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Implementation of the Naive Bayes Method in Looker Studio for data on the achievement of Great IDN in IDN Akhwat School

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ABSTRACT

The IDN Hebat program is an important tool for schools to track and analyze student achievement data. However, with the targeted activities in the IDN program, challenges arise in managing and measuring achievement data efficiently. The research aims to develop a Web Cloud-based data management system for IDN Hisbat achievements at IDN Akhwat School by utilizing Google Looker Studio and the Naive Bayes Algorithm. The data source used in this study is by applying a classification dataset obtained from student achievement information data in the Great IDN Program. The results of this analysis show that the highest accuracy of teaching achievement fell on the status of exceeding the target with a percentage of 89%, and the highest class that placed the status above the target was class 9A with an average percentage of 35%. In addition, the results from this analysis can help coordinators and schools in planning more effective and strategic programs in the future. Overall, this study provides important benefits in improving the quality of teaching and student coaching, as well as supporting data-driven decision-making. This study is expected to enhance the efficiency, accuracy, and effectiveness of managing student achievement, while also supporting the attainment of optimal educational goals for each student to achieve extraordinary results.

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INTRODUCTION

In the modern educational landscape, the digital recording of students' achievements has become an essential tool for schools. By transitioning from traditional paper-based records to digital systems, schools can more efficiently track, manage, and analyze student performance data (Basir et al., 2024a, 2024b; Blundell, 2021; Ibrahim et al., 2020; Rosenberg et al., 2022). Digital records allow for real-time updates and easy access to information, enabling educators to quickly identify areas where students excel or may need additional support (Bai & Li, 2021; Habib et al., 2021; Mary & Rose, 2020; Selwyn, 2022; Shrivastava & Shrivastava, 2024). This seamless integration of technology into education not only enhances the accuracy and organization of records but also provides a comprehensive view of each student's academic journey, making it easier for teachers to tailor their instructional strategies to meet individual needs.

Moreover, digital records of student achievements offer significant benefits beyond the classroom (Baker et al., 2020; Bresciani Ludvik & Wolff, 2023; Cotán et al., 2021; Haleem et al., 2022; Jaiswal, 2020). For students, these records serve as a detailed portfolio of their academic progress, which can be shared with colleges, scholarship committees, or future employers. For parents, digital access to their children's achievements fosters greater involvement in their education, as they can monitor progress and communicate more effectively with teachers. Additionally, schools can use this data to evaluate the effectiveness of their educational programs and make data-driven decisions to improve overall student outcomes. In this way, digital records play a crucial role in supporting students' long-term success and in driving the continuous improvement of educational practices.

IDN Akhwat School is an educational institution dedicated to producing a superior generation. At IDN Akhwat School, there is a program to optimize student potential. One of the flagship programs implemented is "IDN Hebat", which aims to develop students' abilities through various activities such as teaching. The IDN Hebat program has a coordinator in its activities who is responsible for planning, coordinating, managing data, communication, preparing achievement and evaluation reports, and carrying out administrative tasks related to the activities held. The program is designed to provide students with valuable experience so that they can build superior character to prepare themselves for future challenges.

With the targeted activities in the IDN Hebat program, challenges arise in managing and measuring student achievement data efficiently. The separate data collection from each IDN Hebat activity coordinator makes the storage uncentralized, resulting in the analysis of achievement data that is often time-consuming, error-prone, and ineffective in providing an accurate picture of student progress and calculation of achievement targets. To overcome this challenge, a system is needed that is able to automatically integrate achievement data from various IDN Hebat student activities and provide comprehensive analysis.

The research aims to develop a Web Cloud-based data management system for IDN Hebat achievements at IDN Akhwat School by utilizing Google Looker Studio and the Naive Bayes Algorithm. The research is expected to enhance the efficiency, accuracy, and effectiveness of managing student achievement data, while also supporting the attainment of optimal educational goals for each student to achieve extraordinary results.

