K-Means Clustering Method On Academic Advising Management And Early Detection Of Student Dropout (Sequential Explanatory Mixed Method Study At UIN Sunan Ampel Surabaya And IAIN Kediri)

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Abstract.

In this millennial era, education is a need that must be prioritized. It can be seen from the progress in the field of education in Indonesia. Its development is increasingly showing rapid significance. But the irony is that the rapid development of education is also not free from various kinds of severe and diverse challenges and fierce competition at the regional and national levels. One crucial problem that illustrates the success and failure that often occurs in higher education is dropout. The student dropout rate is often associated with public interest in higher education, public interest often concludes that if the dropout rate is high then the quality of the campus can be said to be low, conversely if the student dropout rate is low then the quality of the campus is high. Research was conducted to find the application of the k-means clustering method in early detection of potential student dropouts using the k-means data meaning algorithm. The approach in this research is mixed methods research explanatory design model, where researchers conduct quantitative research with manova analysis and followed by qualitative research, the data used in quantitative methods are used to map students with the highest dropout potential to the lowest dropout potential using k-means clustering data analysis, while qualitative research uses a data base.The results of research on data analysis of mapping students who are potential dropouts resulting from k-means clustering data analysis for IAIN Kediri obtained 10 clusters with a silhouette coefficient value of 0.790 and 3 clusters with a silhouette coefficient value of 0.770. While at UIN Sunan Ampel Surabaya, 8 clusters were obtained with a silhouette coefficient value of 0.840 and 5 clusters with a silhouette coefficient value of 0.820. Based on the silhouette coefficient value data both at IAIN Kediri and UIN Sunan Ampel which is between $0.7 < SC \leq 1$, it is concluded that the cluster model obtained has a strong structure. The effect of k-means clustering method on academic advising management is explained from the results of MANOVA analysis for student data of UIN Sunan Ampel Surabaya shows there is a significant difference between k-means clustering method on academic advising management at UIN Sunan Ampel Surabaya with the value of $F(469.179) = 8$, $p = 0.000$., and there is a significant effect between k-means clustering method on academic advising management at IAIN Kediri with the value of $F(244.8227) = 10$, $p = 0.000$.While the effect of the k-means clustering method on early detection of student dropout is explained from the results of Manova analysis for data from UIN Sunan Ampel Surabaya which shows a significant influence between the k-means clustering method on early detection of student dropout at UIN Sunan Ampel Surabaya with a value of F (1,272,286) = 8, p 0. 000 there is a significant influence between the k-means clustering method on early detection of student dropout at IAIN Kediri. the results of qualitative data analysis are presented in 4 major sections, namely regarding the management of academic advising in planning, organizing, implementing and supervising academic advising in dropout prevention efforts at UIN Sunan Ampel Surabaya and IAIN Kediri.

Keywords: *Academic Counselor Management, K-Means, Dropout Potential and Clustering.*

I. INTRODUCTION

Education is a conscious, organized, and systematic effort to provide assistance / guidance to someone who is in the process of maturing (Binti Maunah: 2009: 7). In today's millennial era, education is a necessity that must be prioritized. This can be seen with the progress in the field of education in Indonesia. The development of education in Indonesia is increasingly showing rapid development. However, along with the rapid development of the world of education, it is not free from various kinds of severe and diverse challenges and the development of the world of education is also accompanied by very fierce competition at all levels regionally, nationally, even throughout the world (Prim Masrokan :2013).Islamic educational institutions have been known since the colonial era, in the form of pesantren and madrasah. Even before there were public education institutions, Islamic education institutions had penetrated the archipelago and the concept or model could be found in the early days of Islam's entry into the archipelago. In the following years, especially after independence, the development of Islamic education institutions was increasingly visible with the emergence of many informal Islamic education institutions (pesantren, TPQ, Madrasah diniyah) and formal Islamic education institutions (RA, madrasah, Islamic University) (Idris: 2013: 102).The highest level of educational institutions in Indonesia is higher education. Higher Education is the level of

education after secondary education which includes diploma programs, undergraduate programs, master programs, doctoral programs, and professional programs, as well as specialist programs, organized by universities based on the culture of the Indonesian nation (Kemenristekdikti: 2012).The mouth of formal education in Indonesian society is higher education, therefore universities are the main focus in assessing a person's success rate.

