

# Grouping of Student Learning Interest Indicators Using the Clustering Method (Case Study: Ma. Al – Asy'ariah Sunggal)

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## Abstract

Student learning interest is an important factor in achieving educational outcomes, as it is directly related to their involvement in the learning process. However, in reality, each student has a different character and learning style, often making it difficult for teachers to determine effective and appropriate learning strategies. Therefore, an approach that can objectively identify patterns of student learning interest is needed. This study aims to group students based on three main indicators of learning interest: class activity, academic grades, and involvement in extracurricular activities. The method used is K-Means Clustering, which is a data mining technique for grouping data based on similar characteristics between objects. This research process began with data collection of 508 students of MA Al- Asy'ariah Sunggal in the 2024 academic year, then the data was transformed into numeric form. Next, the K-Means algorithm was implemented using MATLAB R2014b software. The analysis results show that students can be divided into three main clusters, each with different learning interest characteristics. The first cluster consists of students who are less active and do not participate in extracurricular activities, the second cluster contains students with high academic grades but minimal classroom engagement, and the third cluster reflects students who are active both academically and non-academically. These results provide a concrete picture for schools in developing more targeted learning strategies, based on the needs and potential of students in each group.

**Keywords:** *Academic, Extracurricular, Active, K-Means, Learning Interest*

## 1. Introduction

Education is foundation main in form source Power superior , empowered human beings competitive , and ready face global challenges . At the level School Senior High School (SMA ) or equivalent , students is at the stage crucial developments in determine direction education and career . In the phase this , interest Study become factor important things that influence engagement and success student in the learning process . Interest in learning No formed in a way spontaneous , but rather influenced by various internal and external factors external influences motivation , involvement , and willingness student For participate active in class .

A number of indicator main influencing factors interest Study including activity student during the learning process , achievement mark academics , and engagement in activity extracurricular activities . Activeness students in class , such as ask , answer questions , or participate in discussion , showing existence motivation and desire know what's high . Academic grades reflect level understanding student to material , which can correlated with interest to lesson certain . While that , participation in activity extracurricular develop non- academic skills like discipline , work same , and management time , which in turn can influence motivation Study .

Facts on the ground show that No all student own level interest high learning . Some students experience difficulty follow learning Because low interest learning , while the teacher often face challenge in adapt method teach with character diverse students . Conditions This confirm the need a capable approach give description objective about pattern interest Study students , so that learning strategies can arranged in a way more appropriate target .

One of methods that can used For map pattern the is clustering, with K-Means Clustering algorithm as one of the effective technique . This method Work with grouping data based on similarities characteristics through calculation distance against the group centroid . Research Previously , as done by Gustian & Al-Farits ( 2023) and Rahmad Hidayat (2022), have show effectiveness of K-Means in grouping student based on indicator certain . However, research similar that focuses on indicators activity , value academics , and engagement extracurricular activities in the Madrasah Aliyah environment are still limited .

Based on gap said , research This done For grouping students at MA. Al- Asy'ariah Sunggal based on three indicator main interest Study use K-Means Clustering method . Clustering results expected can give greater understanding clear about pattern interest Study students , so that party schools , teachers, and stakeholders policy can designing more learning strategies adaptive and effective . In addition , research

This expected can enrich study academic in the field application of data mining in education , at the same time become reference for study furthermore .

## 2. Literatur Riview

### 2.1 Learning Interest Indicator

Interest in learning is one of the factor important in success of the educational process . Interest in learning can interpreted as internal drive within self student For involved active in activity learn , explore material lessons , as well as maintain focus and motivation in reach objective academic .

For measure interest Study student in a way more objective , required a number of indicators that can observed and analyzed . Indicators This used as base in grouping student based on level interest Study they . In research this , indicator interest Study customized with condition real in school and arranged based on dimensions behavior student in context activity Study

In research this , indicator interest Study arranged based on Self-Determination theory (Deci & Ryan, 2020), which emphasizes importance autonomy , competence , and connectedness social in form motivation and interest Study .

### 2.2 Activity Students in Class

Activity students in class show to what extent students involved in activity learning in a way direct . Indicator This covers behavior like ask to the teacher, answer questions , discussion with friends , and show enthusiasm during learning ongoing . Students who are active in class generally have a sense of desire high knowledge and motivation in a way intrinsic .

Sense of trust self student in interact with environment learn and convey opinions are also related with activity students in class . Because they No only accept information in a way passive , but also processing and strengthening understanding they through interaction , active students usually more easy understand material .