METHOD

The data source used in this study is by applying a classification dataset obtained from student achievement information data in the IDN Hebat program at IDN Akhwat School. The data collected includes various indicators of achievement activities such as teaching produced by students. The dataset was used to apply the Naive Bayes method in analyzing and classifying student achievement in the Great IDN program. The results of the analysis will be visualized using Looker Studio to provide the school with in-depth insights into student achievement and assist in the evaluation and decision-making process. The method used in this study is the Waterfall method. The Waterfall method is one of the software development models that follows a linear and sequential approach. Each phase in this model must be fully completed before moving on to the next phase. This method is called "Waterfall" because the process flows like a waterfall, from one stage to the next. This method generally consists of several stages as follows:

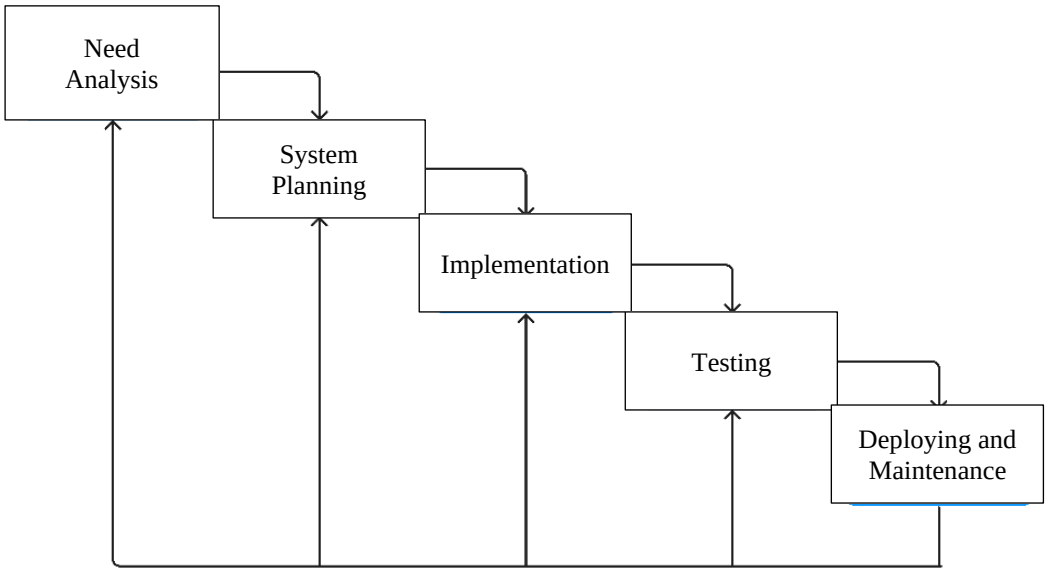

Figure 1. Research Chart

RESULTS AND DISCUSSION

Implementation of IDN Database is Great Teaching Activities

IDN Teaching Data Collection

Based on the results of observations in the research on the achievement of IDN Great Teaching Activities at IDN Akhwat School, the data used include:

a. The total number of teaching sessions carried out by each student in the period during the education level.

b. A list of schools and institutions where students teach, including the names of schools and agencies involved, as well as the number of participants from each school and institution.
c. Information about teaching activities is the name and class of the student, the date and time of teaching, and teaching materials.
d. The target number of teaching sessions that must be achieved by each student in the period during the education level.

Table 1. Number of Teaching Targets for Students

Class	Period	Teaching Target
9	3 Years	3x
8	2 Years	2x
7	1 Year	1x

This data is collected from a variety of sources that include IDN Teaching coordinator reports, academic records, as well as other relevant documentation. Each of these sources of information makes an important contribution to ensuring the accuracy and completeness of the data obtained.

Data pre-processing

The collected data is cleaned and prepared for analysis in the database using *Sheets*. This process includes handling lost data, normalizing the data, and encoding categorical variables into a format that can be processed by Naive Bayes' algorithm. Before sending data to run the Naïve Bayes Algorithm , it is to create a data classification table that includes the student's class, the student's name, the total teaching session of each student, and the achievement status.

Implementation of the Naive Bayes Method

After the data preparation process is complete, the data is imported to run the Naive Bayes algorithm. Naive Bayes' algorithm is used to calculate the probability of achievement of the Teaching IDN of each class.

Calculation of Prior Achievement Status Probability $P(C1)$

Of the 62 data used, it is known that the class MT (Exceeding the Target) is 55 data, the T class (Achieved) is 6 data and the BT class (Not Achieved) is 1 data.