The high quality of higher education is often associated with student success, on the contrary, the low quality of students and the failures they face are considered as a manifestation of the inability of universities to manage institutions, especially the management of the learning process in class and the curriculum taught (Razak: 2016: 31). The community always considers that students are one of the important parameters in assessing the learning process in higher education as well as being the main indicator in measuring the quality and quality of a university. The benchmark of high and low quality in higher education can be seen from the level of student success and failure. One of the crucial problems that illustrates the success and failure that often occurs in higher education is dropout. Student dropout rates are often associated with public interest in higher education, public interest often concludes that if the dropout rate is high then the quality of the campus can be said to be low, otherwise if the student dropout rate is low then the quality of the campus is high in the community.Many factors trigger students' non-completion of college, starting from low interest in learning to cause students to be constrained during college. In addition, the lack of academic and social adaptation in the early semester also triggers students' academic problems. Some students feel difficulties in the early semesters when they have never known the same courses as students, resulting in failure in basic courses in the first semester. The absence of students' independence to study on their own caused the failure. Most of them are accustomed to getting tutoring from tutoring institutions during their high school education.Dropout is defined as the condition of students who are no longer studying or have not completed a certain level of education. Dropout is the cessation of a student either in the middle of a new school year or at the end of the school year. Due to various reasons that require or force students to stop studying (Ahmad: 2011: 86).

In general, dropout sanctions are imposed on students who are unable to complete their studies within 14 semesters, or for not paying SPP for more than 2 consecutive semesters or at the end of semester 4 are unable to fulfill a minimum of 40 credits and with a cumulative grade point average of less than 2.00 (IAIN Kediri: 2020). Dropout is not only detrimental to students but also to the university. For the university, it will affect the accreditation of the university while the student's guardian spends a lot of money and energy but the results are in vain. To reduce the impact of dropouts the university must evaluate and conduct early detection on students, this is useful to minimize the occurrence of dropouts.Dropout in East Java is ranked quite high (large), known as the United Color of Java The tip of East Java, occupies the third position of the supplier of dropout students in the country of Indonesia. Therefore, dropout students must be immediately addressed by various parties, especially universities in East Java, including various parties, especially education policy makers in East Java.

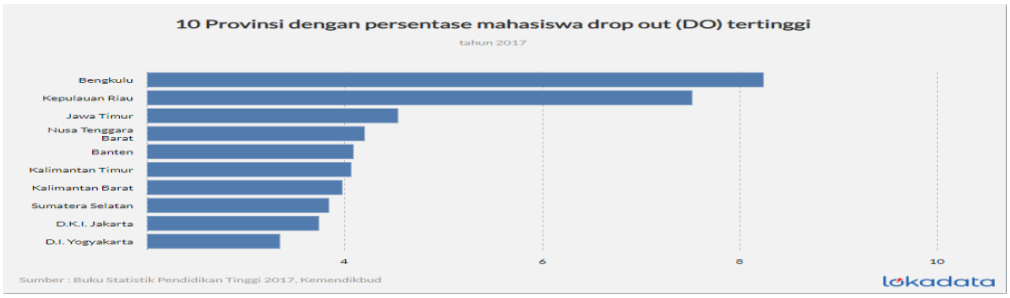

Fig 1.1. Ranking of dropout percentage in East Java (Kemenristekdikti: 2017).

Dropout is a scourge and a challenge throughout higher education. Because the effect of dropout is disastrous for all parties. Not only students, dropouts have a big impact on families and universities (Irchamiyati: 2020: 54).The high and low student dropout rate greatly affects the results of BAN-PT accreditation of study programs to institutions. As in universities in other regions, the Kediri regional campus must also pay attention to the dropout rate in Kediri. In the 2019 academic records, the percentage of student dropouts at IAIN Kediri was 14%, while UIN Sunan Ampel in the same year had a dropout rate of 8.9%. The

difference is quite large, a campus that was established at the same time but in its development shows different circumstances.

IAIN Kediri and UIN Sunan Ampel as the oldest campuses in Kediri have efforts to continue to improve themselves, develop and continue to advance (Choiru: 2022: 146). Various efforts are always made to improve the quality and integrity of this religious campus. In controlling student dropout problems, IAIN Kediri and UIN Sunan Ampel need a method to determine the potential for student dropout based on certain factors by designing dropout prevention management in which sustainable and systematic management is implemented.The management model that most intersects with the implementation and monitoring of student dropout prevention is academic advising management. The academic advisory process is an intensive process of student academic guidance carried out during students' studies in higher education, the academic advisory process involves academic advisory lecturers (PA), academic advisory lecturers are “permanent teaching staff who are appointed and assigned the task of guiding students (Hafidudin: 2013: 24). The lecturer is obliged to guide students to be successful in their studies. Academic advisory lecturers do not change as long as they are still students, except in certain conditions such as the lecturer's death, chronic illness or the like. This is intended, so that the accompanying lecturer can monitor the progress of student studies.The continuous process of academic advising in guiding students requires a special strategy to anticipate student dropout from the start. So with this system and management, it is hoped that the campus will be able to provide intensive full service in an effort to prevent student dropout early on and be able to take special policies early on in an effort to minimize student dropout rates.

