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E-mail:ambidex@takaza.id

Analysis of Patterns Causing Low Interest of High School Students to Continue Their Education to Higher Education Using the Association Rule Mining Algorithm (Apriori)

Hairun Nisah
Muhammadiyah University of North Sumatra
Corresponding Author e-mail: nisapakpahan34@gmail.com

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Abstract: *The low interest of high school students in continuing their education to college is influenced by various internal and external factors that have complex relationships. This study aims to identify patterns of factors causing low student interest and determine the strength of the relationship between factors using the Association Rule Mining (Apriori) algorithm. This study uses a quantitative approach with data mining methods. The study population was high school students who were at the decision-making stage of continuing their education to college, while the research sample was students who completed the research questionnaire. The research instrument was a closed questionnaire with eight indicators including interest in continuing their education, family economic conditions, academic ability, parental support, college information, social environment, personal motivation, and access to college. Data analysis was carried out through the stages of pre-processing, data transformation, formation of frequent itemsets, and evaluation of association rules based on support, confidence, and lift values. The results of the study indicate that the developed web-based application is able to generate frequent itemsets and association rules that describe the relationship between factors causing low student interest in continuing their education. The conclusion of this study shows that the Apriori algorithm can be used as a method to support educational decision-making by identifying dominant factors related to students' interest in continuing their education to college.*

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Introduction

The development of information technology in the digital era has increased the amount of data generated by various fields, including education. Student academic and non-academic data needs to be systematically analyzed to produce useful information to support decision-

making. According to Puspaningrum et al. (2020), data is a collection of raw facts that are meaningless without further processing.

One phenomenon that continues to be a concern in the field of education is the low interest of high school students in continuing their education to higher education. This interest is influenced by various factors, both internal and external. According to Irfani et al. (2025), internal factors include learning motivation, personal interests, self-confidence, and aspirations, while external factors include family economic conditions, parental support, social environment, and information about higher education.

The problem in analyzing low student interest lies in the complex interrelationships between factors. Commonly used descriptive statistical methods are still limited in describing general conditions and are unable to identify deeper patterns of inter-factor relationships.

To overcome these limitations, analytical methods capable of discovering patterns of relationships between variables are needed. Data mining is one approach that can be used to extract hidden information from data sets. According to Lapa Lay et al. (2025), data mining is part of the Knowledge Discovery in Database (KDD) process, which aims to discover hidden patterns and knowledge from large data sets. Association Rule Mining can be used to discover relationships between variables through "If-Then" rules (Wang et al., 2022).

This study aims to identify factors contributing to the low interest of high school students in continuing their education to higher education, determine the patterns of relationships between factors, and measure the strength of relationships based on association rules using the Apriori algorithm. This research is important to conduct data-driven analysis that can provide an understanding of the dominant factors influencing student interest. The novelty of this study lies in the application of the Apriori algorithm with support, confidence, and lift parameters to discover patterns of relationships between factors. According to Fitriani et al. (2022), the Apriori algorithm is used to identify frequent itemsets and form association rules based on support and confidence values.

Research Methods

This study used quantitative data mining methods to analyze the interrelationships between factors contributing to high school students' low interest in continuing their education to higher education. The method used was Association Rule Mining with the Apriori algorithm. According to Lapa Lay et al. (2025), data mining is the process of discovering hidden patterns and knowledge from large data sets.

The Apriori algorithm is used to find frequently occurring factor combinations and form association rules based on support, confidence, and lift values. According to Fitriani et al. (2022), the Apriori algorithm is used to identify frequent itemsets and form association rules based on support and confidence values.

The research instrument was a closed-ended questionnaire with "Yes" or "No" answer options given to high school students. The questionnaire consisted of eight indicators: interest in continuing education, family economic situation, academic ability, parental support, college information, social environment, personal motivation, and access to college.

The questionnaire data were analyzed using the Apriori algorithm through preprocessing, data transformation, frequent itemset formation, and association rule formation. Association Rule Mining was used to discover relationships between variables through "If-Then" rules (Wang et al., 2022). Association rule evaluation was performed using support, confidence, and lift values. Support indicates the occurrence rate of itemsets, confidence indicates the level of trust in the relationship between items, and lift is used to objectively determine the strength of the relationship between factors.

