JMKSP (Jurnal Manajemen, Kepemimpinan, dan Supervisi Pendidikan
Volume 8 (1) 2023, 67-75
E-ISSN 2614-8021, P-ISSN 2548-7094

Development of Learning Media Portable Wind Direction Indicators as Visual Aids for Flight Navigation

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Article History: Received on 2 October 2022, Revised on 17 November 2022
Published on 2 January 2023

Abstract: In this study, we designed a wind direction indicator learning media to help cadets understand how the equipment works. Wind direction indicator is used as a navigation tool for pilots to determine the direction of landing on the airport runway. This research was conducted at the Palembang Civil Aviation Polytechnic with research and development methods. The object of research is the cadets of the airport engineering study program. The results showed that the cadets were very enthusiastic in learning these tools, and increased their knowledge and competence in the field of visual landing aids navigation at airports. With the increase in the competence of cadets, it is hoped that it will support flight safety in Indonesia.

Keywords: Airport, Learning Media, Wind Direction Indicator

A. Introduction

Important infrastructure facilities owned by airports, such as a wind direction indicator or better known as a wind direction indicator is one of the most important infrastructures at airports that is used to indicate the wind direction on an airport runway as a reference for pilots to land their planes safely (Zhang, et al., 2019).

Current wind direction indicators are generally placed near the runway in a condition that cannot be moved and have a source of electricity from the main network. Therefore, the author has the idea to conduct research on the development of a wind direction indicator that is easy to move and has a stand-alone power source. As an educational institution, we develop this in the form of learning media for practical teaching aids for cadets (Supriyadi, 2012). So we developed a portable wind direction indicator with solar power as a learning medium (Abidin, 2015).

Palembang Aviation Polytechnic which is a Technical Implementation Unit of the Transportation Human Resources Development Agency and technically fostered by the Air Transportation Human Resources Development Center is one of the institutions whose job is to produce excellent, professional and ethical workforce output in the field of civil aviation (Soleh, et. al., 2019).

Therefore, the Palembang Aviation Polytechnic needs to develop devices capable of creating innovative communication people. One of the innovative developments at the Palembang Aviation Polytechnic is the availability of learning media for practical activities similar to those at the airport (Soleh, 2022). One of the lessons in the airport engineering technology study program is the material for navigation aids for aircraft landing as a medium for visual landing aids. This tool is used for practical media for cadets in learning how the wind direction indicator works (Ichsan, et al., 2020).

Based on the above, to implement an innovative learning system, it needs to be developed by providing innovative and environmentally sound learning media equipment, using renewable energy, according to current and future technological developments (Yanto, 2019). During the Covid-19 pandemic, various learning methods were carried out to meet the competence of cadets using mixed methods. The mixed method is meant to be a hybrid method, namely when they are given theoretical lessons done remotely using online media. Meanwhile, when they practice, they use the face-to-face method to directly practice on campus (Rifai, et al., 2022).

B. Methods

This research was conducted at the Palembang Aviation Polytechnic using the research and development method according to the stages set by Borg & Gall (Sugiyono, 2017). The object of research is the cadets of the Palembang Aviation Polytechnic airport engineering study program. To determine success in learning, students are given a pretest and posttest. The results of the value data obtained were tested using a sample paired t test (Ghezeljeh, Aliha, Haghani, & Javadi, 2019).

C. Results and Discussion

Before developing a portable wind direction indicator using solar power, the conducted preliminary research on whether or not this tool was needed to be made at the Palembang civil Aviation Polytechnic. The research was conducted on respondents consisting of cadets and lecturers at the Palembang Civil Aviation Polytechnic. The questionnaire was made in the form of a Google document whose link was distributed via WhatsApp groups to lecturers and cadets via Zoom accounts. The nature of this filling is voluntary. From the results of the questionnaire distributed by the author, 91 people filled out the questionnaire consisting of lecturers and cadets at the Palembang civil Aviation Polytechnic with the question 'In your opinion, is a portable wind direction indicator needed as a learning medium?'

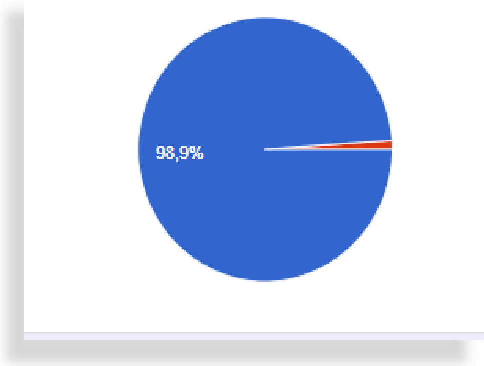

Figure 1. The results of the questionnaire on the need for wind direction indicators

Results Answers from respondents were 90 respondents or 98.9% answered yes and one respondent or 1.1% answered no. We also asked for suggestions and input for the manufacture of portable wind direction indicators. In general, the respondents' answers were support for developing these wind direction indicators. Meanwhile, there were also respondents who asked to be involved in the development of a portable wind direction indicator to provide them with field experience in terms of developing the airport sector.

