Development of Electrical Circuit and Refrigerant Circuit Kit

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Abstract-**This research aims to develop electrical circuit training and refrigerant circuit for vocational second year students following 2013 in curriculum for the certificate of vocational education. It was made up to be used in teaching course called air conditioning code 2101-2106. So that students have the knowledge, understanding of how to work. Speaking of which, the design will be divided in two parts. The first part is an electrical circuit in the air conditioning system and the second part is a refrigerant system. The students are able to learn the principles of self-conditioning system through a series of electrical circuit training and refrigerant circuit. Research in this piece is divided into two major parts, the first part is to design and build a series of exercises to analyze the topic that will be used to design training accordingtothecourse description and course objectives.The second part is the worksheet that was designed for circuit training and a refrigerant circuit. In evaluating the demonstration set, the sampling students were tested with a test before and after class. At trial training refrigeration and air-conditioned class is Department of Electrical Power, Chu Phae Technical College. Experimental training sample from sampling of 20 people enrolled in the course air conditioning code 2101-2106. For the test, 20 students at the training circuit and refrigerant circuit. Found that students who take training with academic achievement than students who did not use these systems.**

Keyword: Refrigeration, Electrical circuit

I. INTRODUCTION

Education is a cornerstone in the creation of prosperity and resolves various problems in society because education is a process that helps people develops themselves in various aspects of the life span.

To help the students learn, achieve such objectives. Instructors are active in the event of instruction to students. And if instructors know how to choose and to be consistent with the objectives of the course, course description, known for researching new teaching techniques, choice of equipment - materials and media used in teaching so that it will achieve the intended of course.

The vocational education is governed by the Vocational Education Commission (VEC) which is educated and prepared people to work in a trade, in a craft, as a technician also related to a specific trade or occupation. According to,requirements of the labor market, both locally and nationally. A production staff of vocational education can bemeeting the technical requirements of industrial applications. Determine the course of the Industrial Vocational Certificate (Vocational) 2013, major in Electrical Power, to provide air conditioning (course code 2101-2106) is the basis of professional subject with three credits including theory and practice seven hours per week for 18 weeks in one semester.

Media education is an important components and role in making instructional program effectiveness. The media of instruction is counted as a channel that enables communication between instructors and students to perform effectively.

Difficulties in teaching Air conditioning Code of 2101-2106, especially in teaching trial practice often occur due to environmental, operational trial as follows.

- The frustration of the cycle experiments to test the functionality of the device.
- Tools and equipment are often damaged by the trial by the students.
- Media teaching makes no incentive to work.
- The budget for teaching laboratory costs is relatively high.

Problems and experiences made the College assigned the researcher to be responsible for teaching air conditioning code 2101-2106. This makes the researcher realizes the importance and benefits of bringing innovative technologies and education used for development. The learners have the opportunities to work in a team and stimulating the learners can present the idea and stimulating the learners can present the idea and solve the problem. It helps the learners to develop knowledge, skill abilities and lasting experience. The good experimental design will stimulate the features for the learner such as critical thinking, communication, application, and discovery in science, integration data completely, think independent and work in group. [1]

Some experiments emphasized the demonstration principle or some technical training. Some experiments focused on conceptual ideas. [2] Teaching by trail methods was appropriate to students learning to the theory they have learned into practical action for the experience.

The experimental kit is the media that can be used as a teaching aid. The teacher designs the media from experiences outside the classroom for applications in the media to present the learning in the classroom. The design of teaching materials that need to be considered and usage appropriate, and is consistent with the purposes of adoption and the learners can easily understand. The appropriate size for usage and the consistent with modern elements as use and media production [3], [4] should be colourful and attractive and inexpensive. If the teacher makes the media, it will not waste time and investment. [4] Teaching design principle should be follow. [5]

The researchers has been creating a series of training circuits kits and a series of refrigerant circuit kits to solve problems in teaching for trials in the practice and saves time. A series of training circuit kits and a series of refrigerant circuit kits that the researcher has developed and built will be used in the field of air conditioning, major in Electrical Power, code 2101-2106. (Vocational Certificate).

