browse the contents of the created lessons.	Passed
TC-Admin-011	Delete Lesson Functionality	1. Select a certain added lessons from the Manage Lesson page. 2. Click the Delete icon from the option Lists	Admin can delete multiple lessons from the manager.	Passed
TC-Admin-012	Logout System	1. Login with a valid admin account. 2. Click the Logout icon from the navigation bar.	The admin will be logged out from the system and will display the sign-in option.	Passed





Electude (*electude.com*)

Car Mechanic Tools and Equipments (*aliexpress.com*)

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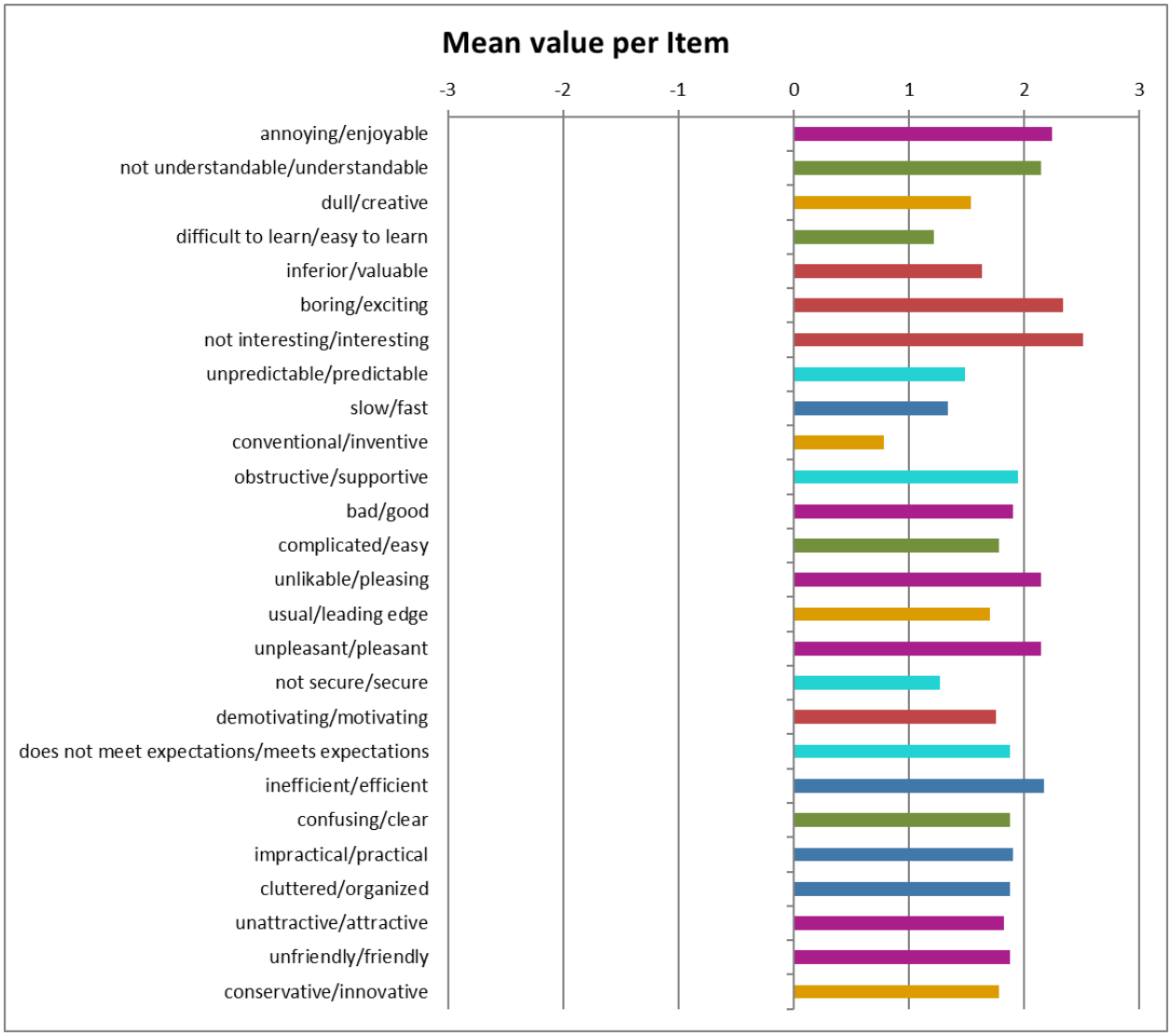
Electric Drill for Car Mechanic Repair (*amazon.in*)

