

## **Design of Split AC-Based Central Equipment as a Learning Media Tool in Refrigeration and Air Conditioning Engineering Courses**

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**Abstract:** Education is a humanistic process, and its implementation increases students' competence in higher education. The emphasis on increasing competence is explained through the performance of the Kurikulum Merdeka (Independent Curriculum). This research highlights the need for effective learning media, especially in Refrigeration and Air Conditioning Engineering courses, which include an understanding of Air Conditioning Systems (ACS). This course curriculum aims to provide a sense of Air Conditioning (AC), including Central AC. However, a lack of learning media in the laboratory requires cadets to visit the nearest airport for practicum. This research aims to design an innovation in creating central equipment learning media designs based on Split AC. This quantitative research method was conducted, with data collection through observation, literature study, questionnaires, and Likert scale analysis. The author determined the population of the Airport Engineering Technology Study Program cadets at the 3rd Batch of the Politeknik Penerbangan Palembang, totaling 22 cadets. This research uses purposive judgment sampling or sampling with purpose or consideration because cadets are considered to understand the problem to be studied. The questionnaire results showed a high need for learning media development, with a mark of 82.3%. Therefore, developing this learning medium is needed to increase cadets' understanding and competence in refrigeration and air conditioning engineering courses.

**Keywords:** Air Conditioner, Central AC, Learning Media, Split AC

### **A. Introduction**

Education is a process of humanism, which is then known as humanizing humans. The Law on the Education System no. 20 of 2003 states that education is a conscious and planned effort to create an atmosphere of learning and learning so that students actively develop their potential to have religious, spiritual strength, self-control, personality, intelligence, noble morals, and the skills needed by themselves and society. Meanwhile, based on the Big Indonesian Dictionary (KBBI), the word education comes from the word 'didik' and has the suffix 'de' and the suffix 'an', so this word has the meaning of a method, method, or act of guiding. So, it can be defined as teaching as a way of changing ethics and behavior by individuals or socially to

realize independence to mature or mature humans through education, learning, guidance, and coaching (Pristiwanti et al., 2022).

We need to ensure the quality of education, and there is a need to increase competency. Higher education quality requires an accurate description of all its components to assess its realization and planned movements. However, it isn't easy to obtain such an image effectively (Garira, 2020)

Increasing competency is an obligation for every higher education institution. The government has created the Independent Curriculum to provide space for students to enrich their skill levels in all majors. Higher education institutions have competency improvement programs so that they understand theory in class and provide education. Politeknik Penerbangan Palembang is a vocational university with a competency improvement program. Competency is the workability of each individual, which includes several aspects, namely knowledge, skills, and work attitudes by established standards. Competency is a combination of these three aspects that can be observed and applied critically for the success of an organization and the achievements of individuals and groups in the organization. In other words, competency is a combination of mastery of knowledge, skills, values, and attitudes, which will later be reflected in thinking habits and acting in carrying out tasks or work

One of the study programs at the Politeknik Penerbangan Palembang is the Airport Engineering Technology Study Program, where graduates are expected to have competency in Air Conditioning Systems (ACS) through one of the courses in Refrigeration and Air Conditioning Engineering. By adapting the existing curriculum, it is hoped that a simple learning medium will provide an understanding of air conditioning (AC), especially central AC. AC is currently a critical need both in industry and households. AC is a machine made to stabilize the temperature and humidity of the air in a room. This tool is used to cool or heat depending on needs. However, AC is often called air conditioning because it is mainly used to cool rooms (WIDIARTO & KUSUMA, 2022).

Currently, Refrigeration and Air Conditioning Engineering is a course accepted by cadets in the Airport Engineering Technology Study Program, Applied Undergraduate Program, where the curriculum aims to operate and carry out maintenance and repairs on refrigeration machines and their control components. In its implementation, this course has 16 meetings in which there is theory and practice, so a good understanding and a quality learning process that cadets can accept are required. Theoretical knowledge is often conveyed in class. However, obtaining it through real learning media in practical meetings and representing an application as in the original or a prototype would be better. It is hoped that this design will provide

benefits, increase understanding of tools in the Refrigeration and Air Conditioning Engineering course, and increase cadet competency.

This course also provides knowledge about AC. The AC studied in this course are Central AC and Split AC. Central AC is an AC system with a centralized air-cooling process in one location, distributed to all directions or rooms (one outdoor with several indoor). The Central AC system has several main components, namely the cooling unit (chiller), air handling unit (AHU), cooling tower, piping system, air duct system, and electrical control system (Saleh et al., 2022). Understanding Split AC is a type of AC that is widely used by the general public. Usually, we can find this type of AC in offices, schools, and residential areas because Split AC is the most straightforward air conditioning system and is generally used for small-capacity rooms or depending on its use

Be it simple AC such as Split AC or Central AC, often used in airport terminals and offices. With the advantage of being able to reach many rooms, saving time and money, Central AC has several disadvantages, one of which is that it requires a large and flat surface; this is due to the large number of components in making Central AC, which has an enormous indoor area. To better understand Central AC in learning, learning media is needed.