This shows that by making this tool, both cadets and lecturers really support the development of this tool to increase cadets' understanding of how the tool works. So, proceed to the process of making the tool according to the original plan. The stages of development of portable wind direction indicators that have been implemented are as follows:

Wind direction indicator device design. At this stage we make a form design in accordance with applicable regulations which will be developed according to needs and functions. The regulations that are used as a reference are national regulations, namely the Decree of the Minister of Transportation Number KP 326 of 2019 concerning Manual Of Standards (MOS 139) VOL I Aerodrome) section 5.1.1 (Kemenhub, 2019).

According to these regulations the size of the wind direction indicator is as shown below.

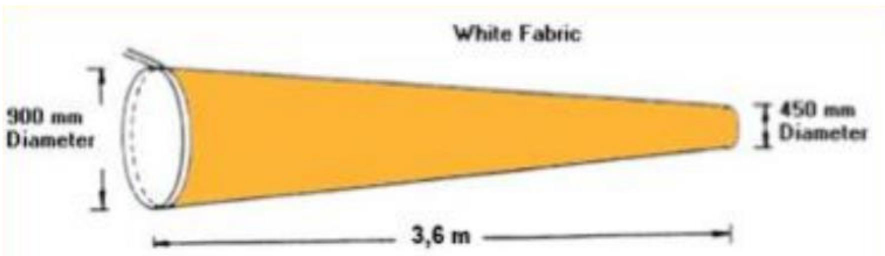

Figure 2. Wind Direction Indicator Size

Likewise, the design of poles and wind direction indicators and other supporting devices is also made. Pictures of portable wind direction indicators can be seen in the following figure.

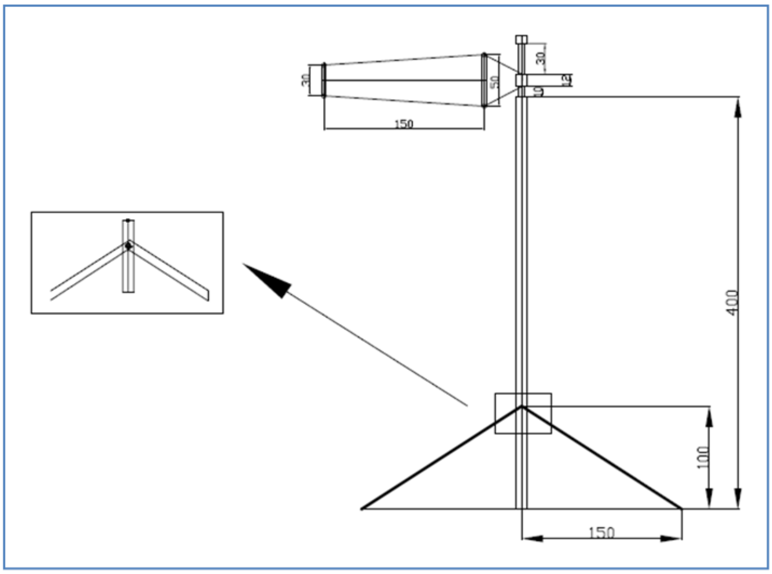

Figure 3. Portable Wind Direction Indicator

The wind direction indicator pole is made of galvanized iron or aluminum pipe with a diameter of 2 inches and a height of 4 (four) meters. The pillar is supported by four angled iron horses. To indicate an obstacle, the pole is painted red with white interspersed.

Validation of wind direction indicators. After the wind direction indicator design is made, the next step is to validate the design. Validators are people who are experts in their respective fields. The design of this electrical circuit was validated by an airport electrician, namely Catra Indra Cahyadi, S.SiT, M.Pd. who is a graduate of airport electrical engineering and also a lecturer at the Palembang Aviation Polytechnic. The validator gave a good score, and was declared to meet scientific and safety standards, so that the design of the wind direction indicator could be continued into the trial phase.

Design Revision, After the validation process by experts, there are several things that are suggested by the validator to be revised in the tool design. So we revised the tool design according to the suggestions given by the validator. In the validation results there were no significant matters, so no revisions were made to the design.

Trial, At this stage we are testing the electrical equipment system that has been made, whether it is running as planned. After being tested, there were no significant matters of concern. Solar panels can charge the battery as seen from the indicator, likewise, the load in the form of a lamp can light up properly. When the battery voltage reaches the upper limit, the battery charging current will automatically be cut off. But if the battery voltage is reduced, the electric current from the solar panels will automatically re-charge the battery.

This tool can be set to turn on a load of lights to turn on automatically when the surrounding environment has no sunlight or it's late at night. Conversely, if there is sunlight in the surrounding environment, the light load will automatically turn off. So that electricity usage becomes efficient.