Table 2. Prior Probability Data of All Student Achievements

Achievement Status	Probability
Exceeding Targets	0.89
Reached	0.10
Not Achieved	0.02

Calculation of Probability Prior to Student Class $P(C2)$

Of the 62 data used, it is known that there are 13 students in class 7A, 12 students in class 7B, 18 students in class 8A, and 19 students in class 9A.

Table 3. Probabilias Data Prior to Achievement of the Entire Class

Class	Probability
7A	0.21
7B	0.19
8	0.29
9	0.31

Calculation of Probability of Likelihood Status of Achievement Based on Student Class $P(X \mid C)$

The probability calculation of likelihood was carried out on 62 data using the frequency of the appearance of a certain achievement status in each specified class. The following is an example of the Probability calculation to determine the probability of the achievement status of Exceeding the Target in Class 7A.

Table 4. Probability of Achievement Likelihood by Class

Class	Exceeding Targets	Achieved	Not Achieved
7A	0.69	0.23	0.08

7B	0.75	0.25	0.00
8A	1.00	0.00	0.00
9A	1.00	0.00	0.00

Posterior Probability Calculation for Female Students' Classes Based on the Status of Achievement Achieved by Each Student $P(C \mid X)$

The calculation of posterior probability on 62 data involves the use of prior probability and likelihood probability to determine the class with the highest probability. The posterior probability is calculated by multiplying the probability of the prior of the Student Class by the probability of the Likelihood of Achievement Status Based on the Student Class, then dividing the result by the probability of the prior Achievement Status. The following is an example of a Posterior Probability calculation to determine the probability of Class 7A in the achievement status of Exceeding the Target. Using the prior probability of each class and the probability probability of the relevant features, we can calculate the posterior probability for each class of students. The results of this calculation will help in determining the class with the highest probability, which is the achievement status that is most likely to be achieved by students based on existing data.

Table 5. Posterior Probability of Classes Based on Achievement

Status	Class 7A	Class 7B	Class 8A	Class 9A
Exceeding Targets	0.16	0.16	0.33	0.35
Reached	0.50	0.50	0.00	0.00
Not Achieved	1.00	0.00	0.00	0.00

The results of this analysis will be used to evaluate the performance and achievements of students in the IDN Hebat program with teaching activities. In addition, the findings from this analysis can help coordinators and schools in planning more effective and strategic programs in the future. Here's the Database Link: IDN Database is Great for Teaching Activities

Implementation of the Great IDN Dashboard for Teaching Activities in Looker Studio