One of the greatest innovations in learning has a big role in improving student competence is a learning media (Umami, 2018). Learning media is a tool that can help the teaching and learning process so that the message's meaning becomes more apparent. The goals of education or learning are the results given to students in the form of an assessment after following the learning process by assessing the cadets' knowledge, attitudes, and skills with changes in behavior. The current problem is the lack of learning media available in the laboratory, so cadets have to visit the nearest airport to the university to observe or do practical work. Even though remembering the practical activities in learning can develop many physical and social skills. This makes it difficult for cadets to understand or carry out practical activities related to these courses. So, researchers find innovations and create designs. Aware of the importance of learning media for the learning process so that it is easier for Cadets to understand the material provided by the lecturers. So, researchers made innovations to develop Central AC learning media on a Split AC basis. To improve cadet learning outcomes with this learning media. This research aims to find out to what extent the Central AC design based on Split AC can provide understanding to the cadets who are taking the Refrigeration and Air Conditioning Engineering course so that the aim

of the curriculum in this course is interpreted as a good achievement and has benefits for cadets when they are in the world of work.

## **B. Methods**

The research method is a scientific way to obtain valid data to find, develop, and prove it in the form of specific knowledge that can be used to understand, solve, and anticipate problems in research (Arifin Zaenal, 2020). Data collection methods are also techniques or methods that researchers can use to collect data. The data collection method is also a method that is independent of data analysis methods or can even be used as the primary tool for data analysis methods and techniques. The data collected in the research will later be used to test hypotheses or answer questions in the problem formulation. They will then be used to make decisions and conclusions (Snowrift et al., 2021).

In research methods, it is also essential to collect populations and samples. According to Prof. Sugiyono, a population is an object or subject with specific qualities and personalities that researchers can apply to study later and draw conclusions. At the same time, the definition of a sample is part of the number and personality that the specified population contains (Sugiyono, 2016). In this research, the author determined the people of the Airport Engineering Technology Study Program cadets at the 3rd Class of the Politeknik Penerbangan Palembang, totaling 22 cadets.

The researcher must concentrate on individuals with the same opinion to obtain the necessary information and be willing to provide it. The sampling design is based on the researcher's assessment of who will supply the best information to succeed in the study's aims (Etikan & Bala, 2017). In this study, purposive judgment sampling was used or sampling with purpose or consideration because the Cadets of the Airport Engineering Technology Study Program at the 3rd Class of the Politeknik Penerbangan Palembang were considered to understand the problems to be studied. Sampling is the technique that helps to select a portion of people from the total population (Reddy & R., 2016). Furthermore, as there are different sampling techniques or methods, the researcher needs to understand the differences to select the proper sampling method for the research (Taherdoost, 2018).

The meaning of purposive or judgment sampling is sampling, which has a strategy where certain people or events can be chosen deliberately to provide important information that cannot be obtained from other choices. The purposive sampling technique is the deliberate choice of a participant due to the qualities of the participant process (Etikan, I., Musa, S.A., Alkassim, 2016). Researchers can include cases or participants in the sample from here because they believe they warrant inclusion. The advantages of this sampling technique are low cost, convenient, not time-consuming, and ideal for exploration. The disadvantage is that it does not allow generalization (Firmansyah & Dede, 2022). The research method used by the author is Research and

Development (R&D) or research and development, which is a method commonly used to obtain specific products and can test the effectiveness of these products (Sugiyono, 2016). Analysis is only done to produce a design, not build and test it.

Appropriate data collection techniques and valid research instruments are essential in producing accurate and reliable data (Ardiansyah et al., 2023). The data collection technique in the research was carried out in three stages. The first stage is to determine the potential and problems by identifying the level of need for making Split AC-based Central AC as a learning media development using observation techniques. Observation techniques are systematic observations and recording of the symptoms to be studied. Observation is a technique researchers use to find out the activities that occur during research by observing directly (Syukri et al., 2019). The observation technique in this research was carried out by following the lessons in the Refrigeration and Air Conditioning Engineering course for Cadets in the Airport Engineering Technology Study Program at the 3rd Class of the Politeknik Penerbangan Palembang. Observation techniques can also be found in field notes, which depend on what has been learned and seen visually by the researcher's eyes.

The second stage is literature study, related to theoretical studies and several references that cannot be separated from scientific literature (Arum & Fahmi Dzikirillah, 2023). In the literature study, the authors also used various written sources such as articles, journals, and documents that were relevant to the research (Fisher et al., 2020). The steps in literature study applied in research are reading and making research notes. Researchers read various kinds of research-related literature, some included in this article. Literature study examines or critically reviews knowledge, ideas, or findings in academic-oriented literature and can formulate theoretical and methodological contributions to specific topics (Pusparani, 2021).