Dropout control management that contains certain techniques, is able to process data in such a way that useful outputs are obtained in providing considerations in policy making for the rector, faculty, study program to the level of academic supervisors, so that dropouts can be anticipated early and minimized.Clustering algorithms are often chosen in the world of business, industry, and also education. The clustering algorithm that can be used is the K-means clustering algorithm. Data analysis with the K-means algorithm is by dividing the data into several clusters. Furthermore, the level of similarity and dissimilarity is analyzed based on the collected data. The next step is to analyze how the relationship pattern between data (Larose: 2005: 165). The use of the K-means method is often done to analyze the potential for Dropout. Research that has been conducted by Adi Firmansyah and his team in grouping potential dropout students in the Informatics Engineering study program at IKIP Siliwangi (Firmansyah: 2017: 6). The research uses IPS parameters, GPA, and the number of credits that have been taken. Related research was conducted by Windania and his team by analyzing the potential dropout for students using the Support Vector Machine method (Purba: 2018), (Saxena: 2018: 72).The k-means method has problems in terms of speed, determining the cluster center (Reza Wahyu: 2019: 6720). If applied to data in large categories, it will be quite difficult to accommodate. So a special method is needed that can overcome the weaknesses of the k-means method. This k-means algorithm has weaknesses that can be refined by the k-means algorithm through initializations or detecting the center point (centroid) at the beginning of cluster formation using certain conditions.

Therefore, the data processing of determining students who have the potential to dropout will be proposed using cluster analysis of dropout students with the k-means algorithm. Furthermore, the results of this cluster analysis data processing as an initial step in implementing dropout prevention strategy management.Academic advising management is an activity carried out to manage the academic advising process in higher education, so that student advising assistance is structured, systematic and directed in its process to achieve predetermined goals. Academic advising management is carried out so that the transformation of students into graduates desired by the predetermined educational objectives can take place effectively and efficiently. Academic advising management is the process of managing all matters relating to student academic advising in higher education, from planning, organizing, supervising and evaluating student academics in higher education, to completing studies through the creation of an atmosphere conducive to the effective teaching and learning process (Soetjipto: 2009: 165). Student management in relation to the dropout control process is very tangent to the management of academic counseling in higher education, with good academic counseling management expected to increase the ability of higher education in dealing with the student dropout problem at hand. At least organizing academic advising management,

will be able to prevent the emergence of various kinds of problems originating from inside and outside the campus and be able to improve the ability of universities to deal with dropout problems.

II. METHODS

The approach in this research is mixed method. The procedure is to collect, analyze, and mix quantitative and qualitative methods in one study. The qualitative approach is used to answer the first problem, namely, the management of college academic advising in reducing student dropout rates at UIN Sunan Ampel Surabaya and at IAIN Kediri, to find it, researchers use qualitative data analysis. Quantitative methods are used to answer the second and fourth problem formulations, namely, the application of clustering methods in early detection of potential student dropouts using the K-means data meaning algorithm at UIN Sunan Ampel Surabaya and IAIN Kediri and the accuracy level of analyzing potential dropout students with the K-means method.

III. RESULT AND DISCUSSION

Quantitative Findings (Stage 1)

The results of cluster formation at UIN Sunan Ampel Surabaya found the best number of 8 clusters. For 8 clusters divided into (Very High (C1), Very High (C2), High (C3), Somewhat High (C4), Somewhat Low (C5), Low (C6), Very Low (C7), Very Low (C8)).

Table 1.2. data on the results of the formation of 8 clusters of UIN Sunan Ampel Surabaya

Cluster	IPK	SKS	Semester	Jumlah	Prosentase
C1	1,539	41,0	2,6	3799	15%
C2	2,131	24,3	3,4	574	2%
C3	3,309	92,7	7,7	320	1%
C4	3,526	139,3	9,4	2396	9%
C5	3,592	20,8	2,9	7102	27%
C6	3,615	65,2	4,1	4338	17%
C7	3,557	146,8	10,1	3414	13%
C8	3,621	113,9	6,3	3884	15%

There are 10 entry points at UIN Sunan Ampel Surabaya, namely UMPTKIN, SBMPTN, SNMPTN, SPANPTKIN, independent achievement, independent regular, special program, foreign partnership (old), foreign partnership (new), domestic partnership, and transfer path. Based on the 10 entry points, the largest number of students who belong to cluster 1 is still owned by students who enter the Regular Independent pathway with a large percentage of 33%, while the least number of students who are classified into cluster 1 is still owned by students whose entry points are domestic partnerships, foreign partnerships, old partnerships and transfers, namely 0%.Based on the 9 faculties at UIN Sunan Ampel Surabaya, the largest number of students who belong to cluster 1 is owned by Tarbiyah students with a percentage of 19%. While the faculty with the least number of students who belong to cluster 1 is the Faculty of Psychology and Health (FPK) with a percentage of 4%. Based on study programs, the largest number of students belonging to cluster 1 is owned by the psychology study program with 117 students, followed by the sharia economics study program with 102 students while the study program with the least number of students belonging to cluster 1 is owned by the teacher profession program with a large percentage of 0%.The highest silhouette coefficient value on the clustering results at UIN Sunan Ampel Surabaya is on the mapping with the number of clusters 8. The average value owned by the silhouette coefficient of each data object in a cluster shows how feasible the data is included in the cluster. Based on the data of IAIN Kediri's silhouette coefficient value is cluster 8 with a silhouette coefficient value of 0.840 which is between $0.7 < SC \leq 1$, it can be concluded that the cluster model obtained has a strong structure. The results of the formation of clusters in IAIN kediri obtained the best number of 10 clusters and 3 clusters. For 10 clusters divided into (Very High (C1), Very High (C2), High (C3), somewhat High (C4), Medium (C5), Somewhat Low (C7), Low (C8), Very Low (C9), Very Low (C10).

