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THE DEVELOPMENT OF CONSTRUCTIVIST SIMULATION LEARNING ENVIRONMENT MODEL TO ENHANCE DECISION-MAKING FOR THE INDUSTRIAL ELECTRICAL TECHNOLOGY STUDENTS

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Abstract.

The purpose of this research is to design and develop an environmental model of learning and simulation based on constructivist decision making. For students in Industrial Electrical Technology the target group used in this research is 1) Undergraduate students Department of Industrial Electrical technology, 20 people 2) Model designer 1 person 3) Model developer 1 person 4) Instructor in electrical machinery course the study model used in this research is phase 3 model research. The use of the model uses multiple studies, including survey research and case studies using pre-experimental research. That has been tested before and after studying. The results show that the process using the model there is a group of learners. The most suitable from the context study in phase 1 is 3 people per group. The method of using model consists of importing into lessons. It encourages learners to ask questions about events and explain demonstrations for factors that promote successful use of the model. The model developer who taught with the successful results of using the model found that 1) decision making, learners have the ability to make decisions. Which is consistent with the decision framework of Fred C. Lunenburg (2010) and Plunkett & Attner & Allen (1994). 2) The student's learning achievement between before and after learning showed that the student's achievement with the model Environment 3) The students' opinions showed that the content was very good, media and simulation were very good, and the design of the model was very good, indicating that the environmental model States Created to be suitable and responsive to learning management that promotes decision making and problem solving

Keywords : Decision-Making, Simulation learning environment, Constructivist

Introduction

From the past to the present, there has been a continuous change in technology, economy, and society by using knowledge as the driving force. Both within the country and outside the country in each era, knowledge has been created and knowledge is created in order to transfer and create innovations that will benefit and create knowledge and ability to drive the quality of life, society, economy that is changing. go by era from the change of development to the knowledge-based society, it has affected many countries in the world. Especially developing countries, which now take a lot of effort to adapt which must face various problems All-round due to social changes and complex problems what is needed is to develop a person with analytical thinking style, critical thinking, decision making, reasoning, etc. Therefore, it is necessary to find a way to make decision-making strategies that are necessary in daily life. In each day, humans face problems that must be decided all the time. Whether choosing clothes Shoes to wear, travel, etc., therefore need to study concrete guidelines for making decisions. That is a decision making with a formulation of methods Decision making process from the first step to the last step by finding the cause of the problem Information provision make choices and choose the best one by comparing. Analyze the data and use it systematically and reflect the results of the chosen options by using scientific methods as tools to help draw conclusions for making decisions there are many forms of decision making. Depending on the opinions of scholars Alan Plunkate and Atner (2013).

The educational model that focuses on the development of the existing people, the current social conditions, therefore need to increase the potential of learning. In order to use the knowledge gained to create and develop, apply innovations to create knowledge that will benefit the public The idea appeared in the office of the National Education Commission that said Thai society should develop into a knowledge society. and using that wisdom Students should be encouraged to be self-created. as shown in Learning skills in the 21st century are learning skills that will result in changes in learning management so that learners in this 21st century have knowledge, ability, critical thinking, decision making, thinking. critical and necessary skills which is in accordance with the constructivist theory that encourages learners to create their own learning and learning comes from the learners create knowledge by connecting the old experience with the new experience and paradigm shift on how to create knowledge through thought processes that helps promote learning focus on students to build knowledge by taking actions through their own thinking processes. by linking previous knowledge with new knowledge and expanding the intellectual structure by organizing a learning environment that promotes the process of creating student knowledge by combining both principles theory and characteristics of consistent technology media. (Sumalee Chaijaroen, 2016)

