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MAPPING THE UTILIZATION OF AUGMENTED REALITY MEDIA IN VOCATIONAL SCHOOL IN DIY USING K-MEANS

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Abstract

The purpose of this study is to reveal group data on the use of augmented reality media in teaching and learning activities so that it is easier to improve student learning outcomes. Augmented reality media was chosen based on the complexity of the scope of teaching materials consisting of thinking skills and limited practice during the implementation of distance learning. The approach for grouping the use of augmented reality media is through the K-Means algorithm with R software. The sample of this study was 136 students of Building Information and Modeling Design skills competency from 5 State Vocational High Schools spread across districts and cities, DIY Province. The review aspect used as the basis for grouping is the need for alternative media in augmented reality, ease of use, supporting facilities, and speed of understanding the material. The grouping results explain that as many as 80 students can master the material well through augmented reality media, and it is appropriate to use it during distance learning. In comparison, the remaining 56 students still find it difficult. Through the results of this grouping, it can be used to combine other media for students who still find it difficult when participating in distance learning.

Keywords: Learning Augmented Reality, Vocational High School, K-Means

Introduction

When facing the Covid-19 pandemic wave in 2020-2021 (Cheer et al., 2021), teachers and learning activities in almost all provinces in Indonesia implemented a distance learning policy (Wibowo et al., 2022). Distance learning was chosen to reduce the risk of virus transmission due to direct interaction(Munastiwi, 2021).

The Department of Education, Youth, and Sports of the Province of DIY has established several policies to support distance learning, one of which is using alternative media to support learning tailored to each school's needs (Susanto & Mulyaningsih, 2020). In addition, schools can also identify and develop media that are considered the most effective and efficient during teaching and learning activities (Dewi et al., 2018).

The implementation of distance learning is one of the challenges for Vocational High Schools (SMK); this is because Vocational Schools have the characteristics of practical learning that are more dominant than theoretical learning (Ariska et al., 2020). Before the Covid-19 pandemic hit, the proportion of teaching and learning activities for SMK students could be explained as almost 65% were practical activities in(Sitohang et al., 2021). At this level, students must examine phenomena in the industry and then solve the phenomena (creative and innovative) (Arthur et al., 2020; Sutiman et al., 2022). However, this becomes a problem when it has to be done online through distance learning.

One of the alternative media developed to support teaching and learning activities on practical subjects in SMK online is augmented reality (Ermawan & Subari, 2022). Several vocational schools chose the use of augmented reality media based on the complexity of the scope of teaching material to be delivered to students, which for practical subjects requires thinking skills to provide an initial simulation before practical activities are carried out (Hermawan et al., 2022). In addition, most of the devices used to operate augmented students, namely Android smartphones, own reality-based learning media(Majid et al., 2021; Suratno & Nugroho, 2021).

Augmented reality technology is a technology that makes it easy for users to make artificial visualizations of the natural world (Martins et al., 2022) through scans in specific areas through smartphone assistive media (Köhler et al., 2019).Unlike the case with virtual reality technology, which provides an opportunity for users to observe an artificial environment through the media of VR glasses (Panagiotidis, 2021). Augmented reality technology allows students to see virtual 3D objects that have been developed and added to the natural environment (A. Laghari et al., 2021; Mahrous et al., 2021). For example, the use of augmented reality media on wooden easel construction materials, where students do not need to make direct observations in the field during a pandemic (Puspitasari et al., 2021). This media can increase students' understanding and interaction with the scope of material to be studied more deeply through augmented reality media modeling (Beck, 2019).