Table 1.3. Data on the formation of 10 clusters of IAIN Kediri

Cluster	IPK	SKS	Semester	Jumlah	Prosentase
C1	0,06	10	2	4726	26%

C2	2,04	87	7	203	1%
C3	3,22	43	5	690	4%
C4	3,52	19	2	1667	9%
C5	3,48	141	8	2080	11%
C6	3,43	149	9	2913	16%
C7	3,53	106	5	728	4%
C8	3,52	23	2	1492	8%
C9	3,62	65	3	2308	13%
C10	3,65	113	5	1410	8%

In cluster 1 with a very high potential for dropout, it is known that the number of students with PTN independent entrance pathways is 1446 students. There are 64 students in the Independent PTS entrance, 1025 students in the PMDK (SPAN-PTKIN) entrance, and 5405 students in the UMB-PTN (UM-PTKIN) entrance. Based on the four entry points, the largest number of students belonging to cluster 1 is owned by students who enter the UM-PTKIN route with a large percentage of 68%, while the least number of students who are classified into cluster 1 is owned by students with the PTS Mandiri entry point with a large percentage of 1%.Based on the faculty, namely the Faculty of Tarbiyah (FT) as many as 2088 students. At the Faculty of Economics and Islamic Business (FEBI) as many as 568 students, the Faculty of Sharia (FS) as many as 452 students, and the Faculty of Ushuluddin and Da'wah (FUD) as many as 905 students, then, the largest number of students who belong to cluster 1 is owned by the Faculty of Tarbiyah with a large percentage of 38%, while the faculty with the least number of students who belong to cluster 1 is owned by the Faculty of Sharia with a large percentage of 8%. Based on the study program, the largest number of students belonging to cluster 1 is owned by the Islamic Education Study Program with a total of 1132 students, followed by the Tadris English study program amounting to 561 students, while the study program with the least number of students who tegolong into cluster 1 is owned by the Islamic Studies study program with 1 student.

The highest silhouette coefficient value on the clustering results at IAIN Kediri is on the mapping with the number of clusters 10. The average value owned by the silhouette coefficient of each data object in a cluster shows how feasible the data is included in the cluster. Based on the data of IAIN Kediri's silhouette coefficient value is cluster 10 with a silhouette coefficient value of 0.790 which is between $0.7 < SC \leq 1$, it can be concluded that the cluster model obtained has a strong structure. Based on the results of data analysis that has been done previously using manova analysis, the findings of the relationship between the variable k-means clustering method on academic advising management are obtained, the results of ANOVA analysis show that there are significant differences between groups in the influence of independent variables on the dependent variable, F (469.179) = 8, p = 0.000. The significant p value indicates that there is a significant influence between the k-means clustering method on academic advising management at UIN Sunan Ampel Surabaya. Likewise, with the relationship between the variable k-means clustering method to academic advising management at IAIN Kediri, the results of ANOVA analysis showed a significant difference between groups in the effect of the independent variable on the dependent variable, F(244.8227) = 10, p = 0.000. The significant p value indicates that there is a significant influence between the k-means clustering method on academic advising management at IAIN Kediri.

While the relationship between the variable k-means clustering method and early detection of student dropout is obtained F(1,272,286) = 8, p 0.000. The p value which is less than 0.05 indicates a significant effect, meaning that there is a significant influence between the k-means clustering method and the early detection of student dropouts at UIN Sunan Ampel Surabaya, as well as the relationship between the k-means clustering method variable and the early detection of student dropouts obtained the value of F (1,227,459) = 10, p 0.000. A p value of less than 0.05 indicates a significant effect, meaning that there is a significant influence between the k-means clustering method on early detection of student dropout at IAIN Kediri.Based on the results of multivariate data analysis on student data at UIN Sunan Ampel Surabaya and IAIN Kediri, it can be concluded that there is a significant influence between the k-means clustering method on academic advising management, besides that there is also a significant influence between the k-means clustering method on early detection of student dropouts, both at UIN Sunan Ampel and IAIN Kediri. In the

k-means clustering method, potential student dropout clusters were obtained ranging from C1 (the cluster of students with the highest dropout potential) to C10 (the cluster of students with the lowest dropout potential). based on the results of the data analysis of the difference test with manova analysis, it was found that there was a significant influence between the use of k-means clustering on academic advising management, both at UIN Sunan Ampel Surabaya and IAIN Kediri.