Therefore, Teaching and Learning has changed the paradigm to "Learning" by focusing on the learner as the center or the center. which the educational management process must encourage students to develop naturally and full potential Focusing on the development and promotion of learners to build knowledge by using information technology to respond to lifelong learning (Sumalee Chaijaroen, 2016) in accordance with the act National Education B.E. 2553 (No. 3), which states that education must be based on the principle that all learners are able to learn and develop themselves, and it is considered that students have most important Which in teaching or vocational or industry, such as electrical, mechanical, civil, electronic controlling various systems there is a risk of mistakes causing danger and damage to the person. Various property as well as teaching and learning in industrial electrical technology which focuses on practice or take action connecting a 3-phase electric motor is a complex circuit connection that requires expertise or practice. Have difficult content complicated and if the electric motor is not connected correctly Will cause damage to life and property therefore find methods to solve the said problem by applying decision-making principles to solve problems in which the learners tend to have errors in connecting electric motors, causing danger by applying various rules or techniques both science come to classify the problems and causes, limitations, conditions that will take effect data collection, analysis, data synthesis come in to help the learners make the right decisions and reduce the chance of mistakes and also simulating the situation of connecting electric motors in computer programs for the learners to practice their skills and be aware of various dangers when the circuit is incorrectly connected and does not end the material cost real experimental equipment in which students will be able to think and solve problems from the simulation, resulting in learning and can be used to solve problems in real life which is an advanced thinking process.

With the reasons and importance mentioned above the study is aware of the importance and the need to develop a learning environment based on constructivist learning model that promotes decision making. by using reasoning and rules by using scientific methods as tools for finding conclusions to help solve problems based on the development from the theoretical framework from the relevant theoretical principles and studies of various studies about creating knowledge, making decisions, and designing and developing into a simulation learning environment that focuses on students' learning of course content while developing decision making of learners that emphasize internal processes the findings will lead to the development of the quality of students to be capable of thinking skills, critical analysis and critical thinking to help them make decisions, solve problems and adapt to social conditions in Modern times.

Research Objectives

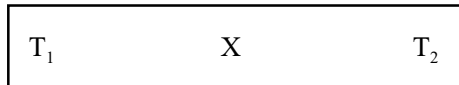
- 1) to study the process of using the environment model to learn about simulation
- 2) to study factors that promote the use of models successfully
- 3) to study the success of using the model by studying the results from.
 - (1) Decision making of students studying with the learning environment, simulation model based on constructivist decision making.
 - (2) Learning achievement of students studying by the learning environment, simulation model based on constructivist decision making.
 - (3) The opinions of students studying with the learning environment model, simulation based on constructivist decision making.

Research Methodology

This research is a phase 3 model research. The use of educational models in this phase is to study how to use the model efficiently. Including the process of using models conditions that promote successful use of the model describing the success or failure of using the model Participants in this phase of the study are designers, developers, assessors, teachers and learners.

1. Target group. 1) Undergraduate students Industrial Electrical Technology Rajabhat University, the lower northern region consists of Nakhon Sawan Rajabhat University, consisting of 8 students and Phetchabun Rajabhat University, consisting of 12 people. The second semester of the academic year 2019, the subjects enrolled in mechanical / electrical / mechanical control and electrical motor control / control. or related subjects to learn about the simulation learning environment. 2) 1 person model designer for surveying the characteristics of model designers. 3) 1 person model developer for surveying the characteristics of model developers. 4) Instructors in the subject: Electrical machinery / Electrical machinery / Electric motor control or related 1 person for surveying teacher qualifications.

