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Decision Support System for Determining Problematic Students Using the Analytic Network Process (ANP) Method

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ABSTRACT
In the world of primary and secondary education in Indonesia, educational guidance and counseling services aim to help students become individuals who can overcome problems well. In general, teenage students cannot be separated from the problems they face, especially during the transition period because these problems can disrupt students' learning activities. Teacher Counseling Guidance (BK) or counselor is a teacher who is obliged to provide direction and guidance to students. One of the problems faced by schools is that it is difficult to determine quickly and precisely which students really need to be given direction and guidance immediately. In this research, a decision support system was created using the Analytical Network Process (ANP) method for problematic students who needed counseling services. ANP is a decision making method that has many or multiple criteria and methods. The result of this research is a decision support system that can determine problematic students so that this system can help schools, especially guidance and counseling teachers/counselors, take the right approach to problematic students.

Keywords: ANP, guidance, teacher, counseling, method, student, system

INTRODUCTION
School rules and regulations are rules and regulations made by the school. Each school has different regulations(Afrila, Fitria, Amalia, Imrayani, & Safitri, 2023). In the world of education, obeying school regulations or not breaking the rules is the main aspect of forming students in creating self-understanding with personal skills and learning outcomes, making students with good behavior and achievement as well as school regulations so that student learning activities at school run efficiently and effectively(Surya & Wahyu, 2020).

SStudents are students who are experiencing a development process and are vulnerable to existing problems(Afiani & Faradita, 2021). Problematic students are one of the factors that influence the comfort of the teaching and learning process in the school environment.(Syaputra, Khairullah, Pahrizal, & Mahfuzi, 2023). Understanding information about problematic students' attitudes is a guide for making improvements to students in the future(Susanty, 2022). The student violation in question can obtain data about the students' attitudes(Susanty, 2022). Students can be said to be good, not good, quite good, not good, not good if the violation causes changes in the course of learning in class.(Dwiyanti & Dermawan, 2020).

The class teacher and guidance counselor who will carry out an analysis of violations among students are expected to be able to find out information about the attitudes and behavior that are violated by students, so that the class teacher can take steps to overcome violations for students who have problems in the form of tests or counseling guidance services.(Yuniarthe & Wahyudi, 2021). Awareness of discipline

should be able to grow and develop in students based on their own awareness because even though teachers, homeroom teachers and school principals are responsible for enforcing discipline among students, the implementation must be based on the students' awareness and will.(Fandini, Sulatani, & Susanto, 2018).

One method that can make decisions that solve problems based on interrelated criteria and cannot be structured hierarchically(Sanusi, 2023). Analytic Network Process (ANP) is a development method of the Analytic Hierarchy Process (AHP) method. The ANP method can accommodate a relationship between criteria and alternatives and relative measurements(Irawan, 2018).

Several studies have studied problematic students and their violations, namely research by FD Wihartiko, applying the Analytical Network Process (ANP) method to display the ranking of sanctions at the Bogor Infokom Vocational School using a point system for students who commit school violations and these points will be processed for three once a month and an evaluation is carried out(Wihartiko, Tosida, & Sentosa, 2018). Research by H. Sitohang, applies the SAW method to determine students who commit violations at the Mulia Pratama Medan Private Middle School using a system that provides information and can also help by generating an alternative solution for students for each violation committed.(Sihotang & Siboro, 2016). Research by A. Widhiyanti, I. Candiasa, K. Aryanto, applies the implementation of AHP-TOPSIS and Naïve Bayes to make decisions in providing guidance to students at SMAN 5 Denpasar which will give rise to a system that will determine which students' priorities will come first given counseling guidance along with treatment.

Based on the explanation above, the author is interested in applying the ANP (Analytic Network Process) method in determining problem students at Angkasa Bandung High School. This research aims to develop an effective decision support system with ANP to minimize student problems, with a focus on 2021 student data and certain assessment criteria such as subject grades, social life, and violations. This research also limits the cases considered to the light level and does not process serious cases such as serious crimes. The output of this research is a system that can help schools determine problematic students and the results will be published in national seminars and scientific journals.