Activity students in class is indicator important in measure interest learning . Activeness This reflected from behavior student during the learning process . Students No active generally show attitude passive , such as No gather tasks , often roll call or come late , and No involved in discussion . Students not enough active present in a way consistent However once in a while late , doing task appropriate time , and only once in a while participate in discussion or ask answer . Meanwhile that , active students show involvement high , such as routinely submitting and answering questions , work task in a way complete and accurate time , and present in a way consistent .

### 2.3 Academic Values

Academic Values are size quantitative used For evaluate achievement student in field academic during the learning process . Assessment This obtained from various form evaluation , such as exams , assignments , projects , class activity , and various activity academic others ( Sudjana , 2009).

One of factor important things that influence achievement mark academic is level interest Study students . Students who have interest Study tall tend more active , diligent , and have motivation intrinsic in understand material lesson . Condition This make it easier they in absorb information , complete task with good , and follow learning in a way more enthusiastic (Uno, 2012).

Study show that interest high learning related close with ability think critical , creative , and logical . Students who have interest and motivation strong in Study tend get results more academic Good compared to with interested students study low (Arifin, 2017). With Thus, interest Study play a role significant in support improvement performance academic student .

### 2.4 Extracurricular

Activity extracurricular is an educational program outside of class hours that aims to develop interests , talents and potential student at a time form character as well as not quite enough answer social activities This implemented under guidance and supervision unit education and role as supporters achievement competence participant educate in a way comprehensive ( Minister of Education and Culture Regulation No. 62 of 2014).

Through activity extracurricular like Scouts and Youth Red Cross (PMR), students get experience direct in activity social , conservation environment , as well as development skills leadership and work same . This is No only enrich experience Study students , but also improve motivation and interest Study they (Putra, 2018).

According to Yudha (1998:8), extracurricular is activities carried out outside of class hours and aimed at support the curricular program . Research by Santoso (2017) shows that involvement active student in extracurricular influential positive to performance academic and interests learn , because activity the capable increase confidence self , discipline , and ability social student .

With Thus , the activities extracurricular own role important in support success education , good in a way academic and non-academic , through development potential and interest Study student .

### 2.5 Understanding Data Mining

Data mining is the process of discovering pattern or interesting information from very large data sets with use Exact techniques and algorithms are included in *Knowledge Discovery in Database* (KDD) framework. According to Susanto (2010), data mining is the process of discovering knowledge or introduction pattern hidden in large data sets For dig knowledge new .

Sembinging (2020) stated that the data mining process uses algorithm introduction pattern recognition for process data into knowledge new that can used in taking decision . This process use method mathematics , statistics , intelligence artificial . Data mining is technique data processing using algorithm , is done with make pattern design and use this model For make new data patterns that are not There is in the database.

### 3. Research Methodology

Methodology study study is method or procedures used by researchers For collect , process , analyze , and interpret data to obtain answer on problem research that has been formulated . In doing research on thesis this , the author follow stages methodology in study this , namely as following :

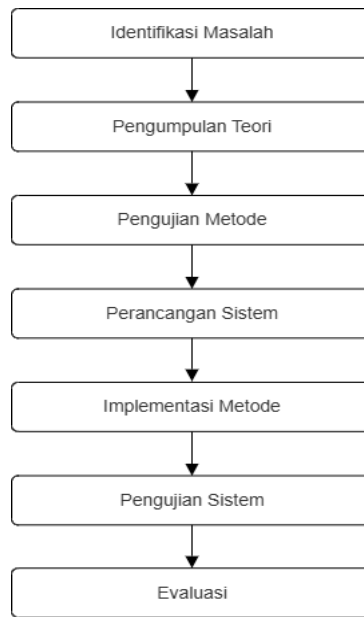


Fig 1: Research Method

#### 3.1 Input Data

Input data on the system in the form of data obtained at MA-AI- Asy'ariah . System input data has saved in Ms.Office Excel as data container , then the data will transformed based on mark transformation from each variables that used for explanation of the data that can be input as well as variables and values transformations used in the system can seen as following :

1. Input Data :
  - a. File name : Data2
  - b. Amount data : 508 data
  - c. Variables : X = Activity student in the classroom  
Y = Academic grades  
Z = Extracurricular
2. Cluster grouping : 3 Clusters
3. Data transformation values on variables :