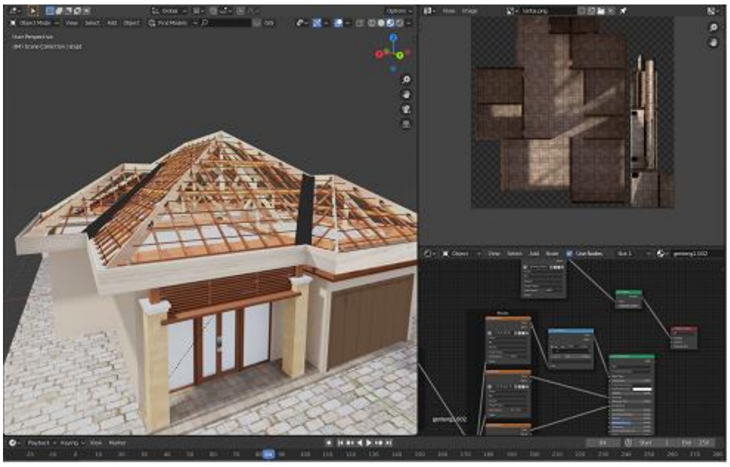

Figure 1. Example of Augmented Reality on Wooden Roof Construction Materials

Augmented reality media can expand the perception of users (students) to better interact with objects to be studied and provide a direct experience of 3D objects displayed (Hamzah et al., 2021; Kounlaxay et al., 2021). This makes it easier for teachers to deliver introductory material to practice as long as distance learning policies are still in effect (Kuleto et al., 2021).

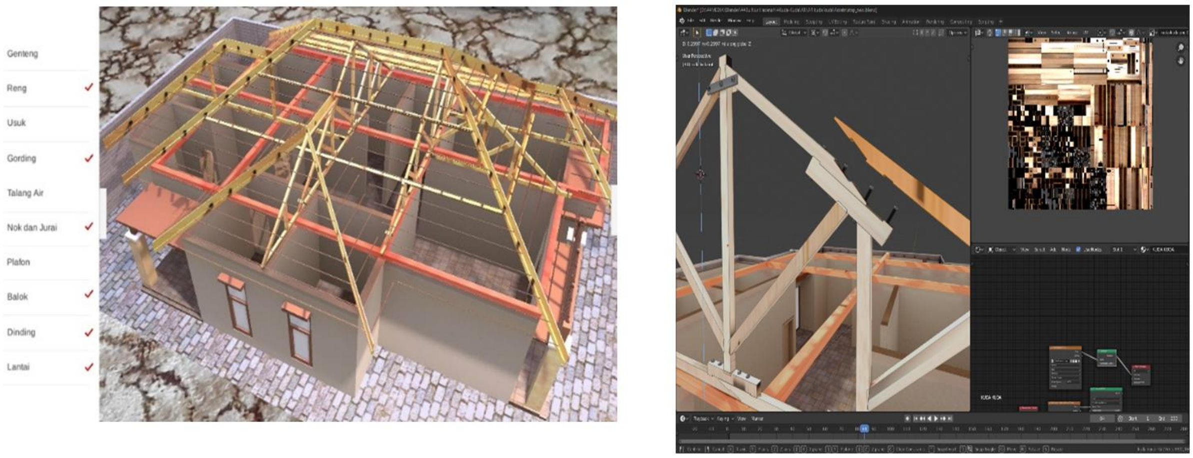

Figure 2. Use of Augmented Reality Media for Wooden Roof Construction Materials

Augmented reality media can connect many objects to the Internet of Things and can interact with these objects (Syahidi et al., 2021). So it is straightforward to deepen the visualization material before conducting direct practical experiments(Kuleto et al., 2021). George (2016), through the results of his research, has succeeded in creating augmented reality applications as a communication bridge between robots and operators (humans) in the scope of work in the industry (Fang et al., 2022). This is relevant to learning in SMK, where almost 50% of teaching materials are related to performance and practice.

Furthermore, Noureddine (2019), the results of his research can also be explained that most of the use of augmented reality is used in the broadcasting, videography, and cinematography industries (Elmqaddem, 2019; Pratama et al., 2022). The resulting virtual graphics are more dynamic, so they look better, and the creation process is faster. In addition, the results of Wulandari's research (Wulandari et al., 2019) can also be explained that the use of augmented reality media in practical learning can be done as an initial introduction to digital object simulation and that educators can use it to determine subsequent learning scenarios (Kim et al., 2021). This is relevant to the current learning approach in Vocational Schools, especially in practical subjects where simulation media is needed without having to carry out activities in one place (Murod et al., 2021).