Based on the results of the hypothesis testing of the relationship between the k-means clustering method variables and academic advising management for UIN Sunan Ampel Surabaya student data, the Multivariate Significance Test results for UIN Sunan Ampel Surabaya student data are obtained as described in the multivariate significance test table for UIN Sunan Ampel Surabaya student data and the univariate significance test results for UIN Sunan Ampel Surabaya student data in table 38 and table 39. ANOVA analysis was conducted to analyze the average difference between groups on one dependent variable. The results of ANOVA analysis show that there is a significant difference between groups in the effect of independent variables on the dependent variable, $F(469.179) = 8$, $p = 0.000$. The significant p value indicates that there is a significant influence between the k-means clustering method on academic advising management at UIN Sunan Ampel Surabaya. The results of the Multivariate Significance Test for UIN Sunan Ampel Surabaya student data as described in the multivariate significance test table for UIN Sunan Ampel Surabaya student data and the results of the univariate significance test for UIN Sunan Ampel Surabaya student data in table 38 and table 39.ANOVA analysis was performed to analyze mean differences between groups on one dependent variable. The results of ANOVA analysis show that there is a significant difference between groups in the effect of the independent variable on the dependent variable, $F(469.179) = 8$, $p = 0.000$.

The significant p value indicates that there is a significant influence between the k-means clustering method on academic advising management at UIN Sunan Ampel Surabaya. While the relationship between the variable k-means clustering method and early detection of student dropout is obtained $F(1,272,286) = 8$, p 0.000. The p value which is less than 0.05 indicates a significant effect, meaning that there is a significant effect between the k-means clustering method and early detection of student dropouts at UIN Sunan Ampel Surabaya.While the results of hypothesis testing the relationship between variables k-means clustering method with academic advising management for student data IAIN Kediri obtained the results of Multivariate Significance Test for student data IAIN Kediri as in the results of multivariate significance test and univariate significance test results IAIN Kediri student data in table 40 and table 41. The results of the ANOVA analysis show that there is a significant difference between groups in the effect of the independent variables on the dependent variable, $F(244,872) = 8$, $p = 0.000$. The significant p value indicates that there is a significant effect between the k-means clustering method and academic advising management at IAIN Kediri.While the relationship between the variable k-means clustering method and early detection of student dropout is obtained $F(1,272,459) = 8$, p 0.000. The p value which is less than 0.05 indicates a significant effect, meaning that there is a significant influence between the k-means clustering method on early detection of student dropouts at UIN Sunan Ampel Surabaya.

Interpretation of Quantitative Findings

Mapping of potential dropout students resulting from k-means clustering data analysis obtained for IAIN Kediri obtained 10 clusters with a silhouette coefficient value of 0.790 and 3 clusters with a silhouette coefficient value of 0.770. while at UIN Sunan Ampel Surabaya obtained 8 clusters silhouette coefficient value of 0.840 and 9 clusters silhouette coefficient value of 0.820. Based on the silhouette coefficient value data both at UIN Sunan Ampel and IAIN Kediri which is between $0.7 < SC \leq 1$, it can be concluded that the cluster model obtained has a strong structure. The analysis results above show that the clustering method with k-means clustering can be applied to find out students who have the potential to dropout early. These results are supported by some previous research results. The application of the k-means clustering method can identify potential dropout students early (Vhallah: 2018: 577). The results of the k-means clustering method can be used to draw conclusions in determining potential dropout students (Windania: 2018: 6). K-means clustering makes it possible to find the characteristics of students and use these characteristics in predicting future performance and knowing students who have the potential to dropout (Firmansyah: 2017:

6).K-means clustering is the simplest clustering algorithm compared to other clustering algorithms. This algorithm has the advantages of being easy to implement and run, relatively fast, easy to adapt, and most widely practiced in data mining tasks (Heryadi Teguh: 2009). Based on the comparison of the predictive ability of non-hierarchical algorithms, it is concluded that the k-means clustering algorithm is better used to group data into a number of clusters (Rosni: 2014).

While the finding of a significant effect between the kmeans clustering method and student academic advising management explains that this can provide valuable insights for institutions in improving the effectiveness of academic advising. K-Means clustering can assist in identifying groups of students with similar advising needs. By understanding the differences between these groups, institutions can develop a more targeted and personalized academic advising approach. By knowing which groups of students tend to require more assistance, institutions can set priorities for resource allocation and the development of appropriate intervention plans. Based on the findings of K-Means clustering, institutions can develop mentoring programs that are specifically tailored to the needs of each group of students, such as additional academic advising programs, study skills training, or emotional support.The finding of a significant effect of k-means clustering on early detection of student dropout can provide valuable insights in developing prevention and intervention strategies. K-Means clustering can help identify groups of students who have a high likelihood of dropout. With a better understanding of the characteristics and behaviors of these groups, institutions can direct their prevention and intervention efforts more effectively. Findings from K-Means clustering analysis can be used to develop early warning systems that allow institutions to identify students at risk of dropout before they reach a point of no return. This can allow institutions to provide additional support or intervention programs immediately. By understanding the unique needs of each group of students, institutions can develop more targeted and personalized support plans to help students overcome the obstacles they may face in their academic journey.