Appendix F - User Experience Questionnaire (UEQ) Survey Template

	1	2	3	4	5	6	7		
annoying	○	○	○	○	○	○	○	conservative	1
not understandable	○	○	○	○	○	○	○	understandable	2
creative	○	○	○	○	○	○	○	dull	3
easy to learn	○	○	○	○	○	○	○	difficult to learn	4
valuable	○	○	○	○	○	○	○	inferior	5
boring	○	○	○	○	○	○	○	exciting	6
not interesting	○	○	○	○	○	○	○	interesting	7
unpredictable	○	○	○	○	○	○	○	predictable	8
fast	○	○	○	○	○	○	○	slow	9
inventive	○	○	○	○	○	○	○	conventional	10
obstructive	○	○	○	○	○	○	○	supportive	11
good	○	○	○	○	○	○	○	bad	12
complicated	○	○	○	○	○	○	○	easy	13
unlikable	○	○	○	○	○	○	○	pleasing	14
usual	○	○	○	○	○	○	○	leading edge	15
unpleasant	○	○	○	○	○	○	○	pleasant	16
secure	○	○	○	○	○	○	○	not secure	17
motivating	○	○	○	○	○	○	○	demotivating	18
meets expectations	○	○	○	○	○	○	○	does not meet expectation	19
inefficient	○	○	○	○	○	○	○	efficient	20
clear	○	○	○	○	○	○	○	confusing	21
impractical	○	○	○	○	○	○	○	practical	22
organized	○	○	○	○	○	○	○	cluttered	23
attractive	○	○	○	○	○	○	○	unattractive	24
friendly	○	○	○	○	○	○	○	unfriendly	25
conservative	○	○	○	○	○	○	○	innovative	26

User Experience Questionnaire (UEQ) Survey [53]


Mean value per Item
-3
-2
-1
0
1
2
3
annoying/enjoyable
not understandable/understandable
dull/creative
difficult to learn/easy to learn
inferior/valuable
boring/exciting
not interesting/interesting
unpredictable/predictable
slow/fast
conventional/inventive
obstructive/supportive
bad/good
complicated/easy
unlikable/pleasing
usual/leading edge
unpleasant/pleasant
not secure/secure
demotivating/motivating
does not meet expectations/meets expectations
inefficient/efficient
confusing/clear
impractical/practical
cluttered/organized
unattractive/attractive
unfriendly/friendly
conservative/innovative

Appendix F - Transcript

Ronnel: So basically, sir nagging major revisions naming nagging 3d simulation po so ang contents po naming is composed of pms PRIVENTIVE MAINTENANCE SERVICE. So nasa thesis 2 na po kami which is creation of the system and deployment stage. Yung gagawin po naming na PMS is engine oil replacement

PJ: Bale 5 po yun at least 5 sabi ng mga panels namin ang mga Napili po naming is Engine Oil Replacement, Service/replacement of Spark Plug, Engine Tune up, Suspension System Components Replacement at Brake Pads and Rotors Replacement

Ronnel: So Basically po yung 5 yun gagawan po naming ng simulation so, yung targets respondents po naming is medyo conflict since TVET po talaga actual target pero hindi sumasagot sa email and hindi sila available if ever po sir ok lang po ba if done na yung system pwede po ba yung grade 10 po ba sila magiging target for testing and survey

Sir Rey: first of all meron akong tanong simulation so meaning parang game ang style nito ? familiar naman kayo sa steam noh kasi meron akong nalaro before sa steam car mechanic simulator pwede niyo gawing basis yung car mechanic simulator as in 3d model talaga siya first person ang view niya so nag aayos siya example nag bigay ng trouble pero laro siya

Ronnel : Actually nasa existing system naming siya so na check na naming po na background check naming siya