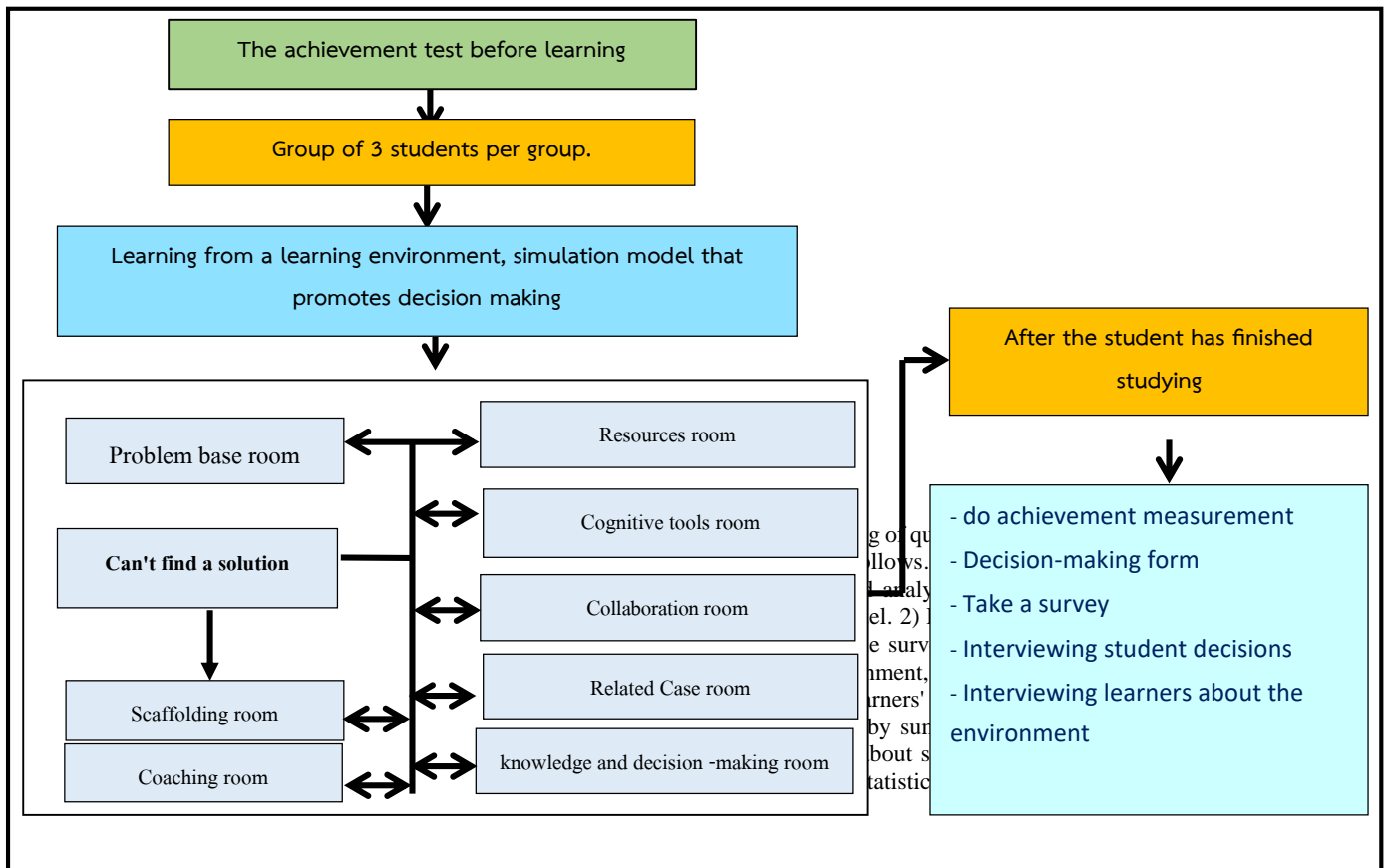
2. Research format in the Phase 3 study which uses the model the study uses various research methods, including survey research and case studies using pre-experimental research. by using a single experimental group That has testing before and after studying which can be written as a chart as follows.



When T_1 instead of testing before teaching and learning.
 X instead of learning with the simulation learning environment.
 T_2 instead of testing after teaching and learning.

3. The tools used to collect data are the decision making test. Interview form for learners about decisions achievement test before and after learning survey of opinions of learners studying with the learning environment model.