Based on these conditions, mapping is needed to optimize online learning through augmented reality media to get the distribution of groups of students who can master the material well and do not experience difficulties when the teaching materials provided are integrated with augmented reality media (Wulandari et al., 2019). In addition, for students who have difficulty using augmented reality media, it can be combined with other more accessible media of their characteristics. Augmented reality appears to facilitate the learning and education process (Putra et al., 2021).

The grouping used to determine how many students have mastered the material well and have no difficulty using augmented reality media in online teaching and learning activities is based on functionality, performance, efficiency, convenience, and security (Gaol & Prasolova-Førland, 2022). Use, compatibility, effectiveness, and flexibility (De Pace et al., 2018). These aspects are by the ISO 25010 standard to determine the quality of the products used and determine user perceptions, in this case, are students using augmented reality media.

The aspects of the review above are then grouped based on the needs of alternative media used during distance learning, one of which is augmented reality media, ease of use of augmented reality media, availability of facilities, and level of understanding of the material by students through augmented reality media(Gaol & Prasolova-Førland, 2022). The need for alternative media (Mardasari et al., 2022)in augmented reality will measure the functionality, performance, and suitability of teaching materials through the augmented reality media used (Nadeem et al., 2022). While the ease of use aspect will measure the level of convenience and security while using augmented reality media. The supporting facilities will measure the flexibility of the facilities owned using augmented reality media(Lai & Cheong, 2022). At the same time, the aspect of the speed of understanding the material will measure the effectiveness and efficiency of understanding achieved by students after using augmented reality media (Riani et al., 2021).

Research Methods

This research was conducted in 2020-2021 when SMK implemented a distance learning policy. Vocational Schools used as research objects are State Vocational Schools in DIY Province, which use one of the distance learning media through augmented reality. The sample is spread throughout the Regency and City with 136 Design, Modeling, and Building Information competency students. The approach used to group the use of augmented reality media through applying K-Means clustering. The data obtained were tabulated and analyzed using R software. The review aspects used as the basis for grouping were the need for alternative media in augmented reality, ease of use, supporting facilities, and the speed of students' understanding of the material.

Results and Discussion

In grouping, the data obtained is calculated first based on the aspects of the review, starting from the need for alternative media in the form of augmented reality, ease of use, supporting facilities, and the speed of students' understanding of the material. Following are the results of the analysis of the description of the data obtained.

Table 1. Analysis Results Description

Aspect Overview	N	Mean	SD	Skew	Kurt	Se
Needs	136	31.53	3.38	0.31	0.11	0.29
Ease of Learning	136	44.46	4.84	0.13	-0.73	0.42
Facility	136	16.11	3.14	-0.83	0.19	0.27
Comprehension Speed	136	29.11	4.34	-0.83	-0.12	0.37

Based on the results of the analysis of the table above, it can be explained that for the aspect of the review, the most significant perceived benefit of using augmented reality media in teaching and learning activities during distance learning by students is the ease of using media, then the aspect of reviewing the speed of understanding material by students through augmented reality media, aspects review of alternative media needs in the form of augmented reality, and aspects of the review of supporting facilities owned by students in using augmented reality media.

To get the number of groups/clusters related to the use of augmented reality media by students during teaching and learning activities during distance learning, the number of optimal group/cluster values is calculated using the Silhouette method. The results of the calculation of the Silhouette method can be seen through the images and tables below.

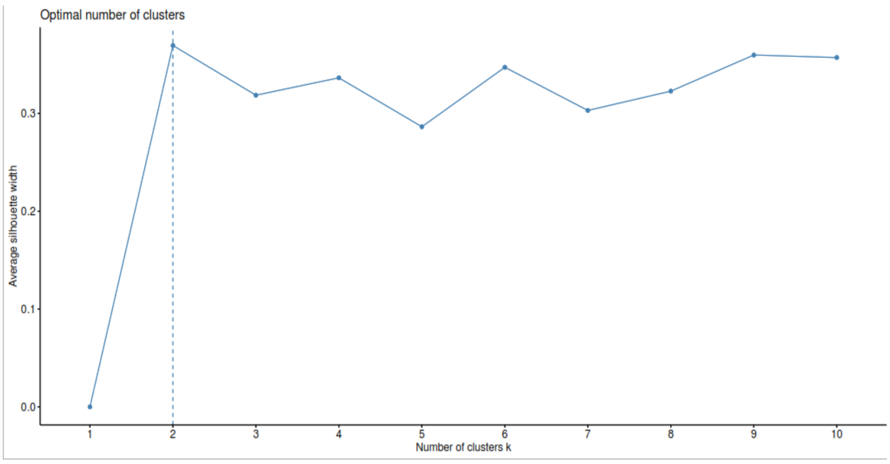

Figure 3. Determination of the Number of Groups/Clusters Using the Silhouette Method

