



Student Character Grouping Based on Six Dimensions of Pancasila Student Profile Using Clustering Method (Case Study of SMK Swasta Setia Budi Binjai)

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Abstract: Character education is one of the important aspects in developing students into individuals with integrity, ethics, and responsibility. Pancasila as the foundation of the Indonesian state has a central role in shaping students' character. This study aims to categorize student character based on six dimensions of the Pancasila learner profile at SMK Swasta Setia Budi Binjai. The six dimensions of the Pancasila learner profile that are the focus of this study include: 1) Faithful, Devoted to God Almighty and Noble, 2) Global Diversity, 3) Mutual Cooperation, 4) Independent, 5) Creative, 6) Critical Reasoning.

The clustering method is used to group students based on the Pancasila learner profile measured through questionnaires distributed to subject teachers. The collected data will be analyzed using relevant clustering algorithms to identify the pattern of student characters present in the school population.

This research is expected to provide deeper insight into the character of students at SMK Swasta Setia Budi Binjai based on Pancasila values. The results of this study are expected to be the basis for the development of a more effective character education program that focuses on strengthening the values of Pancasila in an effort to produce a young generation with strong character, love for the country, and contribute positively to society and the nation.

Keywords: Six Dimensions of the Pancasila Student Profile, Clustering, Student Character.

1. Introduction

In the era of the industrial revolution 4.0, education is required to keep up with technological advances. SMK Swasta Setia Budi is one of the superior, quality and independent schools. School activities are carried out in accordance with the development of community needs and



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advances in science and technology. In order to prepare qualified human resources who are ready to compete in the digital era, education needs to adjust to the curriculum used.

Character education itself basically aims to encourage the birth of good human beings, who have attractive, ethical, unpretentious, honest, intelligent, caring, and resilient personalities (Nur'Inayah, 2021).

The Pancasila Learner Profile has six competencies that are formulated as key dimensions. The six are interrelated and reinforcing so that efforts to realize a complete Pancasila Learner Profile require the development of all six dimensions simultaneously, not partially. The six dimensions are 1) Faithful, devoted to God Almighty, and noble, 2) Independent, 3) Critical reasoning, 4) Creative, 5) Mutual cooperation, and 6) Global diversity. They need to grow together so educators should not only focus on one or two dimensions. Ignoring one of them will hinder the development of other dimensions (Irawati et al., 2022).

The clustering method used in grouping student characters at SMK Swasta Setia Budi is one of the statistical methods that can group data based on similar characteristics. This method will help SMK Swasta Setia Budi in facilitating the learning process and developing student character according to the characteristics of each student. By clustering student characters based on the six dimensions of the Pancasila student profile using the clustering method at SMK Swasta Setia Budi, teachers can teach more effectively after knowing the character of each student and students can more easily learn and develop according to their characteristics. In addition, grouping student characters can also increase the effectiveness of learning, so that students can achieve better results in the learning process at SMK Swasta Setia Budi.

2. Methods

2.1. Clustering

Clustering is one of the unsupervised data mining methods. There are two types of data clustering that are often used in the data clustering process, namely hierarchical data clustering and non-hierarchical data clustering (Surbakti, 2021).

The main purpose of the Clustering method is to group a number of data or objects into clusters (groups) so that each cluster will contain data that is as similar as possible. The Clustering method seeks to place similar objects (close distance) in one group and make the distance between groups as far as possible. This means that objects in one group are very similar to each other and different from objects in other groups can be seen in Figure II. 2.

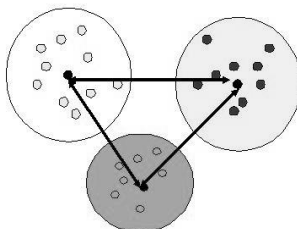


Figure II. 1 Examples of Clusters Formed





2.2. K-Means Algorithm

According to (Wakhidah, 2010) K-Means is an algorithm to cluster n objects based on attributes into k partitions, where $k < n$. The following figure shows the k-means clustering algorithm in action, for a two-dimensional case. The initial centers are generated randomly to show the stages in more detail. The background partition space is for illustration only and is not generated by the k-means algorithm.

The steps in the K-means clustering algorithm are:

1. Determine the number of clusters
2. Determining the centroid value

In determining the centroid value for the beginning of the iteration, the initial centroid value is done randomly. Meanwhile, if determining the centroid value which is the stage of the iteration, then the formula is used.

iteration, the following formula is used

$$\bar{v}_{ij} = \frac{1}{N_i} \sum_{k=0}^{N_i} x_{kj} ,$$

where :

v_{ij} is the centroid / average of the i th cluster for the j th variable

N_i is the amount of data that is a member of the i -th cluster

i, k is the index of the cluster

j is the index of the variable

x_{kj} is the k th data value in the cluster for the j th variable.

in the cluster for the j th variable

3. Calculating the distance between the centroid point and the point of each object to calculate this distance can use the Euclidean Distance, namely

$$D_e = \sqrt{(x_i - s_i)^2 + (y_i - t_i)^2} ,$$

where :

D_e is Euclidean Distance

i is the number of objects,

(x, y) are object coordinates and

(s, t) is the centroid coordinate.