4. Data collection is 1) Have students complete the achievement test before learning about the 3-phase electric motor connection and decision-making test. 2) Divide the group of students into 3 groups, most suitable. Received from the study context of the teaching and learning phase 1, consisting of people who are talented, moderately, weak. 3) To clarify and recommend learners about learning methods with the model. And allowing learners to learn with the simulation environment and do the mission of promoting decision making by studying from various components such as (1) Problem base room (2) Resources room (3) Cognitive tools room (4) Collaboration room (5) Related Case room (6) knowledge and decision making room (7) Scaffolding room (8) Coaching room 4) Learners learn by model summarize the lesson together between the instructor and the student at the end of the hour. 5) Have the students to do a test to measure the achievement on the connection of 3-phase electric motor, decision-making test. Interview form for learners about decisions survey of opinions of learners studying with the learning environment model.



(S.D.), percentage of learners before and after learning from the tests. Regarding the connecting of 3 phase electric motor that the student has created, with 80.00% of the students having to pass the score criteria at 70.00% of the full score.

Related literature

1. context.

Electrical Technology course which aims to produce graduates with relationships in line with the national higher education development plan and international academic and professional standards And to promote the production process of graduates that emphasize on the development of learners to have complete human characteristics able to maintain themselves in a multi-cultural society under globalization That has borderless communication have the potential for lifelong learning have the ability to perform duties in accordance with the established standards and ethics framework able to create works that are beneficial to oneself and society both at the local and international level.

Scope of content the 3-phase electric motor connection consists of 6 topics which are 1) Meaning of motor and operation of 3-phase electric motor 2) Types of 3-phase electric motors 3) Concep connecting to 3-phase electric motors 4) Circuits and symbols connecting 3-phase electric motor circuits 5) Materials and equipment used for installing 3-phase electric motors 6) Connecting 3-phase electric motors in this 3-phase electric motor connection course, which is complex and important to technology students. The electricity industry is huge in which the learners must develop and develop the knowledge, understanding, and basic skills related to electric motor connection to be able to put into practice in both education and careers.

2. Learning psychology.

Learning Psychology is learning and teaching to help strengthen the learners to learn effectively. by relying on the theories, theories, principles relating to learning management that have been learned from the past to the present that have been accumulated which has organized activities to design teaching and learning in various ways, the use of technology media using innovation come to help the student in an intellectual way in order to be able to develop students' knowledge and ability and encourage learners to develop thinking processes gathering analysis data which can lead to decision making processes in the context of a real-life learning environment for the learners to learn vigorously and creating new knowledge and is the creation of meaningful learning by the students consisting of 1) Lev Vygotsky's Social Constructivism Theory focuses on the development of learners in organized social studies. by using media the right technology is used and bridging more than just learning alone. Social interaction by creating ideas about the potential for cognitive development that may be limited to a range of development called the Zone of Proximal Development. If the student is below the Zone of Proximal Development or below the specified criteria need to be helped in learning is called Scaffolding (help base). 2) Cognitive Theory is interested in an internal process called cognition or cognition of humans by believing that understanding learning can explain what is understood If we can understand the internal process which is an intermediary between stimuli and responses and is something that will help to deepen the teaching design until can penetrate deep into the brain's processes cognitive process and have the concept of learning that is acquired or organization or new category of the cognitive structure through the process of data processing and data retention.

3. learning environment.

Learning environment it is a teaching design that must create real situations or situations for students. and learning is measured by providing opportunities allowing students to interact with various sources of knowledge a variety of methods by students are actively involved (Active) in the learning process. and new trends in learning theory and knowledge creation which is more important for learning than teaching, that is the constructive learning environment meaning environment or location that focuses on creating learning consists of learners the classroom or the area where the student has taken action and the design of learning management that responds to methods that is student-centered, designed in an environment that focuses on students to take action in creating learning that is coordinated between the "media" and "methods", which are based on the learning environment that is used as the basis, this includes Educational environments in the constructivist group include the Open Learning Environments model (OLE), The Constructivist Learning Environments model (CLE), The Situated Learning Environments model (SLE), The Designing Instruction for Constructivist Learning Model (SOI) and Cognitive apprenticeship.