Sir Rey: Ayan Car mechanic simulator pwede yan basis ngayon wala naman kaso kung grade 10 ang magiging target niyo sa amin pero ako ang kasi Maganda eh ako gusto ko yung idea niyo

pwede niyo siya I target kung game siya pwede I move sa grade 7 and 8 pinaka basic at least meron silang idea kasi ang grade 9 and 10 namin is actual so parang ang mangyayari nito is maglalaro yung mga bata sa 7 at 8 try nila yan change oil mag palit ng spark plug gamit yung system niyo as they progress pwede nila gamitin sa grade 10 yung actual na pero again kung testing lang naman Maganda siya sa grade 10 I think Madali lang sa grade 10

Ronnel: When it comes to TVET iba po yung perspective nila kung how they learn syempre meron po silang online platform sila or physical activity so depende so sir for formality yung record po na ito required mag transcript kung ano po yung sinasabi ilalagay po naming sa records I tytype naming tapos I sisign niyo na lang po tapos upon agreement kung ok lang po yung nilagay sa transcript kung tanggalin or hindi po

Regarding po sa website naming is mag kakaroon po ng server based website based ang mga students meron silang sariling sign inm register

PJ: Sa register first name last name conform password so homepage para po siyang e book style so tatlo po yung pamimilian ni user includes readings, activities and video demonstrations. Sa readings po more on modules na automotive mechanics mga tools and equipments. Sa activities po includes drag and drop and yung scenario based quizzes and yung sa video demonstrations naman po mga video tutorials sa pagmamit po ng tamang PMS tools.

Meron pong beginner intermediate and advance lessons and kapag pinindot niyo yung beginners may mga list of modules modules 1 2 and so fourth

After that sa video demo merong list of PMS kapag pinindot ni users example pre-delivery inspection may tutorial po kung paano pinapakita yung pre-delivery inspection nay un gamit yung PMS yung sa paggamit ng tools sa automotive dito naman po yung sa Quizzes pag ka start

ng user it's either mamimili po siya if drag and drop or scenario based two options sa quizzes namin. First yung sa scenario based naming is meron pong question tapos mag answer si user from the four options mga 10 question po gagawin naming sa quiz after that kapag pinindot ni user yung scenario based quiz I dradrag and drop ni user yung category nay un example air pressured gauge I dradrag ni user and then last yung simulation activity dito naman po pinapakita yung 5 PMS and then may mga task yung gagawin ni user yung pinapagawa so ayun po and then last yung sa mapapakita po yung scores nila.

Ronnel: depende po samin kung kaya po naming I apply kasi since may mga limitation po kami hindi po naming kung matutupad pero sa kaya naming try po naming as much as possible. So sir meron po ba kayong tanong or proposed website

Sir Rey: ok ganito so proposed website siya na access siya google chrome via pc laptop hindi siya sa cp

Ronnel: hindi po kami sure if kaya naming gawing responsive so kasi sir sobrang hirap kasi may simulation kasi meron different software baka hindi pa siya maging applicable po agad sa mobile devices

Sir Rey: ok lang siya at least kung ganun lagay na lang sa limitations Ninyo yun na talagang web based lang siya hindi siya app based pa sa ngayon then suggestions ko naman for examples meron kayong 3 levels diba ang pwede niyong gawin sub divide niyo yung lessons

First yung beginner lessons Ninyo mechanics familiarizations of tools pwede niyo diyan ilagay familiarizations of basic parts ng sasakyan ayan doon ilagay niyo sa beginner mechanic lessons, sa intermediate mechanic lessons naman ang pwede niyo ilagay diyan ok I didiscuss niyo yung function and purpose of number 1 engine number 2 under chassis and number 3 drive train so

yun yung Nakita sa slide kanina yung troubleshoot yung number 7 ayan nakalagay yung periodic maintenance of drive train ok yan pero dagdagan niyo din ng periodic maintenance of under chassis kasi hiwalay yung drive train sa under chassis