RESEARCH METHODS

In this research, the method used includes several important steps. First, assessment criteria are determined, which include subject grades, attendance, social life, discipline, obedience, and achievement. Data is collected in two categories: criteria (subject grades, social life, violations) and alternative (names of students). A literature study was carried out to find references related to the ANP method, while the field study was applied to science and social studies students at Angkasa Lanud Husein High School, Bandung. Observations were carried out to collect student report card data as a reference, followed by interviews with related parties. Data processing includes software design which includes determining criteria, creating pairwise matrices, weighting, and calculating scores to produce rankings of problematic students.

*Analytical Network Process (*ANP)

The Analytical Network Process (ANP) method is a method that can improve the weaknesses of the ANP method in the form of a capability that supports the relationship between criteria and alternatives.(Frastian, Katarina, & Heriyati, 2018).

RESULTS AND DISCUSSION

A. History of Angkasa High School

Angkasa Lanud Husein Sastranegara High School is a school under the auspices of the Ardhya Garini Foundation which was founded on May 19 1980. Starting with members of the Indonesian Air Force who served in the Husein Sastranegara environment, at that time they had difficulty finding an existing high school (SMA). In the Husein Sastranegara neighborhood there are only junior high schools (SMP). The parents of these pre-soldiers had to send their children to high school which was very far away, because the situation became increasingly difficult, finally the families of these soldiers proposed to the commander to establish a high school (SMA) in the area. This assumption was accepted by Mrs. Dahlia M. Diran, as chairman of the Srihdya Garini Foundation, branch V of Husein Sastranegara Air Base(Sofiati & Sumarni, 2016).

This Angkasa High School is under the auspices of the Ardhya Garini Foundation, the Adhi Upay Foundation and the educational cooperation agency for Husein Sastranegara Air Base at the current location of the high school. At the beginning of its establishment, Angkasa High School only had 4 classes, due to the large number of sons and daughters of military personnel who wanted to register. Eventually it was added to 5 classes and was immediately inaugurated on August 30, 1980.(Yulizah, 2019).

B. Data collection

The data used in this research is data taken from the Counseling and Student Affairs Office of SMA Angkasa Lanud Husein Sastranegara Bandung. This data was created in 2019/2020. The following is a table of criteria and alternatives:

1. Criteria

Table 1. Criteria

No	Criteria
1	a. B. Indonesia b. Mathematics c. Biology d. B. Germany e. PIE f. PKN g. B. English h. Physical education i. SBK j. Crafts k. B. Sundanese
2	Social Spirit
3	Violation

2. Alternative

Table1. Alternative

No	Alternative
1	Student1
2	Student2
3	Student3

4	Student4
5	Student5

C. Alternative Analysis

Alternative analysis in this research focuses on alternative data which is a collection of information about student choices to be assessed. This data consists of problematic students at Angkasa Lanud Husein Sastranegara High School. This research aims to select students who show behavior or academic performance that indicates problems, using the ANP (Analytic Network Process) method to produce rankings. ANP is a decision-making method that allows structured and objective assessment and comparison.

D. Criterion Analysis

In this research, there are five main criteria used to assess problematic students, each with relevant sub-criteria. These criteria include:

1. Subject Values

   These criteria are used to assess students' academic results in various subjects. This is important because academic grades can indicate problems in a student's learning process, even if they attend consistently. Sub-criteria in this criterion include subjects such as Indonesian, Mathematics, Biology, German, Islamic Religious Education (PAI), Citizenship Education (PKN), English, Physical and Health Education (Penjas), Arts and Culture Skills (SBK) , Crafts, and Sundanese.
2. Social Spirit

   This criterion evaluates students' character, attitudes and social interactions both in the school environment and outside of school. A good social spirit can reduce the possibility of students committing violations. This evaluation is important to understand students' attitudes and feelings that may influence their behavior.
3. Violation

   This criterion examines the frequency and types of discipline violations committed by students. This type of violation includes internal violations determined by the school and serves to assess the extent to which students follow existing rules.