4. Multimedia and media contract systems and simulation.

Multimedia media and media contract systems tend to have information and information structures in the form of hyper media, which include text, images, sounds, animation. Hypertext and Hyper link, which are a form of data access methods That is the linkage of knowledge from various sources known as hyperlinks to support the learners to learn effectively facilitates the expansion of the thinking process of students (Sumalee Chaijaroen, 2008) and encourages learners to interact with teachers and other students. Presentation of lessons in a multi-dimensional media allowing students to link to other related multimedia formats Students can search information everywhere students are able to access the media from anywhere around the world anytime, anywhere. From the above characteristics the researcher then designed the learning environment. to use the salient features of multimedia symbol systems, including still images, animations and sounds, or textbooks to help students to be able to learn effectively and facilitates the expansion of students' thoughts as well as facilitating the exchange of knowledge between each other to adjust ideas or ways to make decisions between students and others.

Simulation is a collection of various methods. That is used to simulate real situations or behavior of various systems to help study the flow of activities in various forms by collecting data and analyze the correct patterns for future improvements because in the actual operation, it is not possible to experiment or change the work process until it sees the benefits therefore, simulation helps to analyze the current condition of the system. and help to find a way or an appropriate scenario before applying to the situation or the actual operation this will help reduce the risk of errors. or failure It also helps to save both costs. and time can be another way as well.

5. Decision making.

Decisions are a process of seeking alternatives that are made up of many options, and able to choose the most feasible and most useful choice in general, decisions must be based on principles and rationales, attitudes and judgments, instincts. Decisions are also methods that can lead to solutions to achieving goals. Decisions are not a goal in their own way, but rather a guideline or a tool for success. The decision must start with a search for various methods and practices, as well as able to proceed step by step from then, determine the guidelines or methods. The most suitable in today's education it is necessary to have important skills that are critical, analytical, synthetic and able to make quick decisions. In this skill, the learner must learn build understanding and practice techniques for making correct and appropriate decisions as well to enable the student to adjust to a constantly changing environment.

Research results.

Phase 3 model research. Using the model, it is found that the model use process the grouping of 3 students per group is most appropriate from the context study, and how to use the model consisting of input into the lesson it encourages learners to be ready and pay attention to what they are learning, such as linking their previous knowledge with new knowledge by using questions, telling the events that occur in relation to motor operation. Preparation for learners to learn and explain electric motor demonstration, and to learn by simulating the learning environment and sharing the knowledge summary for the factors that promote the use of models successfully, it is found that the characteristics of the learning model designers is knowledgeable and capable have experience in design there are educational qualifications about teaching design, or have experience managing teaching and learning to be able to analyze synthesize and connect the principles, theories and methods in the design to be consistent. Learning model developers have experience in the development of innovations or learning environment models or making learning materials have a basic understanding of the content design basics using computer programs, teachers have knowledge, expertise, and expertise in the content they teach. Since the instructor needs to stimulate the content so the learners are ready and pay attention to what they are learning by linking previous knowledge with new knowledge by using questions and telling stories of events related to the importance and operation of the motor. Preparing students to learn by explaining demonstrations about the subject to be studied, and learner characteristics have electrical knowledge basic electric motor connection fundamentals of using information technology in communication. The successful results of using the model are as follows:

1) The decision making from interviewing the decision of the learners learning by the environmental model, by analyzing the protocols, it is found that the learners have 6 steps of decision making which are consistent with the decision framework of Fred C. Lunenburg (2010) and Plunkett & Attner & Allen (1994).

Step 1 Define the problem or opportunity. Found that 1) Students are able to distinguish and distinguish between what is the problem and the cause of the motor connection problem. From the situation of connecting a 3-phase electric motor, namely the water pump stops working, the cause of the problem is that the electric wire has melted. 2) The learner can specify what is not the problem and the cause of the problem of the motor connection from the 3-phase electric motor connection situation, namely the circuit breaker, and the cause of the circuit breaker to work when the current flows too much. To protect the equipment and electric motor. 3) Students can specify the gap of the problem, which is the current condition of the connection of the electric motor. From the situation of connecting 3-phase electric motor to what characteristics it is, the water pump stops working, which makes it impossible to inject, clean, and stop other operation systems. 5) Students are able to summarize the problems or determine the problems that occur correctly is the direct connection of the motor resulting in a high start time resulting in the power cable being used to dissolve.