Ronnel: Ano po ba yung sa under chassis po kung pwede po pa explain

Sir Rey: Pag under chassis nandiyan yung steering system nandiyan yung brakes system pag sinabi naming drive train connected siya sa engine so from engine going to the driving wheels diyan papasok yung transmission, papasok yung propeller shaft papasok yung drive shaft at yung differential assembly so ayan papasok sa drive train so ayan yung papasok sa advance lessons niyo yung purpose and functions ng bawat isa. So again beginner lesson niyo is tools and familiarizations tapos pag dating ng intermediate discuss niyo na yung mga parts sa advance lesson diyan papasok yung step by step procedure ng PMS

Ronnel: Sir question lang po PJ pakita mo yung mga 5 lessons namin ask ko lang po if considered siya if pasok po siya sa beginner advance lesson namin regarding sa PMS

Sir Rey: Actually pasok siya sa intermediate kasi pwede niyo I discuss yung purpose and functions ng PMS pwede yan sa intermediate basta ang beginners talaga Magandang coverage niyo is tools lang talaga

Ronnel : Pero sir regarding po sa simulation like madidistinguished po ba talaga sa enginer oil replacement ay ito po talaga sa beginner module talaga

Sir Rey: Actually itong 5 na nilagay Ninyo na PMS hindi ko ma consider as beginner kasi pwede na yang pumasok ng intermediate or advance na yan kung ako tutuosing mas Maganda sa advance yan

Ronnel: pero like sir medjo may alam na yung students target naming TVET pag alam nila yung basic repair so macoconsider na yung 5 list is for them beginner

Sir Rey: Honestly kasi sa TVET or HS laging considered basic fundamentals yan at ang laging basic fundamentals talaga is yung tools kasi kapag wala ka kasing knowledge doon sa tools hindi mo alam pano mo ma execute yung mga susunod na steps kasi halimbawa mag change oil ka kailangan mo ng wrench eh wala kang idea kung ano yung wrench so dapat pumasok yun sa beginners sa tool familiarization

Ronnel: eh sir pag sinabi po natin na beginner isa sa mga beginner experience sabihin po natin meron silang knowledge sa pag gamit ng tools wrenches and other mechanical tools so parang ma considered po ba or hindi talaga

Sir Rey: Ang pwede niyong gawin diyan dalawang level kung industry based or TVET laging basic fundamentals talaga hindi nawawala kahit meron previous knowledge laging binabalikan yung basic fundamentals so ngayon kung gusto niyo I limit niyo na lang sa dalawa yung basic na lang and then wala nang intermediate basic and then advance para at least sa advance nandoon niyo na papasok yung PMS talaga pwede niyo ilagay sa basic kung two levels talaga tools and definitions ng bawat ginagawa sa PMS yung 5 nilagay niyo in terms of step by step ng bawat isa doon niyo ilagay sa advance yun

PJ: Bali po sa beginners wala pong hands on student wala pa pong experience kaya po familiarizations of tools and equipment's

Sir Rey: Depende kung how you define hands on kasi pwede hands on ng tools kasi example screwdriver hindi lang naman siya sa makina ginagamit diba sa ibang applications din naman nagagamit and screwdriver

PJ: Sa video demonstration po naming bali meron po ba kayong mga video demonstration na pwede naming magamit

Sir Rey: Actually meron mga project mga students before halimbawa change oil pinagawa namin as video demonstration ayun nga lang kasi nasa data privacy so hindi ko alam kung pwede naming ibigay sa inyo yun lalo na ibang students ngayon kung gusto Ninyo una kayo yung gagawa pwede niyo gawin sa bahay pero syempre kulang kayo sa equipment ayun yung mahihirapan kayo and second option niyo siguro kung gagawa kayo ng video pwede niyo gawin dito pero hihingi tayo ng permission tapos students yung mag vivideo students naming yung ipapakita sa video pero yung mga previous na ginawa ng students naming hindi naming pwede ibigay yun. Meron pala ako isang comment diba nakalagay sa inyo sa hompage pwede mo unahin yung video demonstrations bago yung activities para hindi malito yung mga users kasi kung gagawin metedology talaga step by step number 1 readings number 2 demons and number 3 yung activities kasi bago gumawa ng actual activity yung users Maganda kung meron na siyang knowledge ng demonstration para Maganda para methodized yung process niyo