4. Grouping objects to determine cluster members is by taking into account the minimum distance of the object. The value obtained in the data membership in the distance matrix is 0 or 1, where the value 1 is for data allocated to the cluster and the value 0 is for data allocated to another cluster.
5. Return to step 2, repeat until the resulting centroid value is fixed and cluster members do not move to other clusters.





2.3. Six Dimensions of Pancasila

Regulation of the Minister of Education and Culture No. 22 of 2020 concerning the Strategic Plan of the Ministry of Education and Culture for 2021-2024 mentions the term Pancasila Learner Profile. The vision of Indonesian Education is to realize an advanced Indonesia that is sovereign, independent and has a personality through the creation of Pancasila students who reason critically, are creative, independent, faithful, devoted to God Almighty, and have noble character, mutual cooperation and global culture. What is meant by the Pancasila Student Profile is the realization of Indonesian students as lifelong learners who have global competence and behave in accordance with the values of Pancasila, with six main characteristics, namely: faith in God and noble character, global diversity, mutual cooperation, independence, critical reasoning and creativity (Rahayuningsih, 2021).

2.4. Students

Students are one of the human components that occupy a central position in the teaching and learning process where in the teaching and learning process, students as parties who want to achieve goals, have goals and then want to achieve them optimally.

2.5. School

Schools are institutions where students receive instruction under the supervision of teachers. Most countries have a formal education system that is generally compulsory.

2.6. Majors

According to (Sianturi, Tarigan, Rizanti, & Cahyadi, 2018) concluded that: A major is a series of educational materials that have been systematically determined in accordance with their fields.

2.7. Subjects

According to Mulyasa, subjects are something that contains learning messages in both specific and general forms. subjects are a set of learning tools that contain learning materials to achieve learning objectives. According to Iskandar Wassid and Dadang Sukendar, subjects are a set of information provided to students to obtain enjoyable learning. Based on the various opinions above, it can be concluded that subjects are tools used by teachers as guidelines in delivering learning materials to students.

3. Results and Discussion

3.1. Calculation Clustering

In using the clustering method, the initial process carried out to form a cluster is to transform the data into numerical form with predetermined codes, then determine the number of groups (K), calculate the centroid, calculate the use of objects against the centroid then group students based on the six dimensions of the Pancasila profile in what department and what subjects, if no





objects move or group then the iteration is complete. Then transform the criteria data above to be calculated using the clustering method.

To determine the group of an object, the first thing to do is to measure how often the Euclidean between two object points (X, Y and Z) is defined as follows:

Table III.1 Majors

Code	Department (X)
1	TKRO (Automotive Light Vehicle Engineering)
2	TBSM (Motorcycle Tech and Business) I
3	TBSM (Motorcycle Tech and Business) II
4	RPL (Software Engineering)
5	TKJ (Computer and Network Engineering)
6	AKL (Institutional Accounting and Finance)
7	OTKP (Office Automation and Governance)
8	TB (Fashion Management)

Table III.2 Subjects

Code	Subject (Y)
1	Mathematics
2	English
3	Informatics
4	Natural and Social Science Project
5	Fundamentals of Expertise Program

Table III.3 Six Dimensions of Pancasila Learner Profile

Code	Six Dimensions of Pancasila Learner Profile (Z)
1	Faithful, Devoted to God Almighty and of Noble Character
2	Global Diversity
3	Gotong Royong
4	Independent
5	Creative
6	Critical Reasoning

Based on student character data filled in by each vocational subject teacher, then take a few examples and transform them as below :

Tabel III.4 Tabel Tranformasi

No	Object	X	Y	Z
1	A	8	1	1
2	B	8	1	1
3	C	8	1	2





4	D	8	2	1
5	E	8	2	1
6	F	8	2	2
7	G	6	3	6
8	H	6	3	6
9	I	6	3	5
10	J	6	4	1
11	K	6	4	2
12	L	6	4	2
13	M	5	5	3
14	N	5	5	4
15	O	5	5	6
16	P	5	1	1
17	Q	5	1	2
18	R	5	1	2
19	S	4	5	5
20	T	4	5	6

Then form the cluster into groups (K =) and determine the Centroid center point. The clustering calculation process is as below.