Table 1: Transformation value

### 4. Research Methodology

No	Variabel	Transformasi	Nilai Transformasi
1	Keaktifan Siswa Dikelas	Tidak Aktif	1
		Kurang Aktif	2
		Aktif	3
2	Nilai Akademik	1196 – 1272	1
		1273 – 1349	2
		1350 – 1426	3
		1427 – 1503	4
		1504 – 1580	5
		1581 – 1657	6
		1658 – 1734	7
		1735 – 1811	8
3	Ekstrakurikuler	TIDAK TERLIBAT	1
		EKSTRAKURIKULER	
		PRAMUKA	2
		PMR	3
		PASKIBRA	4
		SENI KREATIF	5
		PRAMUKA & PMR	6
		PRAMUKA & SENI KREATIF	7
		PMR & SENI KREATIF	8
		PASKIBRA & PRAMUKA	9
		PMR & PASKIBRA	10
		SENI KREATIF & PASKIBRA	11
		PRAMUKA & PMR & SENI KREATIF	12
PASKIBRA & PMR & SENI KREATIF	13		

Implementation is stage implementation at a time testing for system new as well as is stage Where application will operated in real conditions . Implementation at the stage This is a stage process end from implementation Clustering method in the system grouping data

according to with the design that has been done . Implementation done on the application MATLAB programming with apply Clustering method in program coding so that system can carry out the data grouping process according to with stages data grouping . From the results the design that has been done , the process was successful apply Clustering method with K-Means algorithm .

With system This , MA Al- Asy'ariah Sunggal can analyze and group interest data Study student based on class activity , grades academics, and engagement in activity extracurricular in a way more effective and efficient . Implementation Clustering method with K-Means algorithm helps in identify patterns hidden from characteristics students , so that party school can designing more learning strategies appropriate target and appropriate with the needs of each group student .

### 4.1 Results

#### a. Results with 3 Clusters

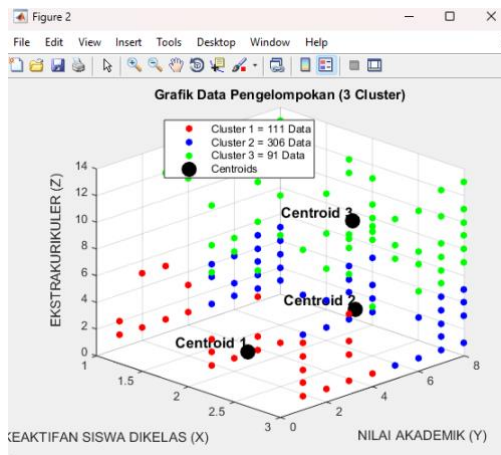


Fig 2: Chart result of the grouping process

Test results system is the output data obtained from the testing process with input data that has been given using MATLAB 2014b. The following is details of the results data grouping indicator interest Study student use method clustering :

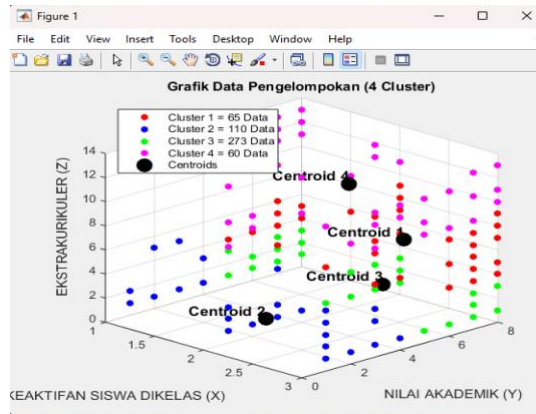
Table 2: Cluster Centers in System Results

No	Pusat Cluster	Variabel			Jumah data
		X	Y	Z	
1	Centroid 1	2.0631	2.3153	1.4234	111
2	Centroid 2	2.0000	7.2745	1.6209	306
3	Centroid 3	2.3407	5.7912	9.8681	91

Based on table results grouping of data that has been presented above , obtained from test process results with using existing input data given , as well as processed through tests conducted using MATLAB R2014b, can known that :

1. In group 1 with total 111 data, interest Study students at MA Al- Asy'ariah Sunggal can grouped based on characteristics students who have activity enough (Less Active ) in class , grades academic low ( 1273 – 1349) and minimal involvement in activity extracurricular ( Scouts ). This is show that part big student in group This need attention more in aspect motivation learning , especially through mentoring academic and improvement participation in non- academic activities , such as extracurricular base or coaching class .
2. In group 2 with total 306 data, interest Study student tend grouped based on characteristics activity sufficient (Less Active ) , value academic high ( 1658 – 1734) , but participation extracurricular Still low ( Scouts ). Students in group This generally show performance strong academics , although not enough active in outdoor activities class . So from that , one of focus development that can done is push student For follow as well as in activity extracurricular activities , to train soft skills, leadership and work The same team.
3. In group 3 with total 91 data, students own characteristics activity enough ( less than Active ), value academic medium ( 1581 – 1657) , as well as active in various activity extracurricular ( PASKIBRA & PRAMUKA) . This show that student in group This own interest tall to non- academic activities , such as Paskibra , PMR, and Creative Arts , however Still need encouragement For increase performance academic . Therefore that , learning strategies that are flexible and interactive can used For guard Spirit Study they without reduce involvement they in activity extracurricular .

