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# Effect of IOT-Based Climate Smart Agriculture Learning Media on Students in Agro Climate Course

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

Research & Development (R&D) with the Design Science Research Methodology (DSRM) development model approach which aims to (1) Problem Identification and Motivation; (2) Define the Objectives for a Solution; (3) Design and Development; (4) Demonstration; (5) Evaluation; and, (6) Communication. The research locus was at the Gowa Agricultural Development Polytechnic (Polbangtan), Department of Agriculture, D4 Sustainable Agricultural Extension Study Program. Observation, interviews and questionnaires are used in data collection methods to develop climate smart agriculture learning media in Agro climate courses. The data analysis method uses the validity analysis approach, reliability analysis, practicality analysis and effectiveness analysis in the effectiveness analysis using normality and homogeneity tests. The results of the research obtained are (1) in the form of student characteristics, identification of needs and detailed task analysis based on the needs of learning media, to the formulation of problems in the field. This means that what is produced at this stage is also input for the next stage; (2) analysis is carried out by applying

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methods to simplify the series of activities carried out and integrated according to needs; (3) this stage is carried out making design and development plans as a solution to the problem of producing prototypes that contain trainers for learning agricultural agroclimatology. Based on the testing of media experts and material experts, it is suggested that the media developed is very valid and feasible to implement; (4) the results of the calculation of practicality show that the media is very practical and effective for use in learning Agricultural Agroclimatology courses, this is based on the recapitulation of the assessment of the results of the small group trial, it can be calculated the overall assessment results in the form of an average of 4.65 and a large group average of 4.71; (5) based on the results and paired samples correlations, the sig value (probability value) of 0.000 is smaller than the probability of 0.05, then (t) difference in test results between the experimental class and the control class on the Post Test results, due to the significant difference in average scores, can be declared effective in increasing student competence in the course.

*Keywords: DSRM; IoT; climate smart agriculture; learning media; agro climate.*

## 1. INTRODUCTION

The agricultural sector is one of the main drivers in the midst of the economic development of the Indonesian people will face severe challenges due to the risk of climate change. The influence of climate change on the agricultural sector is multidimensional, ranging from resources, agricultural infrastructure, agricultural production systems, food security to the welfare of farmers. This situation, directly and indirectly, will affect most of the agricultural sector in Indonesia, including the world of vocational education in the agricultural sector which has a very complex future challenge in preparing graduates as part of the regeneration of skilled workers in agriculture who play an active role as one of the solutions to the problems faced by the farming community today and in the future to welcome the Golden Indonesia 2045 as the 'world food barn' demanding the availability of superior Indonesian agricultural human resources who are professional, independent, competitive and entrepreneurial through agricultural vocational education which is one of the strengths of agriculture in the future. Especially in preparing agriculture to be more advanced, independent and modern [1,2].

The above thoughts hint at the need to pay serious attention to agriculture through the mastery of information media and technology, for example, developing an IoT-based climate smart agriculture system through the development of the best agricultural resources to support the priority of food security-based agricultural development policies by taking into account the effects of climate change in monitoring weather conditions using adaptation technology that synergizes with mitigation on the use of internet-based digital technology [3]. Therefore, in line with the expectations of the Minister of Agriculture, said that vocational education is currently in a new era. An era where not only teaching skills in an intellectual approach, but also at the same time uniting intellectual systems with orientation management such as the field, and practice, based on the decision of the Minister of Agriculture No.55/Kpts/SM. 220/I/ 07/2021 concerning guidelines for implementing education through recognition of prior learning at vocational higher education institutions within the scope of the Ministry of Agriculture. In Polbangtan Gowa, [4]. Starting from concerns in the world of education as a milestone in nation building, the researchers made direct observations on September 28, 2021 and December 1, 2022 at Polbangtan Gowa, one of the vocational education institutions that uses the teaching farm learning model, it was found that in the practicum learning process there was no IoT-based learning media available in the Agro climate course, Agro climate course has several limitations that have an impact on the learning process, so it is deemed necessary to compile the material into relevant learning resources by including IoT material as a media or device used as a tool to achieve efficient and effective learning objectives in the course.