Centroid 1 = (5, 1, 2) taken from data R

Centroid 2 = (4, 5, 5) taken from data S

Centroid 3 = (4, 5, 6) taken from data T

Then do the calculations like the calculation process below, 5 example. Iteration 1:

1. A (8,1,1)

$$C_1=(5, 1, 2) = \sqrt{(8 - 5)^2 + (1 - 1)^2 + (1 - 2)^2} = 3,16$$

$$C_2=(4, 5, 5) = \sqrt{(8 - 4)^2 + (1 - 5)^2 + (1 - 5)^2} = 6,93$$

$$C_3=(4, 5, 6) = \sqrt{(8 - 4)^2 + (1 - 5)^2 + (1 - 6)^2} = 7,55$$

2. B (8,1,1)

$$C_1=(5, 1, 2) = \sqrt{(8 - 5)^2 + (1 - 1)^2 + (1 - 2)^2} = 3,16$$

$$C_2=(4, 5, 5) = \sqrt{(8 - 4)^2 + (1 - 5)^2 + (1 - 5)^2} = 6,93$$

$$C_3=(4, 5, 6) = \sqrt{(8 - 4)^2 + (1 - 5)^2 + (1 - 6)^2} = 7,55$$

3. C (8,1,2)

$$C_1=(5, 1, 2) = \sqrt{(8 - 5)^2 + (1 - 1)^2 + (2 - 2)^2} = 3,00$$

$$C_2=(4, 5, 5) = \sqrt{(8 - 4)^2 + (1 - 5)^2 + (2 - 5)^2} = 6,40$$

$$C_3=(4, 5, 6) = \sqrt{(8 - 4)^2 + (1 - 5)^2 + (2 - 6)^2} = 6,93$$

4. D (8,2,1)

$$C_1=(5, 1, 2) = \sqrt{(8 - 5)^2 + (2 - 1)^2 + (1 - 2)^2} = 3,32$$





$$C2=(4, 5, 5) = \sqrt{(8 - 4)^2 + (2 - 5)^2 + (1 - 5)^2} = 6,40$$

$$C3=(4, 5, 6) = \sqrt{(8 - 4)^2 + (2 - 5)^2 + (1 - 6)^2} = 7,07$$

5. E (8,2,1)

$$C_1=(5, 1, 2) = \sqrt{(8 - 5)^2 + (2 - 1)^2 + (1 - 2)^2} = 3,32$$

$$C2=(4, 5, 5) = \sqrt{(8 - 4)^2 + (2 - 5)^2 + (1 - 5)^2} = 6,40$$

$$C3=(4, 5, 6) = \sqrt{(8 - 4)^2 + (2 - 5)^2 + (1 - 6)^2} = 7,07$$

From the calculation above, the results of the iteration 1 calculation are obtained, which are as shown in the table below.

Table III. 5 Iteration Result Data 1

No	X	Y	Z	C1	C2	C3	Group
1	8	1	1	3,16	6,93	7,55	1
2	8	1	1	3,16	6,93	7,55	1
3	8	1	2	3,00	6,40	6,93	1
4	8	2	1	3,32	6,40	7,07	1
5	8	2	1	3,32	6,40	7,07	1
6	8	2	2	3,16	5,83	6,40	1
7	6	3	6	4,58	3,00	2,83	3
8	6	3	6	4,58	3,00	2,83	3
9	6	3	5	3,74	2,83	3,00	2
10	6	4	1	3,32	4,58	5,48	1
11	6	4	2	3,16	3,74	4,58	1
12	6	4	2	3,16	3,74	4,58	1
13	5	5	3	4,12	2,24	3,16	2
14	5	5	4	4,47	1,41	2,24	2
15	5	5	6	5,66	1,41	1,00	3
16	5	1	1	1,00	5,74	6,48	1
17	5	1	2	0,00	5,10	5,74	1
18	5	1	2	0,00	5,10	5,74	1
19	4	5	5	5,10	0,00	1,00	2
20	4	5	6	5,74	1,00	0,00	3

After calculating using the existing cluster formula, the groups based on the minimum distance to the nearest centroid are:

Old Group: (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0)

New Group: (1 1 1 1 1 1 3 3 2 1 1 1 2 2 3 1 1 1 2 3)

There is a group change, followed by the following iteration :