Based on the graphic above, it can be explained that the number of alternative groups/clusters based on calculations using the Silhouette method is ten groups/clusters. However, when viewed from the optimal number, two groups/ctwotwosters clustered based on the use of augmented reality media in teaching and learning activities during distance learning. The following table calculates the results of the Silhouette method analysis.

Table 2. Silhouette Analysis Results

Cluster	Silhoutte Value (Y)
1	0
2	0.3692948

Cluster	Silhoutte Value (Y)
3	0.3184763
4	0.33625
5	0.2862539
6	0.3470251
7	0.3029092
8	0.3226143
9	0.3595287
10	0.3569669

Based on the above calculation results, to determine the number of groups/clusters to be used through the Silhouette method, it can be explained that the optimal nominal value can be shown in cluster 2, which is 1.3,692948. This is by the graph in Figure 2, and it can be explained that the determination of the number of groups/clusters to obtain student mapping results related to the use of augmented reality media during teaching and learning activities during distance learning can be grouped into two groups/clusters. Description of group/cluster 1 are students who have been able to master the material well through augmented reality media. While group/cluster 2 are students who have difficulty in getting the material through increased reality media. Based on the results of the analysis of the K-Means algorithm using R software, the distribution of the cluster division is as follows:

Table 3. Cluster Distribution Results

Cluster	Total Number (N)	Percentage (%)
1	80	58,82
2	56	41,18

Based on the results of the cluster distribution above, it can be explained that as many as 80 students of State Vocational Schools in DIY Province are in cluster 1. This means several 80 students during teaching and learning activities on the competence of Modeling and Building Information Design skills during distance learning. Can master the material well through the use of augmented reality media. This can be used by the teacher in developing and increasing the variety of augmented reality media for further coverage of the material.

In addition, as many as 56 students of State Vocational Schools in DIY Province are in cluster 2. This means that several 56 students during teaching and learning activities on the competence of Modeling and Building Information Design skills during distance learning still have difficulty using media. Augmented reality. Teachers can use this in reflection to combine media that will be used other than augmented reality media and analyze what factors make it difficult for students to follow the material using augmented reality media. The following is the percentage distribution of cluster distribution based on districts and cities in DIY Province.

Table 4. Percentage of Clusters/Regency/City in DIY

K	Sleman	Yogyakarta	Bantul	Gunung Kidul	Kulon Progo
1	75	81	80	0	38
2	25	19	20	100	62

Based on the percentage of cluster distribution results in the districts and cities of DIY Province, it can be explained that most of cluster 1 are in Sleman, Bantul, and Yogyakarta districts. Meanwhile, most of cluster 2 is located in Kulon Progo and Gunungkidul regencies. This has a meaning; when viewed based on the distribution of groups in the districts and cities of DIY Province, it can be explained that students in SMK Negeri Sleman, Bantul, and Yogyakarta cities tend to do better when participating in teaching and learning activities using augmented reality media. Meanwhile, students in SMK Negeri Kulon Progo and Gunungkidul districts tend to find it challenging to participate in teaching and learning activities using increased reality media.