In some previous studies, including those conducted by Yahya et al., [5] the ability of machines, devices, sensors and people to carry out communication activities via the internet of People (IoP) or IoT. Henceforth, the development of a young monitored android-based monitoring information system will be developed using the Research & Development (R & D) method with the Design Science Research Methodology (DSRM) approach from each stage starting from (1) Problem Identification and Motivation; (2) Define the Objectives for a Solution; (3) Design

and Development; (4 Demonstration; (5) Evaluation; and, (6) Communication that exists primarily in monitoring the measurement of climate/weather elements including air temperature and humidity, soil moisture, rain, and wind speed that can be accessed via the internet with the android-based Climate Smart Agriculture application.

On this occasion, mapping some of the needs in building the infrastructure of IoT-based climate smart agriculture information system applications used to monitor climate elements Jain et al., [6]. The importance of using media in learning, especially the use of IoT-based media, so this research is intended to be an alternative in developing learning media for Climate Smart Agriculture (CSA) based on the Internet of Things (IoT) on Agricultural Climatology teaching materials, especially in learning at Polbangtan. One of the advantages in this development proposal is the application of information and communication technology (ICT), especially IoT. The existence of IoT-based learning media at the Agricultural Development Polytechnic (Polbangtan) as a vocational higher education institution under the guidance of the Agricultural Human Resources Development and Extension Agency (BPPSDMP) is needed in the learning process with a learning concept approach that emphasizes practice through teaching factory or farm teaching and is based on industry needs in agriculture.

One of the four design principles of Industry 4.0. Interconnection is the ability of machines, devices, sensors, and people to connect and communicate with each other through the IoT or internet of People (IoP) [7].

Research conducted Permana, [8] in the development of IoT (Internet of Things) based microcontroller system learning media with the "Worthy" category can monitor and control learning media on microcontroller systems. This research can be developed again with various versions, including the development of a young android-based monitoring information system that is monitored henceforth is a goal solution that will be developed with the Design Science Research Methodology (DSRM) approach of each existing problem, especially in monitoring the measurement of climate / weather elements including air temperature and humidity, soil moisture, rain, and wind speed which can be accessed from anywhere via the internet with the Climate Smart Agriculture-AWS mobile phone application based on android.

On this occasion, the use IoT-based climate Smart Agriculture media to monitor climate elements including air temperature and humidity, soil moisture, rain, and wind speed whose use helps students in making observations of the climate [9]. This media is the result of the development of the DSRM approach as described earlier,. This research begins by identifying the problems found in the field by analyzing the need for development, data obtained from literature studies related to the concept of practice from various related sources while analyzing the needs of learning media currently in use, for further student interviews and field surveys to produce outputs in the form of learner / student characteristics following the identification of learner needs based on media needs obtained during direct observation to the Gowa Polytechnic campus located at Jl. Malino No.KM. 7, Romang Lompoa, Kec. Bontomarannu, Gowa Regency, South Sulawesi 92171. In the Study Program. Horticultural Plant Cultivation (D-III). And conducted small group and large group testing involving 40 (forty) students.