**b. Results with 4 Clusters**



**Fig 3:** Clustering result with 4 cluster

Test results system is the output data obtained from the testing process with input data that has been given using MATLAB 2014b. The following is details of the results data grouping indicator interest Study student use method clustering :

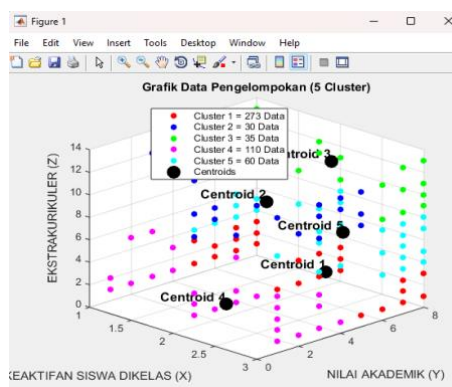
**Table 3:** Data cluster with 4 centroids

No	Pusat Cluster	Vriabel			Jumah data
		X	Y	Z	
1	Centroid 1	2.2923	7.0000	5.8	65
2	Centroid 2	2.0545	2.309	1.3818	110
3	Centroid 3	2.0073	7.2857	1.282	273
4	Centroid 4	2.1833	5.2	11.2166	60

Based on table results grouping of data that has been presented above , obtained from test process results with using existing input data given , as well as processed through tests conducted using MATLAB R2014b, can know that :

1. In group 1 with total 65 data, interest Study students at MA Al- Asy'ariah Sunggal can grouped based on characteristics students who have activity enough (Less Active ) in class , grades academic high ( 1658 – 1734 ) , and involvement active ( SCOUTS & PMR) in activity extracurricular activities . This is show that part big student in group This own ability good and sufficient academic active outside class , but Still can directed For increase involvement in a way consistent . A strategy that can implemented is give challenge more learning varied as well as push they For contribute active in activity collaborative in schools.
2. In group 2 with total 110 data, interest Study student tend grouped based on characteristics activity sufficient (Less Active ) , value academic low ( 1273 – 1349 ) , and no involvement in activity extracurricular activities . Students in group This generally own obstacle Good in a way motivation and participation . Therefore that , is necessary attention special through mentoring programs learning , improvement interest learning , and a holistic approach awaken students' internal motivation through coaching classes and activities simple yet attractive .
3. In group 3 with total 273 data, students own characteristics activity sufficient (Less Active ) , value academic high ( 1658 – 1734 ) , and no involvement in activity extracurricular activities . This is show that student in group it is very focused on achievement academic However not enough interact in activity social and development self outside class . Therefore that , a development strategy that can implemented is push they For active follow activity extracurricular based academic , such as club literacy , works scientific , or organization supportive students balance between achievements and soft skills.
4. In group 4 with total 60 data, students show characteristics activity sufficient (Less Active ) value academic moderate ( 1504 – 1580 ) , and very active in various activity Extracurricular ( CREATIVE ARTS & PASKIBRA) . Students in group This own interest tall to non-academic activities , however Still need encouragement For increase aspect academic they . Therefore that , learning strategies that are flexible , interactive , and contextual are highly recommended for students still Spirit Study without lost Spirit participatory they in activity school .

**c. Results with 5 Clusters**



**Fig 4:** Clustering result with 5 cluster

Test results system is the output data obtained from the testing process with input data that has been given using MATLAB 2014b. The following is details of the results data grouping indicator interest Study student use method clustering :

**Table 4:** Data cluster center with 5 centroid

No	Pusat Cluster	Vriabel			Jumah data
		X	Y	Z	
1	Centroid 1	2.0073	7.2857	1.282	273
2	Centroid 2	2.3333	3.1333	10.6666	30
3	Centroid 3	2.0857	7.2285	11.3142	35
4	Centroid 4	2.0545	2.309	1.3818	110
5	Centroid 5	2.5833	7	5.5666	60