Table III. 6 Iteration Result Data 2

No	X	Y	Z	C1	C2	C3	Group
1	8	1	1	1,68	5,64	6,45	1
2	8	1	1	1,68	5,64	6,45	1
3	8	1	2	1,68	5,13	5,71	1
4	8	2	1	1,35	5,08	6,05	1
5	8	2	1	1,35	5,08	6,05	1
6	8	2	2	1,35	4,51	5,25	1
7	6	3	6	4,67	2,51	1,25	3
8	6	3	6	4,67	2,51	1,25	3
9	6	3	5	3,72	1,95	1,60	3
10	6	4	1	2,19	3,44	5,06	1
11	6	4	2	2,19	2,51	4,07	1
12	6	4	2	2,19	2,51	4,07	1
13	5	5	3	3,78	1,35	3,17	2
14	5	5	4	4,28	0,56	2,25	2
15	5	5	6	5,68	1,82	1,03	3
16	5	1	1	2,08	4,78	5,84	1
17	5	1	2	2,08	4,16	5,01	1
18	5	1	2	2,08	4,16	5,01	1
19	4	5	5	5,37	1,35	1,89	2
20	4	5	6	6,07	2,08	1,60	3

After calculating using the existing cluster formula, the groups based on the minimum distance to the nearest centroid are:

Old Group: (1 1 1 1 1 1 3 3 2 1 1 1 2 2 3 1 1 1 2 3)

New Group: (1 1 1 1 1 1 3 3 3 1 1 1 2 2 3 1 1 1 2 3)

There is a group change, followed by the following iteration :

Table III. 7 Iteration Result Data 3

No	X	Y	Z	C1	C2	C3	Group
1	8	1	1	1,68	6,01	6,14	1
2	8	1	1	1,68	6,01	6,14	1
3	8	1	2	1,68	5,58	5,39	1
4	8	2	1	1,35	5,40	5,75	1
5	8	2	1	1,35	5,40	5,75	1
6	8	2	2	1,35	4,91	4,94	1
7	6	3	6	4,67	3,13	1,02	3
8	6	3	6	4,67	3,13	1,02	3
9	6	3	5	3,72	2,60	1,28	3





10	6	4	1	2,19	3,43	4,84	1
11	6	4	2	2,19	2,60	3,85	1
12	6	4	2	2,19	2,60	3,85	1
13	5	5	3	3,78	1,05	3,07	2
14	5	5	4	4,28	0,33	2,20	2
15	5	5	6	5,68	2,03	1,28	3
16	5	1	1	2,08	5,01	5,57	1
17	5	1	2	2,08	4,48	4,74	1
18	5	1	2	2,08	4,48	4,74	1
19	4	5	5	5,37	1,20	2,01	2
20	4	5	6	6,07	2,11	1,85	3

After calculating using the existing cluster formula, the groups based on the minimum distance to the nearest centroid are:

Old Group: (1 1 1 1 1 1 3 3 3 1 1 1 2 2 3 1 1 1 2 3)

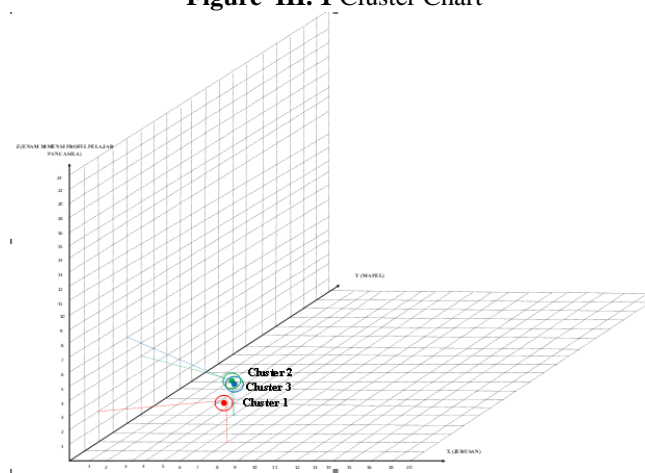
New Group: (1 1 1 1 1 1 3 3 3 1 1 1 2 2 3 1 1 1 2 3)

After calculating using the existing cluster formula, iteration 3 is the same as iteration 2 and there is no data that moves groups anymore so the calculation can be stopped. So that a cluster graph can be made for grouping student characters based on the six dimensions of the Pancasila student profile.

3.2. Clustering Chart

The following is a cluster graph based on the calculation of the results of data mining iterations. The graphs obtained are as follows:

Figure III. 1 Cluster Chart



Of the 20 data, there are 3 groups, namely group 1 has 12 data and group 2 has 3 data and group 3 has 5 data. The explanation of the 3 groups is as follows:





1. Cluster 1 There are 12 data
It can be seen that cluster 1 is centered on (6.75, 2.00, 1.50), namely student data with the OTKP Department, English Subjects have a Global Diversity character.
2. Cluster 2 There are 3 Data
It can be seen that cluster 2 is centered on (4.67, 5.00, 4.00), namely student data with the TKJ Department, Basic Basic Subjects of Expertise Program has an Independent character.
3. Cluster 3 There are 5 Data
It can be seen that cluster 3 is centered on (5.40, 3.80, 5.80), namely student data with the TKJ Department, Natural and Social Science Project Subjects have Critical Reasoning character.

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