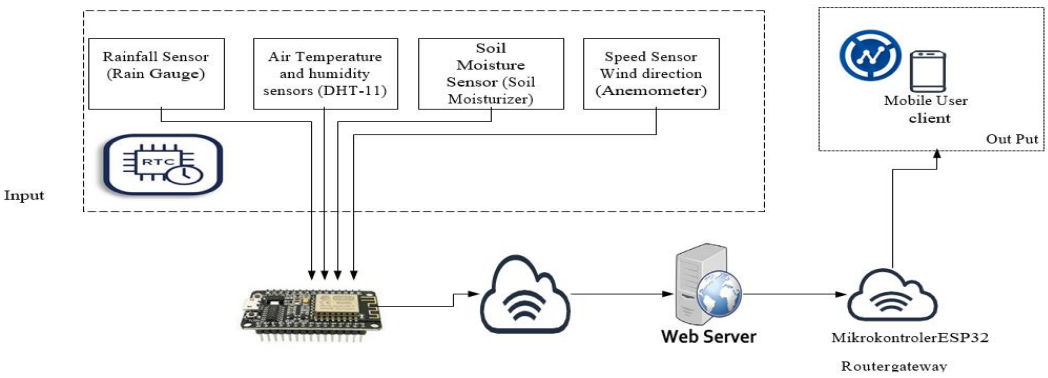


**Fig. 1. Blueprint of climate smart agriculture monitoring information system**

## 2. METHODS

In this study, the development design model used was designed using the Design Science Research Methodology (DSRM) which consists of six syntaxes including Problem Identification and Motivation, Define the Objectives for a Solution, Design and Development, Demonstration, Evaluation, and Communication, but in this case it involves only five stages, which ends at the Evaluation stage. Furthermore, the method was analyzed for each set of activities carried out. The analysis is carried out by applying the method to the simplification of a series of activities integrated according to the needs of the problem identification stage, then data analysis is carried out using the validity analysis approach, reliability analysis, practicality analysis and effectiveness analysis in the effectiveness analysis using normality and homogeneity tests.

## 3. RESULTS AND DISCUSSION

A series of research stages were carried out so that an IoT-based *climate smart agriculture* monitoring media was obtained, showing the results of observations from monitoring in the form of air temperature and humidity values, soil moisture, rainfall, and wind speed for the future.

Based on the recapitulation of the assessment of the small group trial results, it can be calculated the overall assessment results in the form of an average of 4.65. (see Table 1). Based on the results of these calculations, then converted into qualitative data by following the assessment categorization guidelines, it can be seen that based on the assessment of users it is declared practical, of course, with some suggestions and input by respondents who become a reference for improvement, and at the next stage a large group trial was conducted by 40 students of the Gowa Agricultural Development Polytechnic (Polbangtan), Department of Agriculture, D4 Sustainable Agricultural Extension Study Program. Each student gave an assessment of the *trainer* product. The whole item reviewed from several aspects of appearance, material presentation aspects, clarity aspects and aspects of learning benefits.

The results of the assessment by users of *trainer* products obtained an overall average value of 4.71 (see Table 2) meet the criteria very feasible. The results of these calculations are then converted into qualitative data by following the assessment categorization guidelines, it can be seen that based on the assessment of the *trainer* media users in the large group trial it is declared very feasible to use, then from the results of this large group trial no comments or suggestions were found that required improvement or revision. Thus, the effectiveness test of the IoT-based *Climate Smart Agriculture* Media *Trainer was* next carried out to measure the success rate of using the media in improving student learning outcomes where the learning impact analysis was carried out to see the effectiveness of products that had been validated by experts in a learning process, in this learning impact test, effectiveness measurement was carried out by determining the significance of the difference between the average test scores of the control

**Table 1. Recapitulation of responses from 7 large group trial respondents**

| Aspects that Rated | Average Value | |
|---|---|---|
| | Small Group | Category |
| Quality Aspects Material | 4,80 | Very Practical |
| Operation Aspect Media | 4,54 | Very Practical |
| Aspects Learning | 4,61 | Very Practical |
| Overall Average | 4,65 | Very Practical |

*Source: Data Processing Results, 2023*

**Table 2. Recapitulation of responses from 40 respondents of the large group trial**

| Aspects that Rated | Average Value | |
|---|---|---|
| | Large Group | Category |
| Quality Aspects Material | 4,80 | Very Practical |
| Operation Aspect Media | 4,55 | Very Practical |
| Aspects Learning | 4,79 | Very Practical |
| Overall Average | 4,71 | Very Practical |

*Source: Data Processing Results, 2023*

**Table 3. Normality test**

| Tests of Normality Kolmogorov-Smirnov[a] | | | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|---|
| | Class | Statistic | df | Sig. | Statistic | df | Sig. |
| Learner Learning Outcomes | Experiment Pretest | .128 | 40 | .097 | .938 | 40 | .029 |
| | ExperimentPosttest | .134 | 40 | .069 | .934 | 40 | .022 |
| | Control Pretest | .128 | 40 | .097 | .938 | 40 | .029 |
| | Control Posttest | .080 | 40 | .200* | .967 | 40 | .289 |

**. This is a lower bound of the true significance.*

*a. Lilliefors Significance Correction Source: SPSS Data Analysis Results (2023)*

**Table 4. Homogeneity test of learner / student learning outcomes**

| Test of Homogeneity of Variance Levene Statistic | | | Df 1 | df2 | Sig. |
|---|---|---|---|---|---|
| Learner Learning Outcomes (Students) | Based on Mean | .005 | 1 | 78 | .943 |
| | Based on Median | .024 | 1 | 78 | .878 |
| | Based on Median andwith adjusted df | .024 | 1 | 77.900 | .878 |
| | Based on trimmed mean | .008 | 1 | 78 | .927 |