Ronnel: titignan po naming I update yung other information kasi sir when it comes to paper like since na process na po depende kung pwede pa po palitan pero sabi naman samin kung pwede palita or irevise sa papers like respondents or sa survey kung pwede pa naming gawing grade 10 or TVET

Sir Rey: Ang nakalagay sa paper niyo diba TVET diba hindi for grade 10 kasi honestly hindi ka talaga ma rereplayan ng mga TVET kasi medyo busy talaga sila kapag actual kayo mag papa testing yung mga yan mga software Ninyo tingin ko wala naman pero ayun lang mahihirapan kasi hindi sila responsive sila.

Ronnel: Yung prof po naming is under ng testa license po talaga siya siya din mismo nag sabi na mahirap talaga makapag coordinate talaga as much as possible if ok lang sa inyo na

gawing grage 10 talaga

Sir Rey: Actually meron kaming subject na PMS pero nasa senior highschool nasa grade 11 so mas tutuosin mas pasok yun doon pero mas highly skilled kasi yung grade 10 namin kasi elective lang PMS sa senior high so I suggest ok na yung grade 10 ako na lang yung coordinate niyo ako nang bahala doon kung sa kali. Last question in terms of content alam niyo naman yung step by step ng change oil step by step ng spark plug

PJ: Sir so meron po ba kayong module or makakatulong po sa amin sa PMS

Sir Rey: try kong mabigay yung module handout naming pero sana gawin niyo siyang as reference namin

Ronnel: strictly more on plagiarism kasi madami na pong nadadali talaga when it comes to plagiarism if ok lang po pa send na lang po through our email

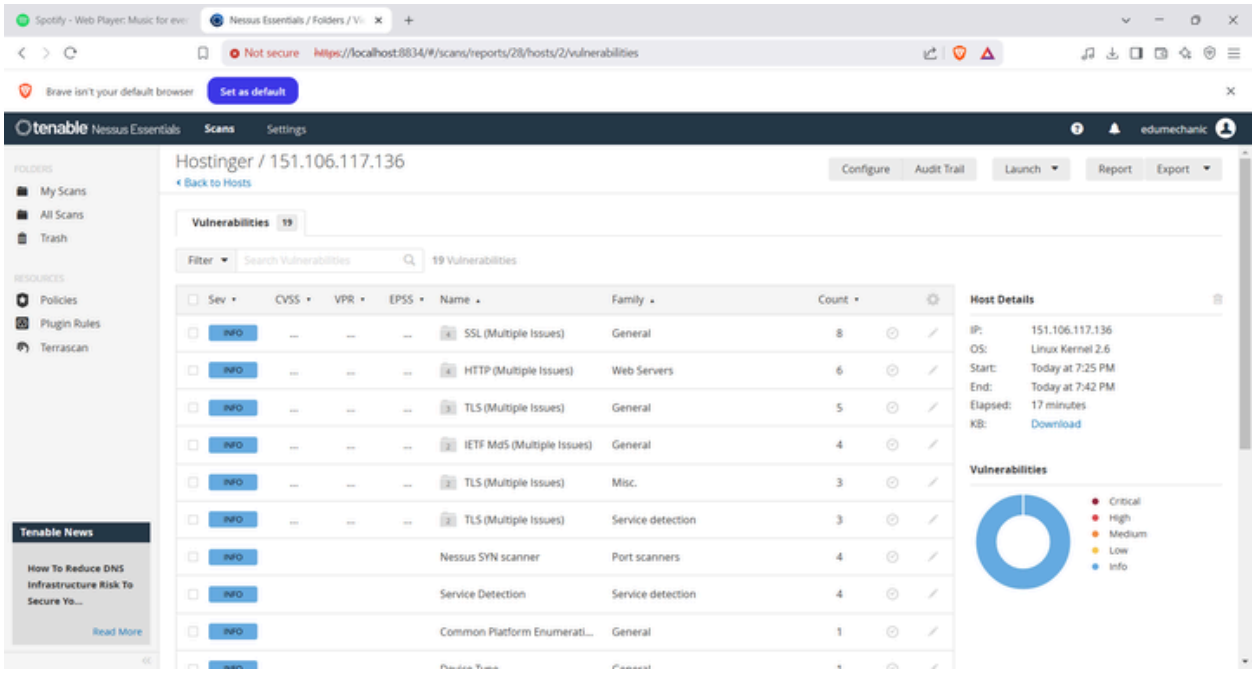
Sir Rey: I try kong hanapin kasi matagal ko nang hindi na kikita namin