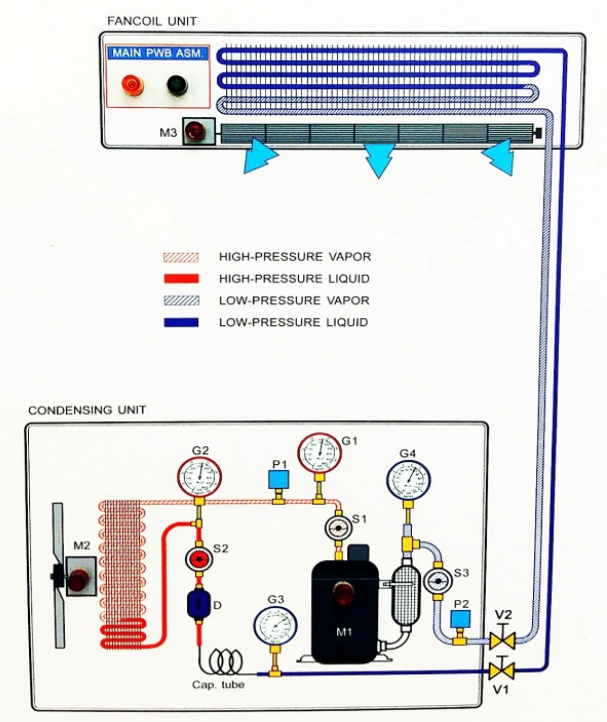

Fig.1. refrigerant circuit.

I. PRACTICAL COMPETENCY

A. refrigerant circuit

The cooling system will work when refrigerant flows within the system. The device makes a liquid flow in the system called compressor which is like a pump that pumps water to flow through the running system. Refrigerant flows into expansion valve will be in a liquid state at high pressure, high temperature. Flow expansion valve will reduce the pressure of the refrigerant. That makes the boiling point of the refrigerant drops.

Refrigerant out of the expansion valve flows into the evaporator as liquid droplets. Refrigerant will boil at a lower temperature of the room,causing heat transfer from the room to refrigerant. The vaporization by boiling at temperature and pressure of the refrigerant is constant. The heat that used to vaporize the boiling is latent heat. The refrigerant from the evaporator will be as the vaporization with low pressure. Low temperatures will be delivered through the tube to compressor. While at the tube, the vapor get heat from the air around it then vapor is heated up but the pressure is still on.

During this heat is called extremely hot. The refrigerant that goes into compressor will be stated at low vapor, low temperature. After that compressor will compressed vapor to volume decreases. Pressure and temperature rise. The temperature of the vapor will be higher than saturated vapor.

The vapor's temperature from the compressor will be higher than the air around it, causing the heat's drain to the air while it was delivered to condenser. The temperature of the vapor drops as saturated vapar'stemperature as but still higher than the air around the condenser.

The vapor that goes into condenser will be high pressure as the saturation temperature but higher than the temperature of the air around the condenser, causing heat transfer from the air around the condenser through a condenser's surface. Vapor condensed into a liquid by the pressure and temperature remains. The heat is transferred to the air called latent heat of condensation. The fluid from the condenser to the liquid state, high temperature, and high pressure will flow into a tank. It consists of refrigerant as a liquid state and refrigerant as vapor state which has not condensed floating on the top. Liquid is released from the tank to deliver through a tube into expansion valve.

On the way to a tube, refrigerant which is a saturate fluid has saturation temperature that higher than the air around the pipe, causing the heat transfer from refrigerant to the air. So refrigerant's temperature will be lower than saturation temperature. Subsequently, the

refrigerant flow will start a new cycle. Including the expansion, vaporization, compression and condensation will circulate indefinitely by the time of the operation.

B. Circuit Air Conditioning

In a part of air conditioner is early use liquid in glass thermometer then apply for using with room thermostat instead. The installer that installs room thermostat has to consider that electrical circuit of each room thermostat before preceding that refrigerant circuit. Speaking of a room thermostat, each product is similar to electricity. Some model is used to control only the temperature. Some model will control all in one including the temperature, fan speed and on-off as Fig 2.

Fig.2.Room thermostat byEcono.

II. PRACTICAL COMPETENCY

A. To Select Content for Experimental

After teaches unit getting eight units. After analysis of the content of the course description, the researchers chose to study the contents of four units as follow.

- Checking equipment in the electrical circuit.
- Demonstration and practical the split-air conditioning.
- Applications of electrical circuit in the split-air conditioner.
- Applications of the split-refrigerant system.