Qualitative Findings (Phase II)

Management of college academic advising in reducing student dropout rates at UIN Sunan Ampel: Planning of academic advisors in reducing dropout rates. Based on the analysis of the results of interviews with deans, vice deans, caprodi, sekpro, academic advisors and students as well as the results of observations, and documentation on the SINAU system, it was found that the planning of guardianship was carried out with:Guardianship planning has been contained in the SOP for academic advising authorized by UIN Sunan Ampel and integrated in the campus website and academic advisor book. Planning starts with the issuance of a guardian lecturer decree by the academic administration department. Submission of guardianship by related officials at the beginning of each semester and every lecturer meeting. Planning includes determining KRS, career guidance, and academic development. The faculty coordinates with the caprodi and sekprodi regarding guardianship. Supervision scheduling between students and lecturers, at least once a semester.Organizing academic advisors in reducing dropout rates. Based on the analysis of the results of interviews with deans, vice deans, caprodi, sekpro, academic advisors and students as well as the results of observations, and documentation on the SINAU system found that the organization of guardianship is carried out by: 1)

Academic advisors are determined by the faculty, manifested in the SOP for academic advising, 2) The criteria for academic advisors are permanent non-civil servant lecturers who have NIDN and lecturers according to the department in the study program. 3) The distribution of academic advisors has not been divided ideally. 4) Especially in the Tarbiyah faculty, the division of academic lecturers is ideal. 5) Some academic advisors do not have a room.Implementation of academic advisors in reducing dropout rates. Based on the analysis of the results of interviews with deans, vice deans, caprodi, sekpro, academic advisors and students as well as the results of observations, and documentation of the SINAU system, it was found that the implementation of guardianship was carried out by: 1) Academic supervisors have been stated in the decree and guardianship SOP. 2) Announcement of educational administrative schedules by the university, guiding students in the course registration process, guardianship guidance, course approval, providing motivation, career coaching and counseling. 3) Guidance process through the SINAU platform. 4) Guidance is carried out offline and on line. 5) Guidance both individually and in groups. 6) Guidance is generally

carried out around academic issues, scheduling, and other academic issues. 7) Some lecturers provide rewards and punishments to their students. Academic advising management at UIN Sunan Ampel can illustrate that the implementation of guardianship more often focuses only on KRS programming.

a. Supervision of academic supervisors in reducing dropout rates.

Based on the analysis of the results of interviews with deans, vice deans, caprodi, sekpro, academic advisors and students as well as the results of observations, and documentation of the SINAU system, it was found that the supervision of guardianship was carried out by: 1) academic advisors oversee student problems during college, taking courses or filling out KRS, SPP deposits, and GPA, and 2) Academic advisors supervise the progress of academic development and control student grades. Academic advising management at UIN Sunan Ampel can illustrate that the supervision process is only limited to academic administration, has not been scheduled and is not comprehensive.

b. Management of college academic advising in reducing student dropout rates at IAIN Kediri

Planning academic advisors in reducing dropout rates: Planning the guidance schedule in accordance with the time span determined by the campus, planning student studies, providing advisory advice on courses programmed in accordance with the student's academic performance index so that students can take courses ideally, validating and certifying student plan cards on the SIAKAD system, planning guardianship duties contained in the academic guidebook and decision letter (SK) guardianship but not yet compiled SOP guardianship.

Organizing academic supervisors in reducing dropout rates: Determination of the criteria for lecturers who are entitled to become academic advisors, namely study program homebase lecturers, civil servant lecturers, permanent non-civil servant lecturers, and lecturers with NIDN, the ratio of academic advisors and students is not ideally divided, academic advisors do not have a special room for advising, academic advising lecturer benefits are still quite low.

Implementation of academic advisors in reducing dropout rates: Based on the analysis of the results of interviews with deans, vice deans, caprodi, sekpro, academic advisors and students as well as the results of observations and documentation on the SIAKAD system, it was found that the implementation of guardianship was carried out by: The institution announces the schedule for the implementation of the study plan card (KRS), Lecturers make guardianship agreements with students through online or offline media, Students meet lecturers for the purposes of KRS programming, leave applications, UKT delays, scholarship needs, and research title guidance.