Ronnel: pero sir yung sinned naming na email waiting link kahit doon na lang po kayo mag reply

Sir Rey: if ever ba magkakaroon tayo ng meeting or kapag na develop na yung system Ninyo

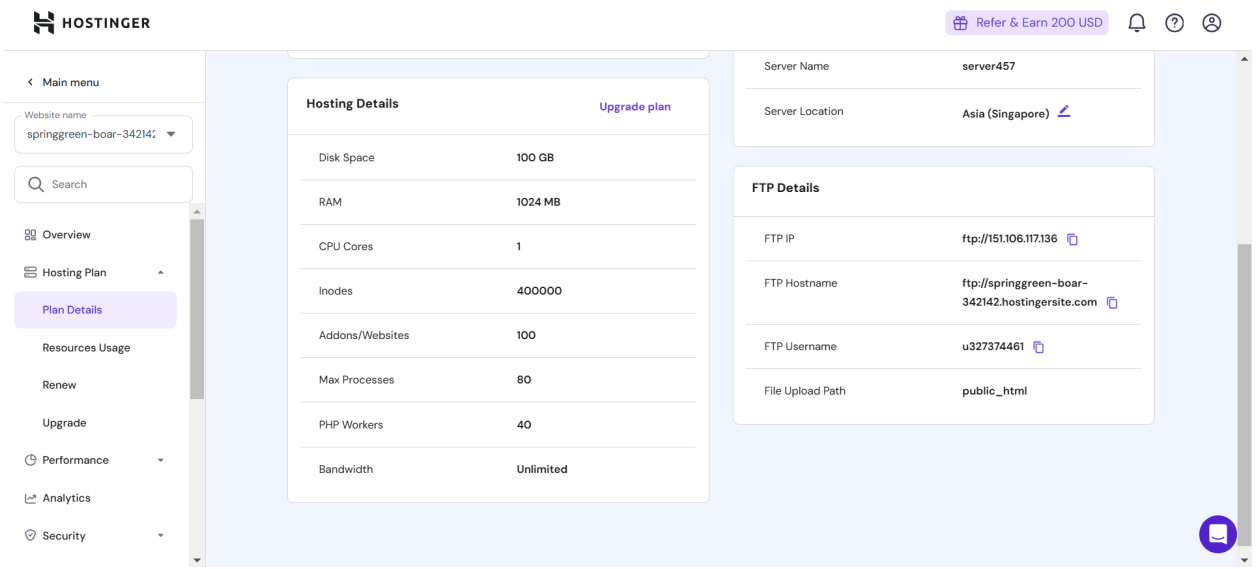
Ronnel: kapag meron na lang po kaming questions po sir kasi gets naman po sir na busy kayo at kayo naman po yung head mag email na lang po kami kung may questions or clarifications depende po talaga sir.