E. Analytic Network Process (ANP) Calculations

Data collection involved gathering information through observation and various sources such as subject grades, rule violations, and student needs questionnaires (AKPD) provided by guidance and counseling teachers and students at Angkasa Lanud Husein Sastranegara Bandung High School. Following data collection, criteria for decision-making were established, including subject grades, attendance, social life, discipline, and violations, with each criterion assigned a weight based on its importance in student assessment. The weight value of each alternative was determined using a weight table, categorizing course marks into ranges such as below 75 (Not Good), 75-82 (Fair), 83-90 (Good), and above 91 (Very Good). A pairwise comparison matrix was then used to compare priorities between criteria, aiding in determining the relative weight of each criterion. After comparison, the normalization matrix was calculated by dividing values in the comparison matrix by the number of columns, with the eigenvalue derived as the average of the normalization results to determine the final priority of the criteria. Finally, the

consistency ratio was calculated to ensure the comparisons were consistent, using the Consistency Index (CI) and Consistency Ratio (CR) formulas to measure the consistency of the decisions made.

F. System Design

This system involves one main actor, namely the user, who has access to manage the data and features in the system, including student data, users, criteria, and criteria analysis. The business use case describes the interaction between the user and the system which is designed to produce decisions regarding problematic students by providing data management and calculation features using the ANP method. Use case diagrams explain interactions between actors and systems, while use case scenarios describe operational details such as login, management of criteria and student data, as well as ANP processes, including how users interact with the system and the system's reactions to user actions. The activity diagram shows the flow of activities between the user and the system, including management of criteria and student data as well as the ANP process, illustrating the interaction of various system components to achieve goals. Sequence diagrams describe interactions between objects in the system to achieve certain goals, such as managing criteria data, students, and ANP calculations, as well as how information is processed and transferred between objects. Class diagrams visualize the system structure in terms of technical components, including tables used to store student data, criteria, and grades, as well as relationships between classes in the system. The database design is designed to store the required information, including criteria tables, students, criteria values, and users, with an efficient table design to ensure data can be accessed easily and supports system functions. The design and design of this system aims to create an effective decision aid tool in assessing problematic students, ensuring all relevant aspects are considered, and providing accurate and reliable output.

Implementation And Testing

1. Implementation

At the implementation stage, the software is developed according to the previous design using a personal computer to facilitate the testing process. This software is web-based, built with the PHP programming language and using the Studio Code or Notepad++ tools, while Google Chrome is used as a browser, and the MySQL database and Apache Web Server are integrated through the XAMPP application. The database is implemented following the design that has been created, with the MySQL database as the basis. The implementation includes various tables such as Criteria, Criteria_Value, Students, Student_Criteria_Value, Student_Value, Alternatives, Alternative_Values, and User. Each table is organized to store the required information according to the system being developed, ensuring a data structure that suits the application needs. The interface implementation in this system includes several key components designed to manage various functions. The Login Interface is the first page displayed when the system is started, where the admin can access the system by entering the registered email and password. The Criteria interface allows users to manage student criteria with create, update, read, and delete functions. The Student Interface is designed to manage student data with create, update and delete options. The ANP process is implemented to calculate and display the matrix after criteria selection, while the Alternative Node interface is used to select alternative data and display the relevant matrix. Finally, the User interface allows managing user data with create, update, and delete functions.

2. System Testing

Testing is an activity carried out to test a system that has been built. This is done with the aim of testing the quality of the system whether it is in accordance with the design or not. The testing carried out in this research is by using Black Box Testing which focuses on functional testing of the software and identifying bugs to be fixed before release.

CONCLUSION

Based on research conducted by applying the Analytic Network Process (ANP) method, it can be concluded that this method is able to produce values and ranking order. Although ANP provides a measurement scale for determining priorities, this method relies heavily on user input, such as admins or decision makers who must have knowledge and experience related to the choices made, considering that the ANP calculation process involves many stages. In analyzing and designing a decision support system to determine problematic students, this research aims to display a ranking sequence for problematic students, where the system created produces data about students who require special treatment as recommendations for decision makers. The implementation of ANP at Angkasa Lanud Husein Sastranegara High School was successful by determining the reference criteria for decision making, rating the suitability of each alternative for each criterion, assigning value weights to the criteria, normalizing the matrix, and ranking using the superlimit matrix to find the largest value for each alternative. System testing using black box testing shows 100% results, indicating the system is running well and can display the ANP calculation results. Determining problematic students produces an accuracy of 55% with the top 10 rankings according to school determination. However, this research still has errors and limitations, so it is recommended for further system development, such as adding alternative data export features to avoid inputting data one by one, as well as improving the user interface to make it more attractive.

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