Step 2 Identifying limiting. Found that 1) the learners have the ability to consider the limitations and requirements used to solve problems in connecting the electric motor, namely, budget, materials, equipment, working area, duration, personnel, how to connect the motor. action plan 2) Students are able to explain conditions that cannot be changed: budget, how to connect motor circuits areas of use. 3) Students are able to explain conditions that can be changed, namely methods, procedures, responsibilities, materials, equipment.

Step 3 Generating alternatives. Found that 1) students have clearly specified their goals in order to be able to find suitable methods to achieve the specified goals, including efficient control systems for the water pump motor, and the water pump system working normally. 2) The learners can tell how to proceed Solving problems to achieve the set goals, including planning, determining steps method for solving the problem designate the worker valuation 3) Students have the means to search for necessary information for solving 3-phase electric motor connection problems in various ways. That will help to solve the problem, including searching from Google Internet, Youtube, Books, Questions, knowledgeable people who have experience.

Step 4 Evaluating alternatives and Analyze the alternatives. found that 1) The learners were able to tell the method of choice that has the possibility to solve the problem in the situation which is directly connecting the motor by using the contactor. 2) The student can compare the advantages and waste of the impact that occurs by analysis Ponder options comparison of the benefits and disadvantages of each of the selected options, which are the impact on electrical systems, budget, personnel, equipment maintenance. Consider the options that are suitable for the factors that are specified in step 2, which is to connect the motor directly by using the magnetic contactor, 4) the learners are able to consider and analyze whether the selected options have what are the impacts, such as budgets, Electrical systems, personnel, Materials, Equipment, Maintenance.

Step 5 Implement the decision. Found that 1) The learners can choose the method of connecting the 3-phase electric motor which is considered from the suitability, specifications, comparison of advantages. The disadvantage and the impact of that choice is the direct motor connection using the magnetic contactor. 2) The learner has a plan The working procedure for solving the problems of connecting the 3-phase electric motor is the meeting of the procurement of materials and equipment dismantling process, and reinstalling the system testing.

Step 6 Establish a control and evaluation system. Found that 1) The learners have created methods to reflect the performance. Appropriately, there is a recording of the work process, reporting the results of the evaluation. 2) The student can analyze the work that has been done to what should be improved, which is the budget, the process. Work, duration, materials, equipment, and personnel. 3) Students will learn how to solve problems in the event that the performance results do not meet the target. by going back and looking at the wrong decision in order to get the results of the 3 phase motor connection as the goal is to review the new plan. find defects in each section find a new way Study the solution to cover all parts. Working process.

and the score of the students' decision making scores from the decision making learning through the environment The average score of the decision is 76.95 points from the full score of 105 points, equivalent to 73.28 percent, is at a good level.

2) The achievement of 20 learners before and after studying found that the mean score before school was 11.00 (SD = 3.15), equivalent to 44.00 percent and the average score after studying was 20.20 (SD = 2.84), Representing 80.80% and 80.00% of the qualified students, 70.00% of the full score, 85.00% of all students and when testing the difference of the average learning achievement, it was found that the student achievement with the environmental model After studying, it was higher than before learning at the statistical significance level of .05.

3) The opinions of learners using the simulation learning environment model found that the content is averaged at 4.67 and the standard deviation is 0.08, very good level in media and simulation have value. The average is 4.73 and the standard deviation is 0.09, the level is very good and the design of the model has the average value of 4.68 and the standard deviation is at 0.08 level is very good, indicating that the environmental model created to be suitable and responsive to learning management that promotes decision making and problem solving.