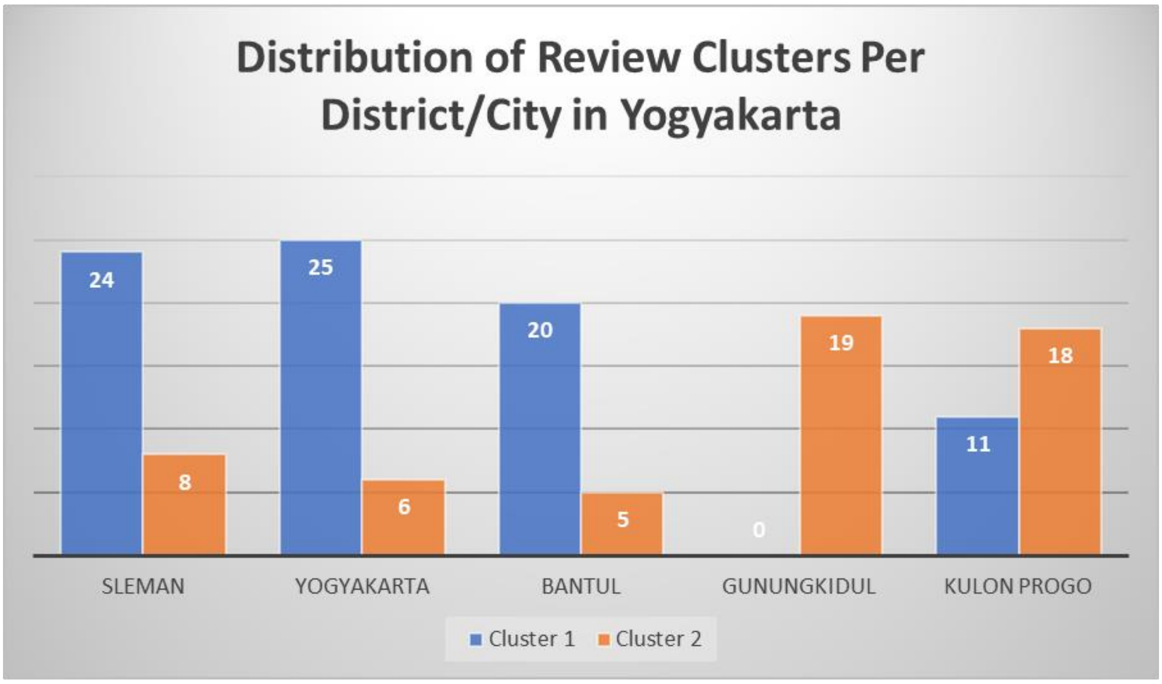

Figure 4. Distribution of Review Cluster Per Distict/City in Yogyakarta

The results of the analysis on the aspect of reviewing the needs of alternative media in the form of using augmented reality media during distance learning in Vocational High Schools can be explained that students tend not to experience difficulties when running the press, but what is interesting is the review of how much relevance the teaching materials have to the simulations used through the media. Augmented reality media has a significant influence. This is in line with the opinion of Triyono (Triyono et al., 2020); it can be explained that the simulation media during learning will influence the formation of one's competence. In addition, simulation media will provide students with initial understanding and imagination if the media is to learning needs (Sumarna, 2019). The aspect of reviewing the ease of using augmented reality media during distance learning in SMK can be explained that students tend to be interested in the media; this is because in terms; of augmented reality, media has been adjusted to each user's smartphone ownership. This is in line with the opinion of Hasanah (2016) and Elmqaddem (2019), it can be explained that the test results on the use of augmented reality media already have security gradations for each type of android smartphone, so if there is an indication of unfriendly/secure software, then the media it will not be usable. While reviewing the speed of understanding the material by students, after using augmented reality media aims to photograph how much understanding of the material is obtained to o provide action to students before starting the integration of learning with a performance approach. This is in line with the results of Apriansyah's research (Apriansyah, 2020); it can be explained that the use of learning media influences the speed of understanding the material by students so that the use of appropriate media can facilitate the achievement of learning objectives.

Conclusion

Based on the description of the results and discussion, it can be explained that as many as 80 students in cluster 1 can master the material well by using augmented reality media while participating in teaching and learning activities through distance learning on the competence of Modeling and Building Information Design skills, the majority of which are spread in Sleman district. Bantul and the city of Yogyakarta. Meanwhile, 56 other students in cluster 2 found it difficult to participate in teaching and learning activities during distance learning using augmented reality media, most of which were spread in the Kulon Progo and Gunungkidul districts.

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