Based on table results grouping of data that has been presented above , obtained from test process results with using existing input data given, as well as processed through tests conducted using MATLAB R2014b, can known that :

1. In group 1 with total 273 data, interest Study students at MA Al- Asy'ariah Sunggal can grouped based on characteristics students who have activity enough (Less Active ) in class , grades academic high ( 1658 – 1734 ) , and no involvement in activity extracurricular activities . This is show that part big student in group it is very focused on achievement academic , but No involved in non- academic activities . Therefore that , one of focus development that can done is push student For follow activity extracurricular based academic or development yourself , to strengthen soft skills and abilities social they .
2. In group 2 with total 30 data, interest Study student tend grouped based on characteristics activity sufficient (Less Active ) , value academic low ( 1350 – 1426 ) , and involvement tall in activity Extracurricular ( CREATIVE ARTS & PASKIBRA ) . Students in group This show Spirit tall in non- academic activities , however Not yet show optimal performance in field academic . Therefore Therefore , a flexible and contextual learning strategy is needed , which is capable of linking activity academic with interest they are outside class .
3. In group 3 with total 35 data, students own characteristics activity sufficient (Less Active ) , value academic high ( 1658 – 1734 ) , as well as active in various activity extracurricular ( CREATIVE ARTS & PASKIBRA ) . This show that student in group This own balanced interests between academic and non- academic , making they as profile ideal students . Development strategies for group This is give room more in leadership , mentoring, and engagement programs in projects learning collaborative , so that they Can become role model and driving force positive in the environment school .
4. In group 4 with total 110 data, interest Study student can grouped based on characteristics activity sufficient (Less Active ) , value academic low ( 1273 – 1349 ) , and no involvement in activity extracurricular . . Student in group This need attention special , good from aspect academic and development yourself . Therefore that , the suggested approach is through coaching intensive , guidance learning , and personal motivation , as well as in a way gradually involving they in simple non - academic activities However interesting .
5. In group 5 with total 60 data, students show characteristics activity ( Active ) , value academic high ( 1658 – 1734 ) , and involvement active in activity extracurricular ( CREATIVE ARTS ) . Group This show excellent balance between activity in class , achievement high academic ( 1658 – 1734), and involvement active in activity Creative Arts extracurricular activities . Characteristics This reflect student with potential strong learning and high motivation . Therefore that , the appropriate development strategy is give challenge learn more complex as well as involving they in role leadership in organizations or projects creative at school , so that potential they can develop in a way maximum good in the field academic both academic and non-academic .

## 5. Conclusions and Suggestion

### 5.1 Conclusion

Based on research that has been done so drawn the conclusion as following :

1. In research There are 3 clusters , namely : Cluster 1 contains 111 students with centroid (2.06; 2.31; 1.42), variance 3.1317, reflecting student Enough active , value academic moderate , and not follow extracurricular activities . Cluster 2 contains 306 students , centroid (2.00; 7.27; 1.62), variance 2.5913, describing student with mark academic high , active moderate , and minimal participation extracurricular activities . Cluster 3 contains 91 students , centroid (2.34; 5.79; 9.86), variance 10.2625, consisting of from student active in class and extracurricular activities as well as own mark academic tall .
2. Clustering Results for 5 Groups : Cluster 1 has the lowest variance ( 1.6446), indicating character similar students . Cluster 2 has variance highest (4.5600), reflecting difference more characters large . Cluster 3 has variance medium (3.2702) with character enough students varies . Cluster 4 has variance medium (2.9557), shows part big student own similar characters . While that , Cluster 5 has variance Enough high (3.8152), depicting diversity character student in group the .
3. Validation Clustering Effectiveness : Shows that grouping of 3, 4, or 5 effective clusters , with variance that reflects identity each cluster and K-Means is successful grouping data according to indicator interest Study .
4. From 508 student data : Class activity and grades academic become most influential indicators in grouping , while extracurricular only as factor supporters .
1. Grouping results give outlook for school For develop appropriate learning strategies , implement personal approach , and improve motivation as well as performance student in a way comprehensive.

### 5.2 Suggestion

In the research This writer suggest :

1. For School : School Can use results grouping This For develop a customized program with need each group student .
2. For Teachers: Teachers should adapt method teach with character students , using approach diverse , and giving attention more on students who are less active .
3. For Parents: Parents need accompany child in accordance with interests and abilities , both in Study and in activity extracurricular .
4. For Researchers Next : Research furthermore recommended add other factors such as motivation , habits learning at home , and parental support , as well as try method other groupings for compare results with K-Means.

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