The population of this study was high school students who were in the decision-making stage

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of continuing their education to higher education. The research sample was obtained from high school students who completed a questionnaire as respondents. Data collection was conducted in February 2026 through in-person and online questionnaire distribution. The collected data were then checked for completeness before being used in the analysis process.

The research procedure involved several stages: data collection, data pre-processing, data transformation, Apriori algorithm analysis, and association rule evaluation. The questionnaire data was first examined and organized to prepare it for use in the analysis process.

The transformation stage involves converting respondents' answers into itemsets suitable for the Apriori algorithm. Next, the system searches for frequent itemsets and forms association rules based on minimum support and confidence values. The resulting association rules are then evaluated using support, confidence, and lift values to determine the relationship patterns between factors. Rules that meet the criteria are analyzed to identify the dominant factors contributing to students' low interest in continuing their education at university.

Results and Discussion

System Requirements

System requirements are the initial step in identifying the components required for application development to meet the research objectives. The developed application is web-based, employing the Association Rule Mining (Apriori) algorithm to analyze student interest patterns in continuing their education at university based on questionnaire data.

This application provides features for dataset management, analysis category selection, minimum support and confidence parameter settings, Apriori processing, and results presentation in the form of frequent itemsets, association rules, support, confidence, and lift values, result interpretation, and PDF reports. To support application implementation and testing, system requirements are divided into hardware and software.

1. Hardware Requirements

   Hardware is one of the components needed to support the development and testing processes of the applications used in this research. All activities, from program creation and database management to dataset processing and system testing, require the support of devices with specifications tailored to the application's needs.

   Application development was conducted using an Acer Aspire 5 laptop as the primary device. The laptop was used to perform various stages of web-based system development, such as writing program code, configuring the local server, managing the database, and implementing the Apriori algorithm in data analysis.

   The device has 8 GB of RAM, enabling smooth application development, including running multiple software programs simultaneously. Furthermore, a 256 GB SSD is used to store source code, databases, research datasets, and various other supporting files required during implementation.

   With the support of these hardware specifications, all stages of application development, implementation, and testing can be carried out properly so that the system built is able to operate according to research needs.

2. Software Requirements

   Software is one of the components used to support the development, implementation, and testing of applications in this research. All software used plays a role in writing program code, managing databases, processing datasets, and running applications throughout the research process.

   In application development, Visual Studio Code is used as an editor to create and manage source code. Applications are built using the PHP programming language, the

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primary language for web-based system development, while MySQL is used as a database management system to store and manage user and respondent data.

During implementation and testing, the application was run using XAMPP as a local server, providing Apache and MySQL services. Furthermore, the Bootstrap framework was used to build the application interface, making it more presentable, responsive, and user-friendly.

Dataset file reading and processing are performed using the PhpSpreadsheet library, allowing the application to process datasets in CSV and XLSX formats. All application features are accessed and tested through a web browser, allowing users to easily perform analysis.

The software has been tailored to the needs of the system being developed, ensuring that the data management process, the implementation of the Apriori algorithm, and the presentation of the analysis results can run smoothly in accordance with the research objectives. (software).

System Implementation

System implementation is the stage of realizing the design results into a usable application that meets the research objectives. At this stage, the system design is realized in the form of a web-based application so that each created function can be run and tested as needed.

The developed application is used to analyze student interest patterns in continuing their education at university using the Association Rule Mining (Apriori) algorithm. This application allows users to manage research data, select analysis categories, determine minimum support and minimum confidence values, and run the analysis process to derive association rules from questionnaire data.

The application was developed using the PHP programming language, supported by MySQL for data storage. The application ran on a local XAMPP server during implementation and testing. Additionally, Bootstrap served as the interface framework to create a clean, responsive, and user-friendly application.

The application features include a dashboard, dataset upload, dataset list, Apriori Process, and analysis results. In the Apriori Process menu, users can select a dataset, define an analysis category (either Low or High Interest), and enter minimum support and minimum confidence values. The analysis results are displayed in the form of frequent itemsets, association rules, support, confidence, and lift values, result interpretations, suggestions, conclusions, and a PDF report.