*Source: SPSS Data Analysis Results (2023)*

**Table 5. Paired sample T test results**

| Paired Samples Statistics | | | | | |
|---|---|---|---|---|---|
| | | Mean | N | Std. Deviation | Std. Error Mean |
| Pair 1 | Experiment Posttest | 90.3368 | 40 | 2.89466 | .45769 |
| | Control Posttest | 64.0250 | 40 | 3.08219 | .48734 |

| Paired Samples Correlations | | | | |
|---|---|---|---|---|
| | | N | Correlation | Sig. |
| Pair 1 | Experiment Posttest & Control Posttest | 40 | .386 | .014 |

| Paired Samples Test | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Experiment Posttest - Control Posttest | 26.31175 | 3.31497 | .52414 | 25.25157 | 27.37193 | 50.200 | 39 | .000 |

*a. The denominator used in estimating the effect sizes.*

group that ran as usual (*pre-test*) and (*post-test*) with the experimental group that was given treatment (*pre-test)* and (*post-test*) in each session using the *t-test*. The criterion used is that the *post-test* and *pre-test values are* declared significantly different if the resulting *t-test* value has an *error probability* (p) of 0.000 smaller than 0.05. The results obtained are in accordance with the criteria for a normally distributed category and are effective for use. The following Tables 3, 4, and `5, of the results obtained.

Cohen's d uses the sample standard deviation of the mean difference. Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor. Source: SPSS Data Analysis Results (2023)

## 4. CONCLUSION

Based on the results of the research that has been done, it can be concluded that this media has worked well, namely the results of the calculation of the practicality assessment show that the media is very practical to use in Agro climate course learning as evidenced by the results of the assessment by the trainer media users stated to be very practical to use as well as the results of the effectiveness test show that the use of trainer media is stated to be very practical to use or implement with some input suggestions that were made previously.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES


1. Rokade A, Singh M. Analysis of precise green house management system using machine learning based Internet of Things (IoT) for smart farming. In2021 2nd International Conference on Smart Electronics and Communication (ICOSEC) 2021 Oct 7 (pp. 21-28). IEEE.
2. Ayaz M, Ammad-Uddin M, Sharif Z, Mansour A, Aggoune EH. Internet-of-Things (IoT)-based smart agriculture: Toward making the fields talk. IEEE access. 2019 Aug 1;7:129551-83.
3. Al-Nayyef H. The Climate Smart System with Water Machine Control. Journal La Multiapp. 2023;4(2):2. Available:https://doi.org/10.37899/journallamultiapp.v4i2.845
4. Polbangtan Gowa. Politeknik Pembangunan Pertanian Gowa. Polbangtan Gowa; 2022. Available:https://polbangtan-gowa.ac.id/
5. Yahya M, Wahyudi, Hidayat, A. Implementasi Artificial Intelligence (AI) di Bidang Pendidikan Kejuruan Pada Era Revolusi Industri 4.0. seminar nasional dies natalis. 2023;62(1):190–199. Available:https://doi.org/10.59562/semnasdies.v1i1.794
6. Jain N, Gutti J, Cr N, MDSS, GDP, TC. Manjunath D. Development of a Smart Agriculture Robot using IOT. International Journal of Engineering Technology and Management Sciences. 2023;7(4):25–29. Available:https://doi.org/10.46647/ijetms.2023.v07i04.006
7. Yahya M. Era Industri 4.0: Tantangan dan Peluang Perkembangan Pendidikan Kejuruan Indonesia; 2018. [Other]. eprint.unm.ac.id. Available:http://eprints.unm.ac.id/6456/
8. Permana RS. Pengembangan media pembelajaran sistem mikrokontroler berbasis internet of things dengan menggunakan wemos di smk pl leonardo klaten [Skripsi, Universitas Negeri Yogyakarta]; 2019. Available:https://eprints.uny.ac.id/64289/
9. Pagare A. IoT Based Smart Agriculture Monitoring System. IJSREM; 2023. Available:https://ijsrem.com/download/iot-based-smart-agriculture-monitoring-system-3/




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