Supervision of academic advisors in reducing dropout rates: Based on the analysis of the results of interviews with deans, vice deans, caprodi, sekpro, academic advisors and students as well as the results of observations, and documentation on the SIAKAD system, it was found that the implementation of guardianship was carried out with: Supervision is carried out by correcting student activities in accordance with the established plan, Academic advisory lecturers only supervise the extent of what is required by students, Supervision is carried out on every student activity on campus only, Supervision is limited to filling KRS, SPP payments, GPA, and the process of implementing lectures, Supervision is carried out by calling the students concerned, Not all academic lecturers carry out supervision properly. Academic supervision management at IAIN Kediri can illustrate that the supervision process is only limited to academic administration, unscheduled and not comprehensive.Supporting factors for the implementation of academic health management.

Based on the results of interviews and observations, the implementation of academic health management at IAIN Kediri and UIN Sunan Ampel found several supporting factors. Namely, internal encouragement includes: desire or hope for the future, individual innate, awareness, past experience and external encouragement includes: praise and reward (Reward and phunisment), coercion, role models of academic supervisors, knowing the results, rivals or competition. Factors inhibiting the implementation of academic health management. Based on the results of interviews and observations, the implementation of academic health management at IAIN Kediri and UIN Sunan Ampel Surabaya found several inhibiting factors. Namely, internal factors include: limited resources, lack of knowledge and skills, unclear roles and

responsibilities, lack of motivation and external factors include: workload (Based on the results of interviews, students' busyness with extracurricular activities, work, and personal responsibilities become obstacles in effective academic guidance).

Discussion Findings and Quantitative and Qualitative Interpretation (Integrative)

Efforts to reduce dropout rates can be done by mapping the potential for student dropout, efforts to reduce student dropout rates can be used the following steps: Data Collection: collecting student academic and non-academic data, including data related to student profiles recorded in SIAKAD including Student Grade Point Average (GPA), Semester Credit Units (SKS), Semesters taken, While mapping other cluster objects is mapped based on the following variables Gender, College entry path, Faculty, Study Program, Class / Year of College Entry, school origin, student academic status. Data Processing: preprocess the data, including removing unnecessary data, adjusting inconsistent data, and converting the data format into a form suitable for analysis.Selection of Clustering Methods: selection of clustering methods that are suitable for data in college SIAKAD. In this case, the clustering method chosen is a commonly used method, namely the K-Means data meaning algorithm: Clustering: uses the selected clustering algorithm to group students based on pre-selected features. Each cluster may represent a group of students with similar characteristics. Cluster analysis: analyze the clusters resulting from the clustering process. Identify the distinctive features of each group and understand why students in that group may be considered at risk of dropping out.Validation: validate the clustering results using an evaluation metric, namely using silhouette scroce to ensure the quality of the clustering. Intervention: once groups of potential dropout students are identified, colleges can design appropriate intervention programs for each group. This could include mentoring, counseling, academic guidance programs, or other additional support. Monitor and Evaluate: conduct regular monitoring of the effectiveness of the intervention programs that have been implemented. Continuous evaluation is required to assess if there is any improvement in the retention rate of students.

Early detection of potential student dropout plays an important role in efforts to reduce college dropout rates in higher education. This process involves identifying students who are at high risk of dropping out before the problem becomes serious. In this way, universities can provide timely interventions and the necessary support to keep students on the path to graduation. There are several potential student dropout detection strategies that can be employed. Namely, the use of data analysis (Ren Y: 2015: 89), development of prediction models (Koper: 2013: 1058), intervention based on findings (Tinto: 1975: 125), development of support programs (Baker: 2014: 3-19), continuous monitoring (Gao: 2017: 134-141). Further action can be taken by maximizing the management function of academic advising in an effort to assist students from the beginning of college to the completion of their studies in higher education. By combining these strategies, universities can effectively reduce dropout rates by paying special attention to at-risk students. This approach is with sensitivity and attention to the needs of each student.The management of academic counseling at UIN Sunan Ampel and IAIN Kediri has largely been implemented, but there has not been found a detailed health guide either in the form of SOPs or academic guidelines. In fact, good management will improve the quality of students (Hasrian: 2021). Based on the results of both qualitative and quantitative research findings, the following points were found: Planning, based on the findings of planning in each institution, shows that the planning stage has not been actualized either in the form of documents or socialization. This is indicated by the SOP contained in the institution at the planning stage is still very general so that academic advisors cannot make more specific plans and only focus on student learning outcomes.

In fact, if planning can be arranged in more detail, the output that will be produced by lecturers is clearly measured. One of the planning stages can be done by clustering students to detect early student situations and early detection of potential student dropouts by taking steps, namely data collection, data processing, and selection of clustering methods. Organizing, the organizational stage of academic nursing at IAIN Kediri and UIN Sunan Ampel has been carried out with evidence of the existence of a decree on the division of academic nursing duties, but the ratio of academic advisory lecturers to students is not ideal because one academic advisory lecturer can handle more than 20 students with planning that has not been

well structured. The organizing principle, especially the distribution of tasks professionally, should be evenly distributed according to their fields of expertise (Yansen: 2021). This has a direct impact on the performance of academic health which is not carried out optimally because there will be more than ten students who are not supervised by academic advisors. Supposedly in the organizing process, the stages that must be carried out are grouping, student group analysis and validation. This is also a stage of the k-means clustering method.The implementation, implementation management stage at IAIN Kediri and UIN Sunan Ampel only focuses on checking tuition fees and KRS checking even though it should not only cover these things but also include personal development and career development (Permendikbud: 2014).