Through the implementation of this application, research data processing can be conducted more systematically and efficiently. The resulting analysis can help users identify patterns of relationships between factors related to students' interest in continuing their education at university, which can be used to support decision-making.

1. Login Page

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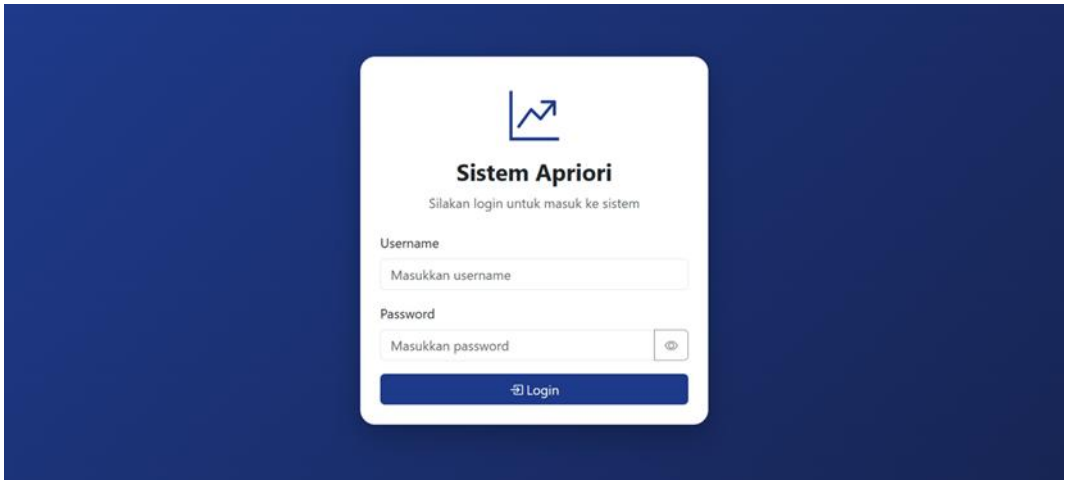

Figure 1 Login Page

Based on Figure 1, the login page consists of username and password fields, which are used for user authentication before accessing the application. Additionally, a feature is available to show or hide the password to make it easier for users to verify the entered data. After the user presses the Login button, the system will validate the data. If the data matches the database, the user will be redirected to the dashboard page. If the data does not match, the system will display a message indicating a failed login.

2. Dashboard Page

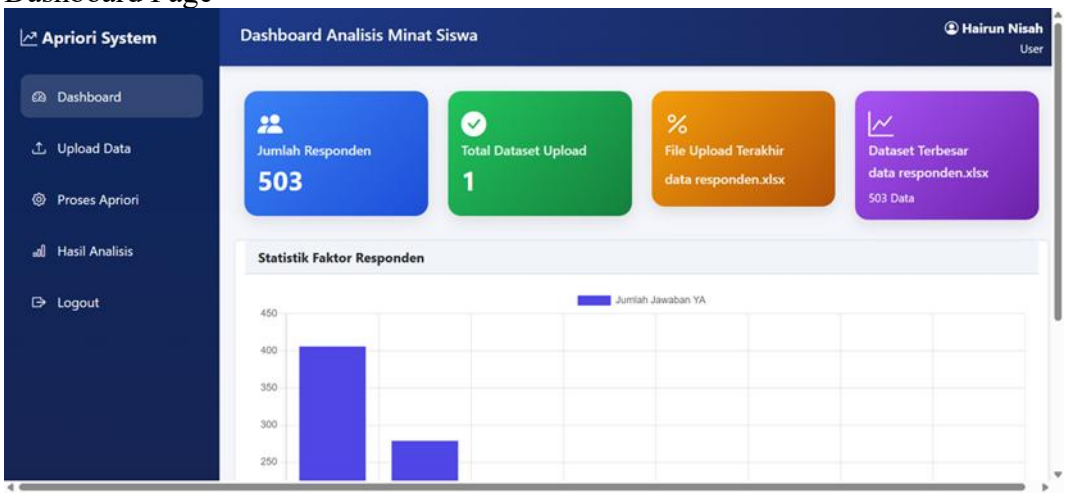

Figure 2 Dashboard Page

Based on Figure 2, the dashboard page presents key information regarding the research data available in the system. The information displayed includes the number of respondents, the total number of uploaded datasets, the most recent dataset file, and the dataset with the largest number of respondents. Furthermore, the dashboard displays a statistical graph of respondent factors as a visualization of the number of "Yes" responses to each research factor, allowing users to obtain an initial overview of the data's condition before conducting the Apriori analysis process.