Appendix G - Nessus Basic Network Scan Results

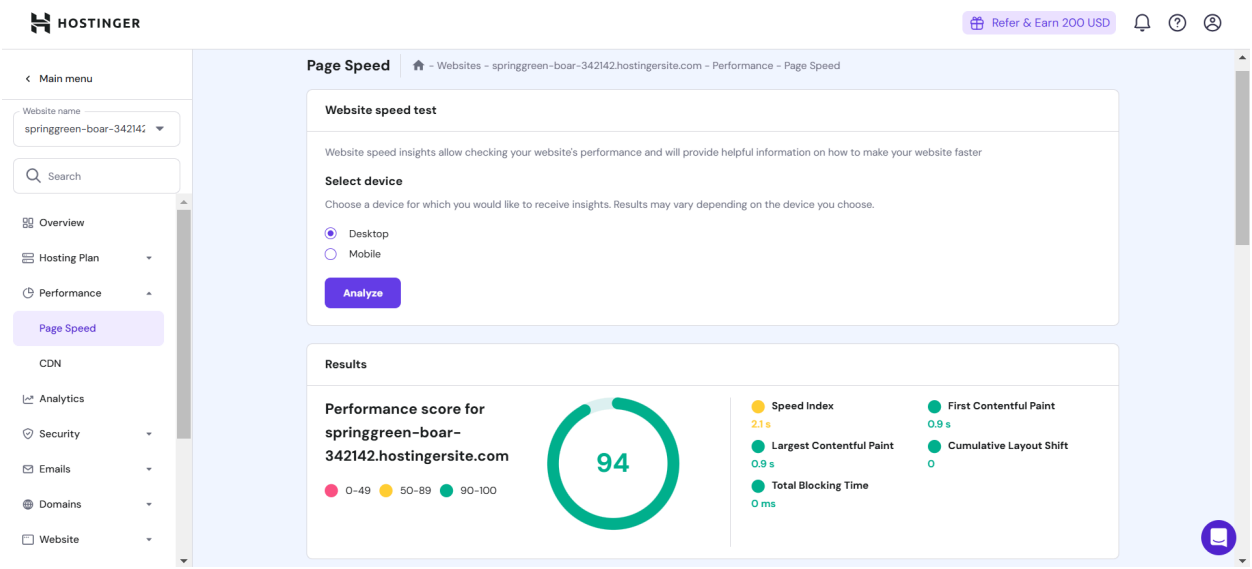


Appendix H - Hostinger Web Hosting

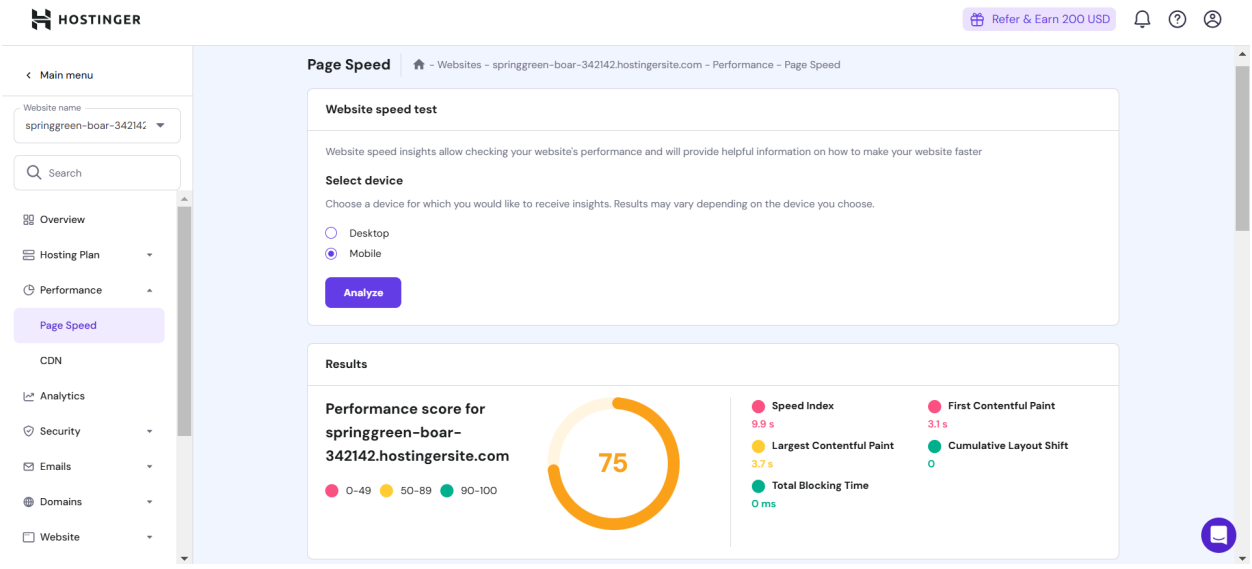
Hosting Details



Desktop Performance Results



Mobile Performance Results



Malware Scanner