Summary and discussion

Decision making results of learners learning by the learning environment, simulation model based on constructivist decision making by analyzing the protocol from interview results found that the environmental model design, learning, simulation, which uses the theoretical principles to design and build as a model by passing the quality search through expert evaluation, including measurement, content evaluation, media and simulation in terms of design That is consistent with the principles theories and decision-making processes and solutions applied from Fred C. Lunenburg (2010) and Plunkett & Attner & Allen (1994). Step 1 Define the problem or opportunity. Step 2 Identifying limiting. Step 3 Generating alternatives. Step 4 Evaluating alternatives and Analyze the alternatives. Step 5 Implement the decision. Step 6 Establish a control and evaluation system. as well as in the learning mission, students are able to take action, make decisions, and solve problems from situations of connecting 3-phase electric motors with the form of steps. Development and learning management to promote decision making

The results of learning achievement of learners learning by learning environment, simulation based on constructivist decision making in which the learners have achieved through the specified criteria. Show that the learning environment model affect the learning of students allowing learners to have academic achievement that meets the specified criteria in which the learners have a higher mean after studying than before there are 80.00 percent of the total number of qualified students, 70.00 percent of the full score, representing 85.00 percent of all students. and when testing the difference of the average learning achievement, it was found that the student achievement with the environmental model after studying, it was higher than before learning at the statistical significance level of .05.

The results of the study of the opinions of the students on the learning by the learning environment, the simulation based on constructivist decision making on the content aspect, it was found that the content aspect had an average value. At 4.67 and the standard deviation of 0.08 shows that the content is theoretically consistent learning scope principles there is gradually sorting from the ease of content. Enter the difficulty of the content in order for students to understand. Content is appropriate not too complicated modern and up to date the content and illustrations are consistent and help promote good learning. Can be used. 2) Media and simulation: It was found that media and simulation with an average of 4.73 and a standard deviation of 0.09, indicating that the design of a navigator with a structure helps to search for information more easily and appropriately based on the characteristics of media and media technology as well as linking knowledge can stimulate learning including searching and researching information as needed and have simulation in computer program to help students to master the skills of connecting electric motors and avoiding danger to learners. 3) In the learning model design, it was found that the model design had an average value of 4.68 and the standard deviation of 0.08, indicating that the environmental model design able to enable learners to learn by having 8 components consisting of (1) Problem base room the problem is a real context. Allows students to seek knowledge by practicality. And encourages learners to create their own knowledge. (2) Resources room there is information design that shows the relationship and is consistent with the content in the form of charts, mind maps. to help create cognitive processes easy for students to understand and facilitate the search for solutions to problems (3) Cognitive tools room (3.1) Seeking tool, which will support learners to search for relevant information using search engines such as Google. (3.2) Collecting tool provides e-books and computer lessons to download for further study. (3.3) Organizing tool helps learners group related information into categories, linking top ideas of related information (3.4) Integrating tool. There is a fusion between related information and knowledge recorded in the blog (Idea Box) (3.5) Communication tool. communicate discuss and exchange ideas among students and teachers using Facebook, Line, Google Meet. (4) Collaboration room. There is support for collaborative learning. and working as a group there is support for the exchange of experiences. Between students, teachers, experts, and opinions and solve problems together through networks such as Facebook, Line, Google Meet, students can expand their perspective of learning. (5) Related Case room. There are support similar situations for students to study. by bringing relevant experiences and problems in a variety of contexts in which students can relate or share experiences to solve problems. (6) knowledge and decision making room It promotes knowledge and decision making by providing education to enable students to be able to make decisions and solve problems. (7) Scaffolding room. Conceptual Scaffolding. Conceptual help. Which helps students to gain ideas and suggestions or suggestions to help students Metacognitive scaffolding, cognitive aids by supporting the learning management process and help guide the method through

guidance. Procedural scaffolding. process assistance by guiding how to use resources and tools. Strategic scaffolding strategic help by support analytical thinking decisions during learning will focus on the identification and selection of the desired information. (8) Coaching room. There is a design suitable for counseling and advice to students. In order to stimulate the thinking of the students, the coach (Coaching) can communicate and provide information, be directed, suggest hint to the learners to not be inaccurate or be lost.

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