3. Upload Data Page

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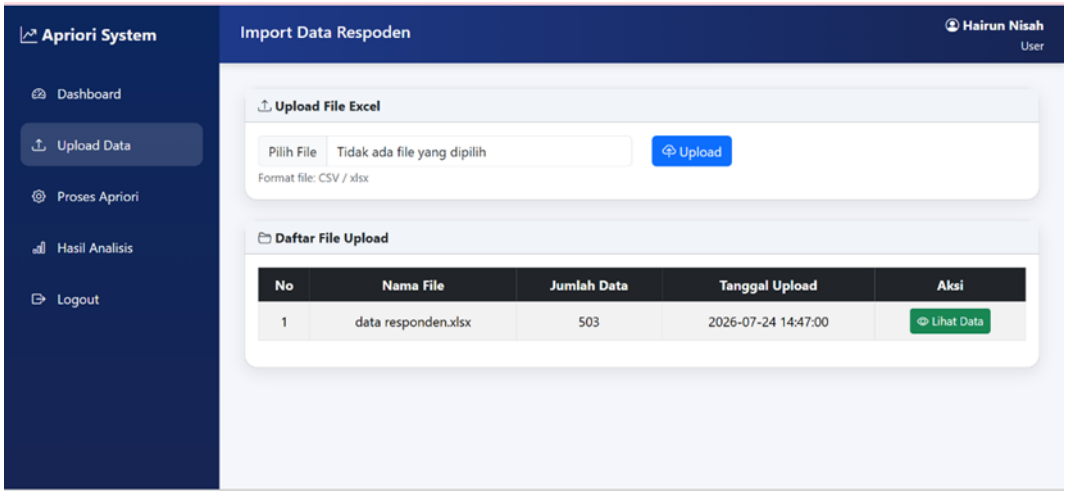

Figure 3 Data Upload Page

Based on Figure 3, the Upload Dataset page is used to enter respondent data into the system for analysis. Users can select a CSV or XLSX file and then upload it using the Upload button. Once the upload process is complete, the system will display a list of saved datasets, including the file name, data amount, upload date, and a View Data button to view the contents of the successfully uploaded dataset.

4. A Priori Proseis Page

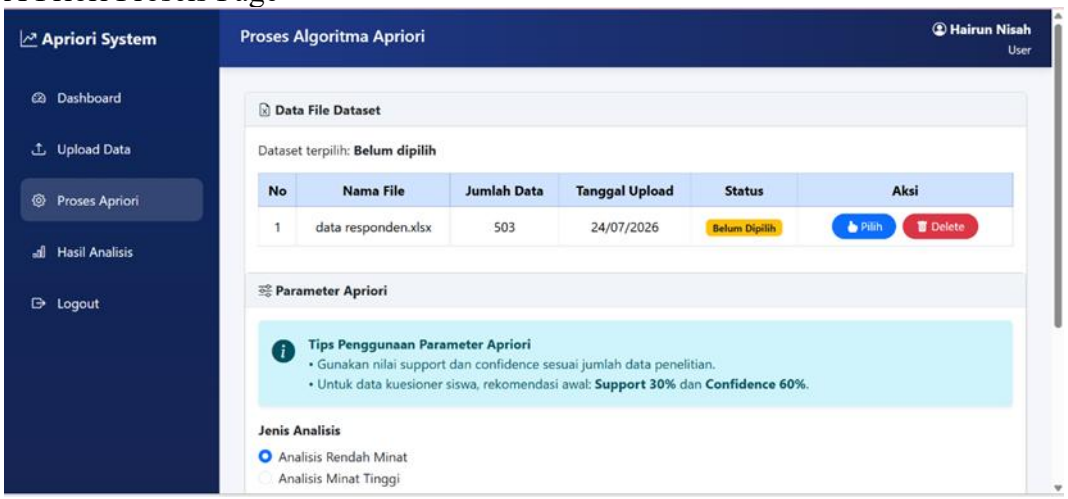

Figure 4 Apriori Process Page

Based on Figure 4, the Apriori Process page allows users to select the dataset to be used for analysis. On this page, users can specify the type of analysis, enter minimum support and minimum confidence values, and then run the Apriori process. Additionally, information on parameter usage is provided as a guide for users to determine appropriate values before the analysis process begins.