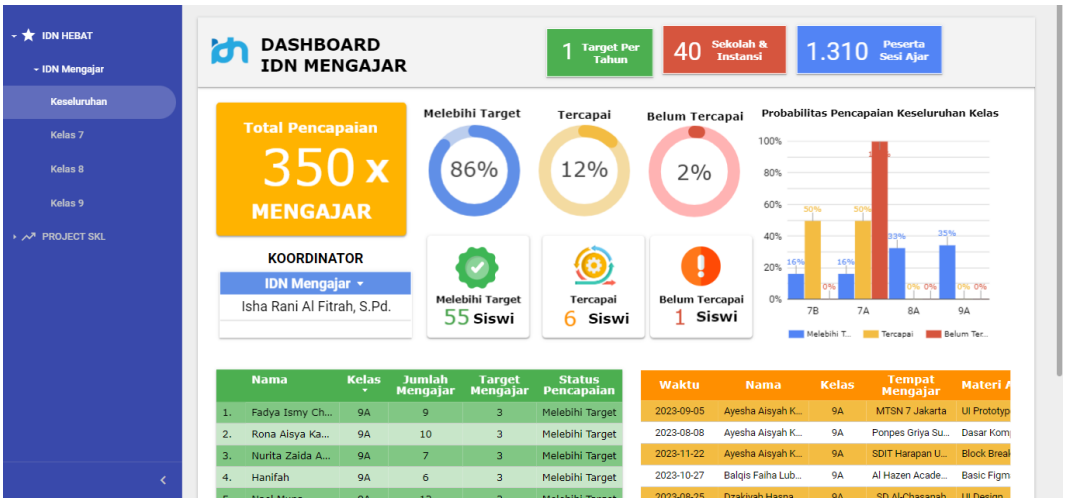

Figure 2. Overall Dashboard View of IDN Teaching – 1

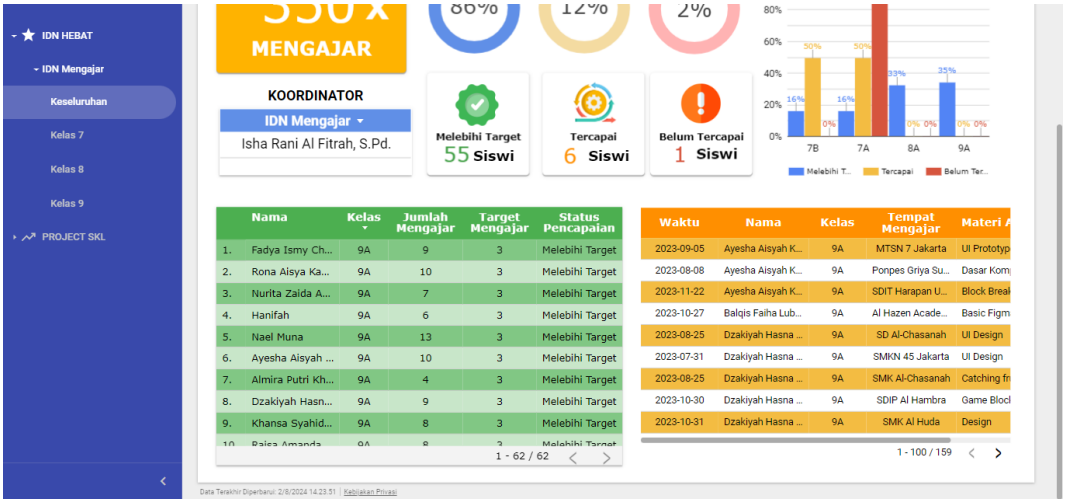

Figure 3. Overall Dashboard View of IDN Teaching – 2

On the display page of the Teaching IDN Dashboard, it has features, namely:

1) Information on Annual Targets for Teaching Students: This section displays the targets that must be achieved by students every year in teaching activities that have been determined by the school.
2) Total Information of All Schools and Institutions that Have Participated: This section displays the total number of schools and institutions that have become teaching locations for students during the teaching program.
3) Total Teaching Achievement of Students: This section displays data on the total teaching achievements that have been achieved by students. This information includes the number of teaching sessions that have been conducted, the achievement of the set targets, and the individual's achievement status (e.g., Exceeding Targets, Achieved, or Not Achieved). This data serves to provide a comprehensive overview of each student's teaching performance and assist in the evaluation and planning of future teaching activities.
4) Name of IDN Teaching Coordinator: This section presents information about the name of the IDN Teaching coordinator. The coordinator is responsible for planning, coordinating, data management, communication, reporting, and evaluation of activities in this program. The information displayed includes the full name of the coordinator. This data is important to ensure transparency and provide appropriate rewards to coordinators for their contributions to the success of the program.
5) Achievement Probability Diagram Teaching Each Class: This section presents a bar graph that displays the probability of student teaching achievement in each class. This diagram visualizes probability data that shows how likely each class is to achieve, exceed, or not achieve the predetermined teaching targets. This information is useful for understanding the distribution of achievement across different classes, identifying significant patterns, and supporting the analysis of teaching performance. With clear visualizations, users can easily compare and evaluate the effectiveness of teaching at different grade levels.
6) Teaching Achievement Status Percentage Chart: This section displays a pie chart to display the percentage of each student's teaching achievement status. This diagram visualizes the percentage of students who have achieved, exceeded, or have not achieved the teaching targets that have been set. Using a percentage chart, users can easily see the distribution and proportion of achievement status, making it easier to make data-driven decisions.
7) Number of Class Students in each Achievement Status: This section presents data on the number of students in each class based on their achievement status in teaching. This information includes how many students have achieved, exceeded, or have not achieved the teaching targets that have been set, for each class. This data is useful for providing a detailed picture of the distribution of achievement across classes, helping to identify classes that are performing well and those that need more attention.
8) Detailed Information on Teaching Activities: This section presents a table that contains complete details about the teaching activities of female students in teaching. The information displayed includes teaching time, day, date, month and year as well as teaching materials delivered. This feature provides a comprehensive overview of student involvement and contribution in teaching activities, helping to monitor and evaluate the effectiveness of teaching. With this detailed data,

users can assess the quality and consistency of teaching, as well as plan for future curriculum improvements and teaching strategies.