By using the k-means clustering method, after analyzing the groups and obtaining validation of the quality of the grouping, students' potential can be identified both academically, personally or career-wise. This process is called the intervention process, where if this process has been passed then the academic advisor will have a real picture of the situation. students and can carry out academic advising using methods according to student needs.Supervision, the results of the findings at the supervision stage show that academic advisory supervision is only dominated by supervision from the leadership to the academic advisor lecturers. Meanwhile, academic advisors to students only provide learning development services. According to the health services sector, there should be three service areas, namely personal development services, learning development and career development (Permendikbud: 2014). Based on this, it can be concluded that the academic advisor lecturer has not supervised the personal development and career development of students. Meanwhile, at the management stage, the monitoring and evaluation section greatly influences the entire managerial process which has implications for the desired results (Ara Hidayat: 2009). Based on the results of the quantitative interpretation, if the k-means clustering method is carried out periodically then automatically monitoring and evaluation activities will also be carried out because monitoring and evaluation activities are needed to see student retention levels.

IV. CONCLUSION

The application of the Clustering Method in early detection of potential student dropouts using the Data Meaning k-means algorithm at UIN Sunan Ampel Surabaya and IAIN Kediri is carried out in the following steps: determine the first initial centroid randomly from the data, then calculate the closest distance from the centroid which will produce the centroid new ones used in the next iteration. Grouping was carried out 10 times, namely forming 1 to 10 clusters. Then the two best clusters are selected. By grouping by forming 1-10 clusters. Then two best clusters were obtained, for grouping at UIN Sunan Ampel two best clusters were obtained, namely 10 clusters with cluster C1 (very high 26% dropout), up to C10 (very low potential for 8% dropout). Meanwhile, the next best number of clusters analyzed by K-means clustering produced 3 potential dropout clusters spread across C1 (very high dropout 44%), C2 (medium dropout potential 17%), and C3 (very low dropout potential 39%). Meanwhile, the next best model was analyzed by K-means clustering, resulting in 5 potential dropout clusters spread from C1 which had a very high dropout potential to C5 which had a very low dropout potential. The level of accuracy of students' analysis of potential Dropout using the K-means method is considered good, it has the ability to cluster large data. The level of grouping accuracy uses Silhouette coefficient analysis. In the academic data of IAIN Kediri students, based on responding data, the optimal number of clusters was obtained, namely 10 clusters with a Silhouette coefficient value of 0.790 and 3 clusters with a Silhouette coefficient value of 0.770.

The IAIN Kediri silhouette coefficient value is between $0.7<SC<1$, it is concluded that the cluster model obtained has a strong structure. The level of grouping accuracy uses Silhouette coefficient analysis. Academic data for UIN Sunan Ampel Surabaya students, calculations that correspond to the data, the optimal number of clusters is 8 clusters with a Silhouette coefficient value of 0.840 and 5 clusters with a Silhouette coefficient value of 0.820. Data on the silhouette coefficient value of UIN Sunan Ampel Surabaya is between $0.7<SC<1$ and it can be concluded that the cluster model obtained has a strong structure.The influence of the k-means clustering method on academic advisory management from the results of MANOVA analysis is as follows: there are significant differences between groups in the influence of the independent variable on the dependent variable. The results of the ANOVA analysis showed that there were significant differences

between groups in the influence of the independent variable on the dependent variable, F (469.179) = 8, p = 0.000. There is a significant influence between the k-means clustering method on academic advisory management at UIN Sunan Ampel Surabaya. ANOVA analysis shows that there are significant differences between groups in the influence of the independent variable on the dependent variable, F(244.8227)= 10, p= 0.000.

The significant p value indicates that there is a significant influence between the k-means clustering method on academic advisory management at IAIN Kediri. The influence of the k-means clustering method on early detection of student dropout at UIN Sunan Ampel Surabaya shows the relationship between the k-means clustering method variables and early detection of student dropout. A p value of less than 0.05 indicates a significant influence, meaning that there is a significant influence between the k-means clustering method on early detection of student dropout at UIN Sunan Ampel Surabaya. The relationship between the variables of the k-means clustering method and early detection of dropout for IAIN Kediri students was found to be F(1,227,459)=10, p 0.000. A p value of less than 0.05 indicates a significant influence, meaning that there is a significant influence between the k-means clustering method on early detection of student dropout at IAIN Kediri. Management carried out by academic advisor lecturers (DPA) in efforts to prevent student dropout at IAIN Kediri and at UIN Sunan Ampel is by planning, organizing, acting, controlling.

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