5. Analysis Results Page

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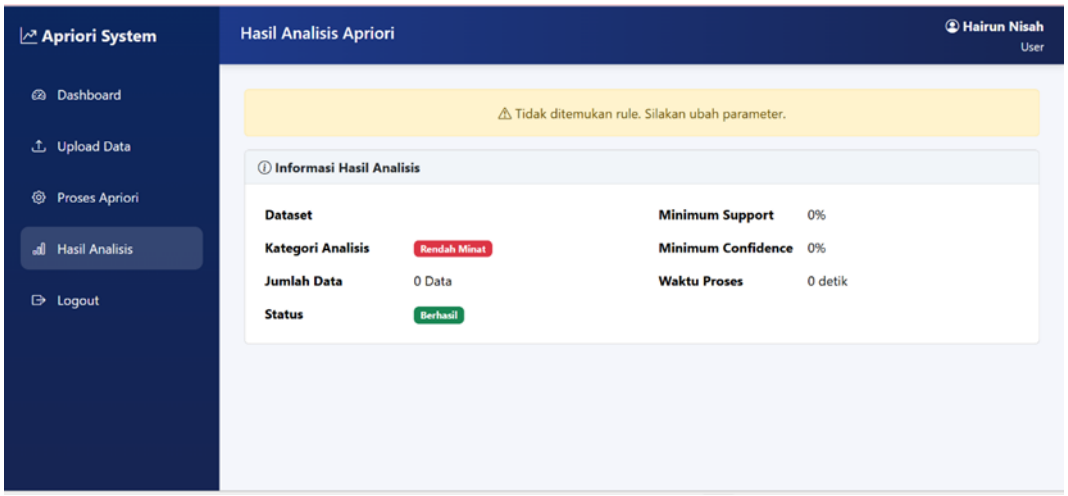

Figure 5 Analysis Results Page

Based on Figure 5, the Analysis Results page presents a summary of the analysis results obtained from the Apriori algorithm application. Information displayed includes the dataset used, analysis category, data amount, minimum support value, minimum confidence, processing time, and analysis status. If an association rule has not been found, the system displays a notification prompting the user to readjust the parameter values before re-running the analysis.

System Testing

System testing is a stage carried out to ensure the developed application functions according to research requirements. This stage aims to test each feature to ensure that all processes in the application run according to design.

In this study, testing was conducted on the main features of an application that implements the Association Rule Mining (Apriori) algorithm. The testing included the dataset upload process, dataset selection, analysis category determination, minimum support and minimum confidence value settings, the Apriori process, and the analysis results displayed by the system.

Through the testing phase, the consistency between input data, the analysis process, and the output results can be determined. Thus, the application is expected to produce accurate information and support the analysis of student interest patterns in continuing their education at university.

1. Dataset Upload Testing

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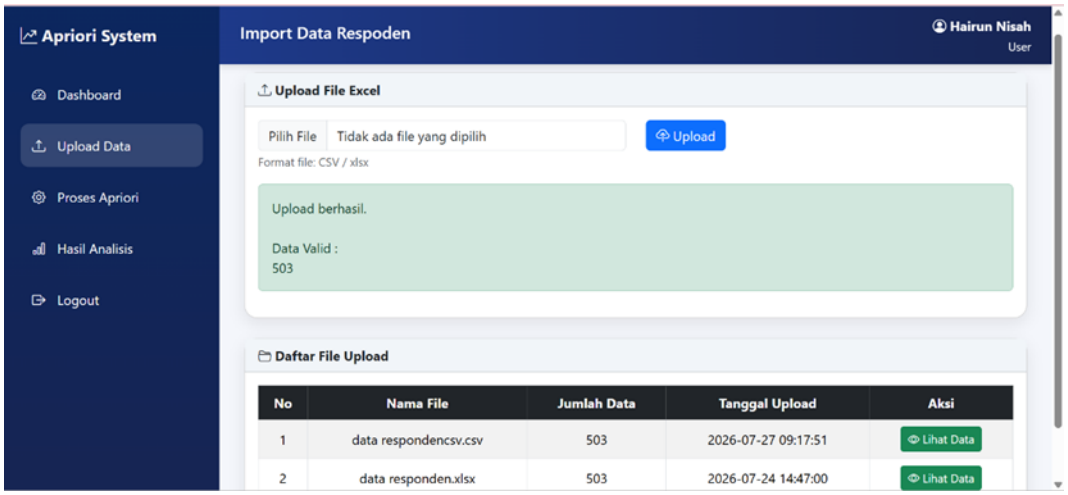