The settings for the portable wind direction indicator electrical system are regulated by the solar charge controller. In the solar charge controller there is a screen and a menu button that can be accessed using a human machine interface system. Making it easier for users to change or set this tool.

Trial Usage, at this stage it is tested directly according to the desired usage. The trials were carried out as a whole, namely the portable wind direction indicator unit and its electrical system. The first trial was carried out in the yard of the airport laboratory building at the Palembang Aviation Polytechnic. From the test results the wind direction indicator can work well, it can be seen from the wind direction indicator which rotates according to the wind direction. Likewise, the electrical system can work properly, the solar panels can charge the battery through the solar charge controller, and the load lights in the form of obstacle lights can also turn on.

Furthermore, we moved the portable wind direction indicator on top of the airport laboratory building, with the aim of getting a wider space to get more wind. The location of the portable wind direction indicator can be seen in the following figure.

Figure 4. Test of Portable wind direction indicator

During the trial implementation as a learning medium for students, pretest and posttest were carried out with the result values in the table as follows.

Table 1. Participant Scores

No	Pretest	Posttest
1	50	80
2	40	60
3	60	50
4	50	70
5	50	50
6	70	100
7	50	40
8	60	100
9	70	100
10	60	60

Furthermore, from the values contained in table 1, a normality test is carried out using the IBM SPSS application. The results of the normality test can be seen in the following table.

Table 2. Normality Test Results

		Unstandardized Residual
N		10
Normal Parameters[a,b]	Mean	0E-7
	Std. Deviation	17.82483850
Most Extreme Differences	Absolute	.270
	Positive	.152
	Negative	-.270
Kolmogorov-Smirnov Z		.855
Asymp. Sig. (2-tailed)		.458

From the table of the results of the One Sample Kolmogorov-Smirnov normality test in table 1 above, it can be seen that the Asymp value. Sig (2-tailed) is 0.458 more than 0.05. Then according to the basis of the Kolmogorov-Smirnov test above it can be concluded that the data is normally distributed. Then a hypothesis test was carried out to determine whether there was a difference between before and after the training. Before determining the difference, the hypothesis is formulated as follows: Ho = There is no average difference between the results of the training before and after the training, meaning that there is no effect on the training participants if the training is carried out or there is no training. Ha = There is an average difference between the results of the training before and after the training, meaning that there is an influence on the training participants if there is training or no training. Then the next step is to determine whether there is a difference between before training and after training based on the results of the paired sample test in the table generated by SPSS in table 3. Determining whether there are differences or not will be conveyed in the discussion section.

Table 3. t test with SPSS

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Nilai Pretest - Nilai Posttest	-15.000	18.409	5.821	-28.169	-1.831	-2.577	9	.030

When viewed from the statistical description can be seen in table 4 below.

Table 4. Descriptive Statistical Data

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error
Nilai Pretest	10	30	40	70	56,00	3,055	9,661	93,333	,111	,687
Nilai Posttest	10	60	40	100	71,00	7,219	22,828	521,111	,268	,687
Valid N (listwise)	10									

The pretest average score was 56.00 while the post-test average score was 71. Thus, there was a significant increase between before the training and after the training. This means that it can be said that the training succeeded in increasing the knowledge of the trainees (Soleh, 2019).

If seen from table 3, the significant value of Sig.(2-tailed) shows a number of 0.030. Because the guideline for decision making in the paired t test is to look at the SPSS sig. output value (Santoso, 2014) as follows: If Sig.(2-tailed) <0.05 then Ho is rejected and Ha is accepted. If Sig.(2-tailed) > 0.05 then Ho is accepted and Ha is rejected.

The Sig.(2_tailed) value in table 3 is 0.030, which means it is less than 0.05 so that it is in accordance with the first hypothesis, namely Ho is rejected and Ha is accepted. If Ha is accepted, there is an average difference between the results of the training before and after the training, meaning that there is an influence on the training participants if there is training or no training. The influence and difference referred to is the increase in the knowledge and skills of the trainees after attending training on how the wind direction indicator works at the airport held at the Palembang civil Aviation Polytechnic.

The evaluation stage is carried out after all stages from the beginning have been carried out to find out the obstacles encountered when this product was implemented directly to users. From the test results, the product can function according to the purpose of using this tool, namely it can indicate the direction of the wind and the electrical system can illuminate the wind direction indicator and can be seen from a distance of 300 meters. Cadets can also better understand how the wind direction indicator works and the workings of generating electricity from sunlight which is renewable energy.

D. Conclusion

The development of this portable wind direction indicator can be used and implemented as learning media for cadets and for wind direction indicators at airports. This portable wind direction indicator can also be used for wind direction at emergency airports caused by disaster conditions or other emergency airports because it is easy to move.

E. Acknowledgement

We thank to Director and all families of Politeknik Penerbangan Palembang who have supported us to do this project.

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