The final stage is to provide a requirements questionnaire to determine whether the product being developed is essential or not. The purpose of giving a questionnaire is to find complete information about a problem (Syarifuddin et al., 2021). Perhaps the most widely used means for assessing survey respondents' attitudes consists of a series of stem statements. Such statements, known as Likert items, are named for Rensis Likert (Willitss et al., 2016). This research was conducted by distributing a questionnaire via Google Forms, with the research category used being a Likert scale consisting of five alternative answers. The Likert scale is widely used in social work research and is commonly constructed with four to seven points. It is usually treated as an interval scale (Wu & Leung, 2017). The Likert scale uses several questions to measure individual behavior by responding to 5 points (Budiaji, 2013). In this study, an interval scale is needed to create distances using the formula:

- a. Index Formula  $\% = \text{total score} / Y \times 100$

They are used to determine intervals or distance ranges and interpret percent to determine the assessment by finding the percent of score interval (I).

b. Interval Formula

$$I = 100 / \text{total score}$$

$$\text{So, } 100 / 5 = 20$$

This is the interval result of the distance from the lowest per 20%. The following tables are criteria for interpreting scores based on interval:

**Table 1. Likert Scale of Design Requirements**

Number	Level Achievement	Qualification
1	81 - 100%	Strongly Agree
2	61 - 80%	Agree
3	41 - 60%	Neither Agree or Disagree
4	21 - 40%	Disagree
5	<20%	Strongly Disagree

**C. Results and Discussion**

The potential problem found in the Refrigeration and Air Conditioning Engineering course at the Airport Engineering Technology Study Program, Politeknik Penerbangan Palembang, is the lack of learning media in this course to support increasing the competency of the cadets. Apart from that, there is a lack of practical equipment in the laboratory as a learning medium. This research is supported by research regarding the development of learning media, cooling techniques, and Air Conditioning (AC). The author then develops his research innovation by designing a Split AC-based Central AC for learning media with the hope that in the future, cadets who carry out practicum activities in related courses will not need to visit the nearest airport from the College.

The first step that the author took in product design was to plan the formulation of the product design, including the components of Central AC and Split AC, how the design works, and related materials to support the research activities. The initial product had no central air conditioning, which could mean a lack of learning media for the Refrigeration and Air Conditioning Engineering courses. The results of the distribution of design requirements questionnaires related to these courses to respondents were as follows:

**Table 2. Results of Respondents' Questionnaires**

Number Question	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
1	17	5	0	0	0
2	6	5	7	2	2
3	6	5	7	2	2

4	5	5	7	3	2
5	6	5	7	2	2
6	6	5	7	2	2
7	17	5	0	0	0
8	15	7	0	0	0
9	12	10	0	0	0
10	12	10	0	0	0
11	14	8	0	0	0

Based on the table above, it contains 11 questions, each of which was filled in by 22 respondents. The results can be seen in questions 1, 7, 8, 9, 10, and 11. Respondents only chose to agree and strongly agree on answers. This means that all respondents have the same perception about these questions. Then, on questions number 2, 3, 4, 5, and 6, each respondent had a different opinion, ranging from strongly agree to disagree strongly.

The following is the data processing that the author carried out to obtain the results of the learning media development needs in this research:

a. T x Pn Formula

**Table 3. Questionnaire Processing**

Result Scale	T x Pn	Result
Strongly Agree	116 x 5	580
Agree	70 x 4	280
Neither Agree or Disagree	35 x 3	105
Disagree	11 x 2	22
Strongly Disagree	10 x 1	10

b. Ideal Score

X = lowest Likert score x number of respondents

$$X = 1 \times 242$$

$$X = 242$$

Y = highest Likert score x number of respondents

$$Y = 5 \times 242$$

$$Y = 1.210$$

c. Completion

From the results above, the total number of results is  $580 + 280 + 105 + 22 + 10 = 997$ .

So,

$$\text{Index formula \%} = \text{total score} / Y \times 100$$

$$\begin{aligned} &= 997 / 1,210 \times 100 \\ &= 82.3\% \end{aligned}$$

So, if included in the score interval, the score is 82.3% in the Strongly Agree category, which means that this design is needed to develop learning media for the Refrigeration and Air Conditioning Engineering course.

#### **D. Conclusion**

The development of learning media for Central AC based on Split AC in the Airport Engineering Technology Study Program at the Politeknik Penerbangan Palembang can be a solution to increase the understanding and competence of cadets in the Refrigeration and Air Conditioning Engineering courses. The basis for this innovative design is the focus on improving competency in higher education, emphasizing the need for practicums and the lack of laboratory equipment. The questionnaire results, with a score of 82.3%, fall into the strongly agree category, which means that the development of this learning media is needed. Most respondents strongly agree with innovation in the action of learning media. Therefore, it is hoped that implementing this learning media can positively contribute to the effectiveness of learning at the Politeknik Penerbangan Palembang, especially in the context of the Refrigeration and Air Conditioning Engineering courses.

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