Figure 6 Dataset Upload Test

Based on Figure 6, the dataset upload process was successful. The system displays information that the file was successfully processed along with the number of valid data points. The dataset is then saved to the system and displayed in the file list, ready for use in the analysis process using the Apriori algorithm.

2. Apriori Process Testing

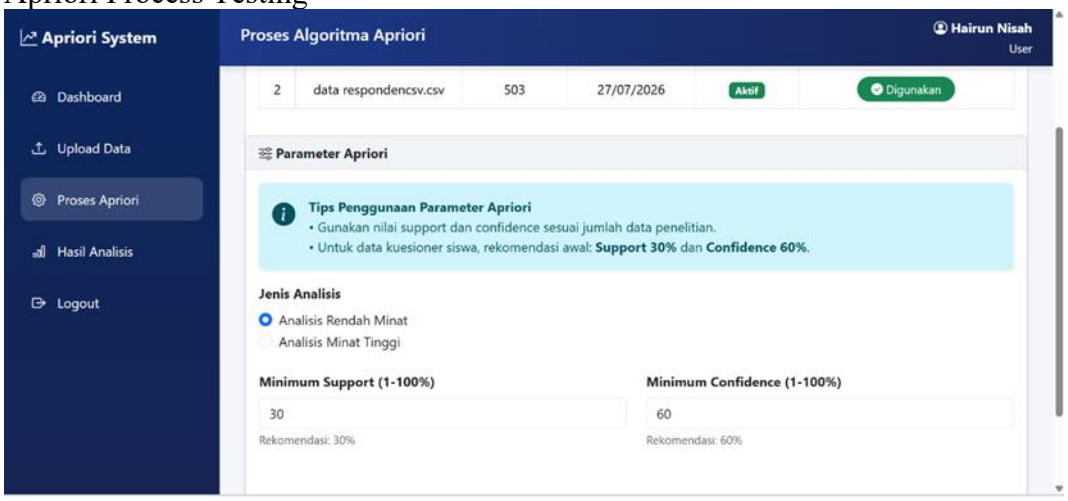

Figure 7 Apriori Process Testing

Based on Figure 7, the user has selected the dataset to be analyzed, then specified the analysis type as Low Interest with a minimum support value of 30% and a minimum confidence value of 60%. These parameters are used by the system as the basis for running the Apriori algorithm to generate frequent itemsets and association rules.

3. System Output Testing

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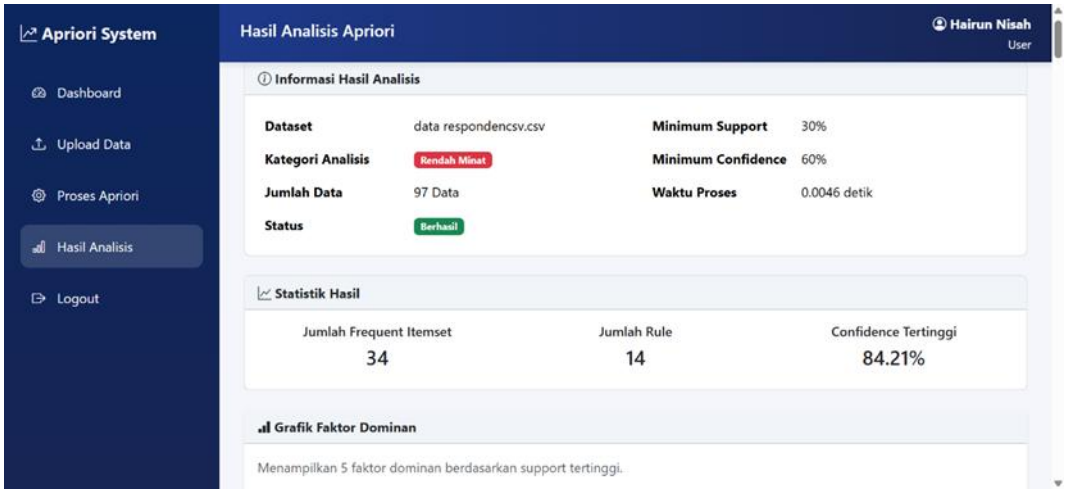