B. Instrument Used in This Study Consisted

- Lesson plans and worksheets for teaching courses called air conditioning (code 2101-2106) with electrical circuit and refrigerant circuit topic.
- Series of circuit kits and series of refrigerant circuit kits
- Achievement Test pre-test - post-test.
- Evaluation form for series of electrical circuit kits and series of refrigerant circuit kits

C. The Samples Used in TheResearch

Students in vocational education (2nd year), Department of Electrical Power, Chum Phae Technical College incourse electrical circuit and refrigerant circuit (code 2101-2106, Semester 1/2016), had 20 students by using simple random sampling.

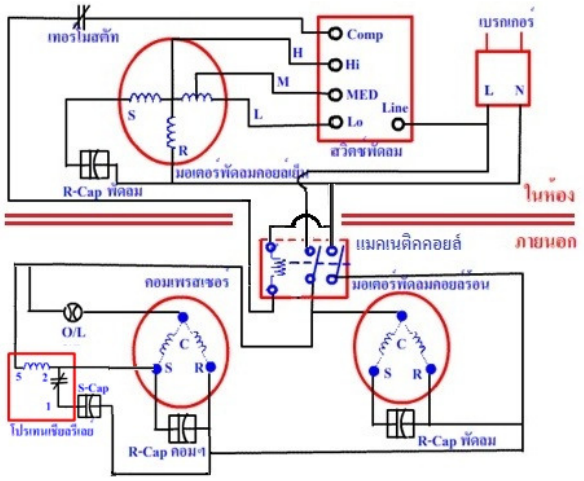

Fig.3.Circuit air conditioning.

III. Results and Discussion

From Fig.3, the proposed set was designed based on analyzed topics in Fig. 1. The proposed experimental set was consisted of voltmeter, circuit breaker, emergencyswitch, control switch, temperature control, thermostat for evaporator, thermostat for heater, defrost timer, overload relay, 3 pole current relay, 4 pole current relay, motor compressor, fan motor, door switch for lamp, door switch for fan motor, heater, and lamp . To serve practical learning in teaching points in table 1, functions of circuit using refrigerator in Fig. 3 was considered. The experimental set must be able to show operation all part of system.

Table 1: Posttest scores

Details	Number of students	Scores	Average	%
Post test for 1st experiment	10	50	44.23	89.06
Post test for 2nd experiment	10	50	39.92	77.84
Total		100	83.45	83.45

Table 2: Learning achievement

Details	Number of students	Scores	Average	%
Learning Achievement test	10	100	84.93	84.93

Table 4: Proposed kit efficiency

Details	Full Score	Average	%
Scores from post test) E1)	100	84.45	84.45
Scores from learning achievement test (E2)	100	84.93	84.93

The statistical analyses for the data from the posttestswere summarized in table 1. From the table, the percentages of score were 83.45% in average. The student learning achievement test was applied to this sample. For the score was shown in table 2. Here, the learning achievement was 84.93%. The proposed experimental kit efficiency was determined by using results of post-test and learning achievement as shown in table 4. The efficiency of the proposed kit was found as 84.45/84.93 that following the hypothesis at 80/80, implying the proposed kit can be used effectively.

IV. CONCLUSIONS

The process to develop a series of circuit kits and series of refrigerant circuit kits for students. Chum Phae Technical College had20 students, that presented as above will be taught in practical. The developed the ability to study air conditioning to achieve knowledge, understanding of learning. It is evident that electrical circuit and refrigerant circuit can be used to study courses air conditioning. As shown the results of the evaluation from samples taken at the above research. And the assumption was consistent that it causes mistake in the test which took place less than one percent.Especially practical occurring often the problem of the environment in the laboratory is devices which are large, expensive and limited. Therefore, the teachers need to prepare a variety of tools, equipment and more. Besides, some teachers may not have expertise in analyzing the material, content, preparing devices or cannot find the proper devices in the experiment. To face problems in buying equipment and providing the right equipment for the content of learning and practicing the skills they need for purpose. It takes longer to prepare or have the time and skills to train students.The achievement of learning's learners is that the teachers are the important persons to manage teaching and learning activities, choosing how to teach, and choosing the media for supporting the goal.

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