Figure 8 System Output Testing

Based on Figure 8, the system displays analysis results information, including the dataset name, analysis category, amount of data processed, minimum support value, minimum confidence, processing time, and analysis status. Furthermore, the system also displays result statistics, including the number of frequent itemsets found, the number of association rules formed, and the highest confidence value, providing users with an overview of the analysis results.

Figure 9 Testing the Output of Frequent Itemset 1-Itemset

Based on Figure 9, the system successfully displays a 1-itemset frequent itemset that meets the minimum support value. Each factor is presented along with its level of occurrence in the research data, allowing users to identify the most dominant factors based on the Apriori analysis results.

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Figure 10 Testing the Output of Frequent Itemset 2-Itemset

Based on Figure 10, the system displays a 2-item frequent itemset consisting of a combination of two factors that frequently appear together in the research data. Each combination is accompanied by its occurrence rate so that users can see the initial relationship between the factors before the association rule is formed.

Figure 11 Testing the Output Association Rule

Based on Figure 11, the system successfully generated association rules from the Apriori analysis process. Each rule is displayed along with support, confidence, and lift values, allowing users to determine the strength of the relationship between the factors found based on the predetermined analysis parameters.

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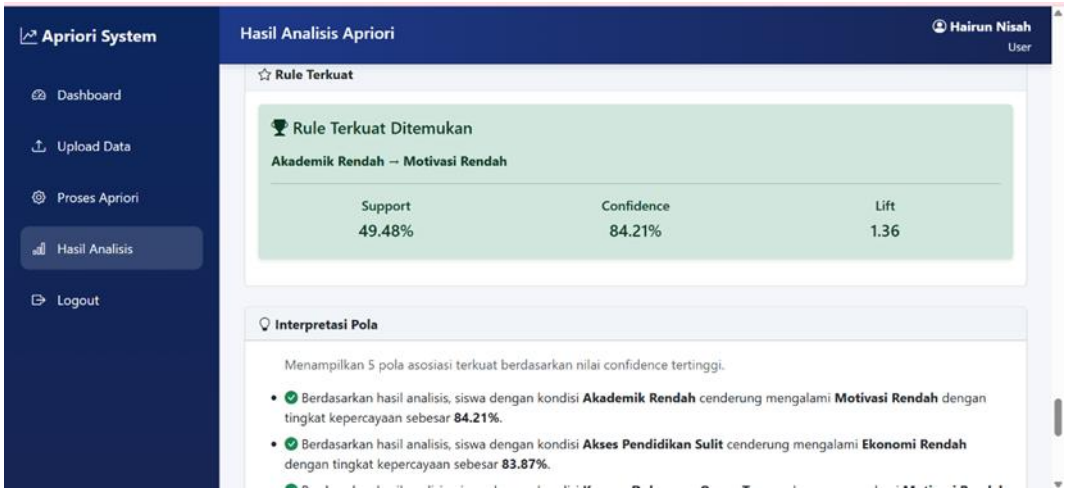

Figure 12 Strongest Output Rule Testing and Interpretation

Based on Figure 12, the system displays the rule with the highest confidence value, along with its support, confidence, and lift values. Furthermore, the system provides interpretations of several association patterns found, making it easier for users to understand the relationships between factors that have the strongest influence on the analysis results.

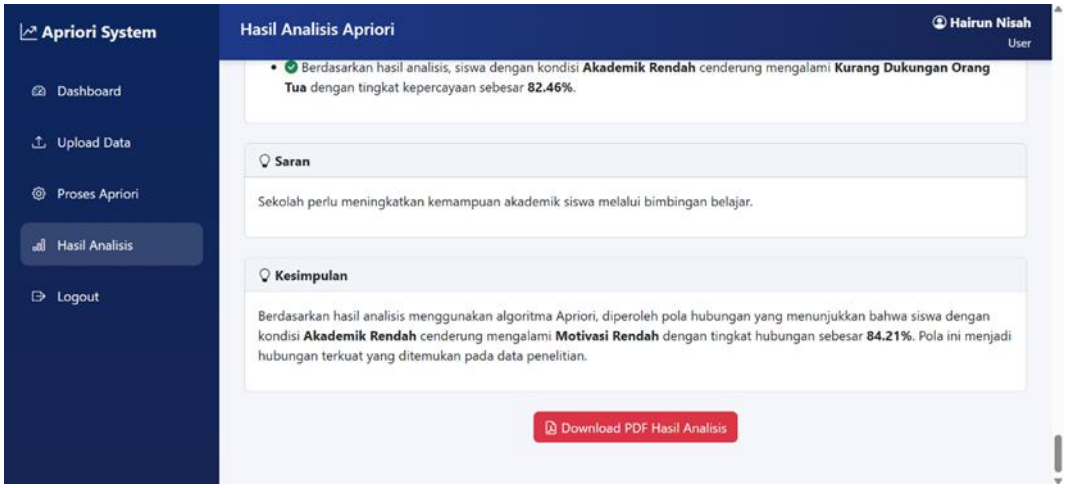

Figure 13 Output Testing Conclusions and Suggestions

Based on Figure 13, the system automatically presents suggestions and conclusions based on the results of the Apriori analysis. The suggestions are provided as recommendations that can be considered based on the patterns found, while the conclusions explain the factor relationships with the highest level of confidence, thus potentially becoming one of the main findings in the research.

System Suitability to Needs

Based on the results of the implementation and testing that have been carried out, this application has functioned in accordance with the research objectives. All available features, starting from the login process, uploading data sets, selecting data sets, setting minimum support and minimum confidence values, to the analysis process using the Apriori algorithm can be run well.

The test results show that the system is capable of processing questionnaire data and presenting analysis results according to the established parameters. The resulting knowledge includes item

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frequency, association ratio, support value, confidence, and lift, as well as being equipped with dominant factor graphs, interpretation of results, suggestions, conclusions, and intuitive facilities for generating analysis reports in PDF format.

Based on the results of the study, it can be concluded that the application has been balanced to meet the research needs in analyzing factors that influence the interest of high school students in continuing higher education using the Association Reliance Mining (Apriori) algorithm. All functions of the application can be run well so that it is able to provide information on the results of the analysis clearly and support the process of drawing research conclusions.

Conclusion

Based on the research results, it can be concluded that the application of the Association Rule Mining (Apriori) algorithm in a web-based application is able to identify patterns of relationships between factors that cause low interest in high school students to continue their education to college. The developed system successfully processes questionnaire data, forms frequent itemsets, generates association rules based on support, confidence, and lift values, and presents a systematic interpretation of the analysis results. The research findings indicate that the Apriori algorithm can be used as a supporting method in finding dominant factors related to students' decisions to continue their education, so that the resulting information can help schools, teachers, and educational stakeholders in understanding student conditions and designing strategies to increase interest in continuing their studies to college.

This study still has limitations in the number and scope of respondent data used, so the association patterns obtained do not fully represent the characteristics of all high school students in general. Furthermore, the study only used the Apriori algorithm with support, confidence, and lift parameters, so comparisons with other data mining methods have not been conducted. Future research is recommended to expand the number of respondents, involve more schools with different characteristics, and compare the Apriori algorithm with other methods such as FP-Growth or classification methods to obtain more optimal analysis results. Practically, this study contributes in the form of a data-driven analysis system that can be used as a decision-making tool in the field of education, particularly to identify factors causing low student interest and develop more targeted interventions.

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