9) Filters for Every Class of Students: This section provides a drop down that is used for class filters if it has more than 1 level that allows users to filter and view data based on a specific student class page. By using this filter, users can easily select a specific class and view the information in the dashboard according to the achievement data of the selected grade level. This feature is designed to make it easier to analyze data in more detail and focus on each class, so that users can make more informed evaluations and make data-driven decisions more effectively.

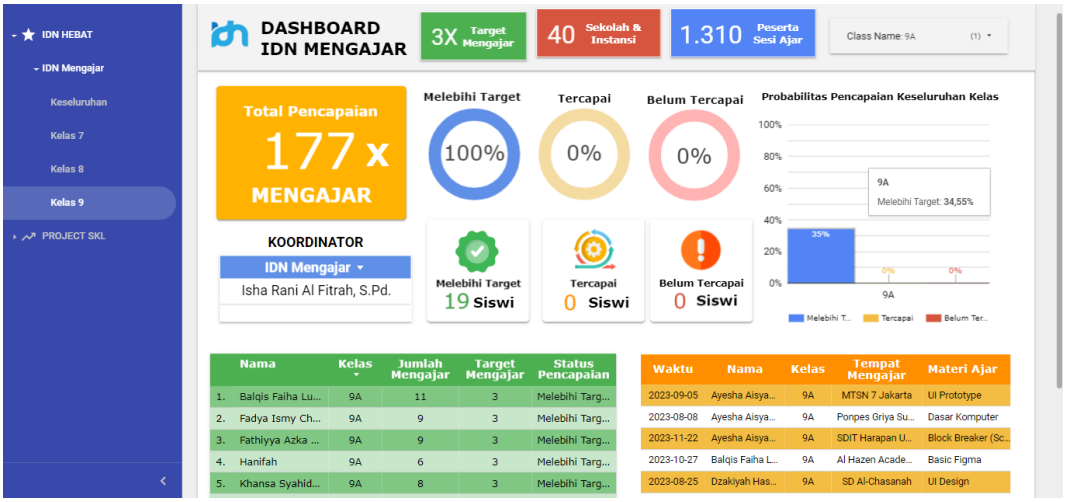

Figure 4. IDN Teaching Class 9A Dashboard Display

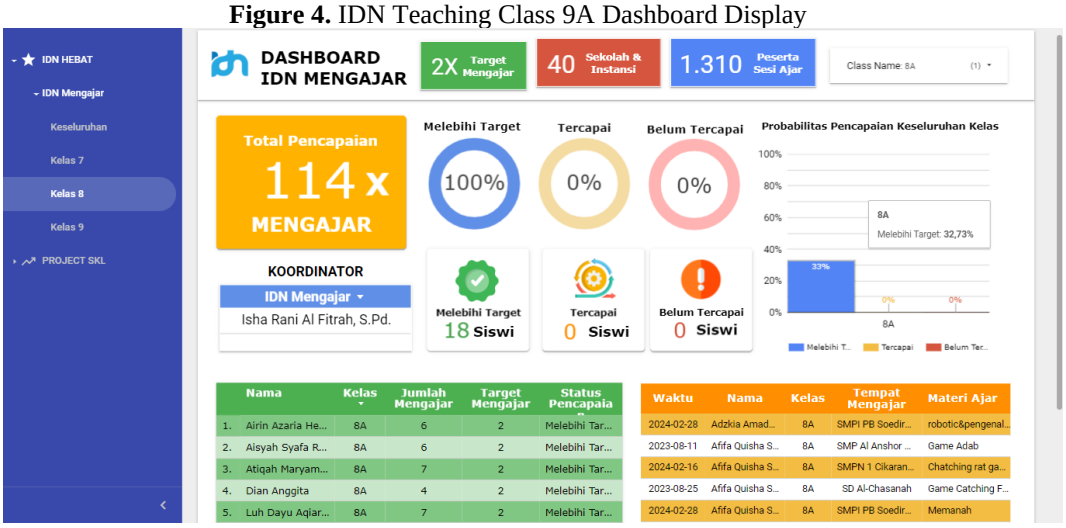

Figure 5. Display of IDN Teaching Dashboard Class 8A

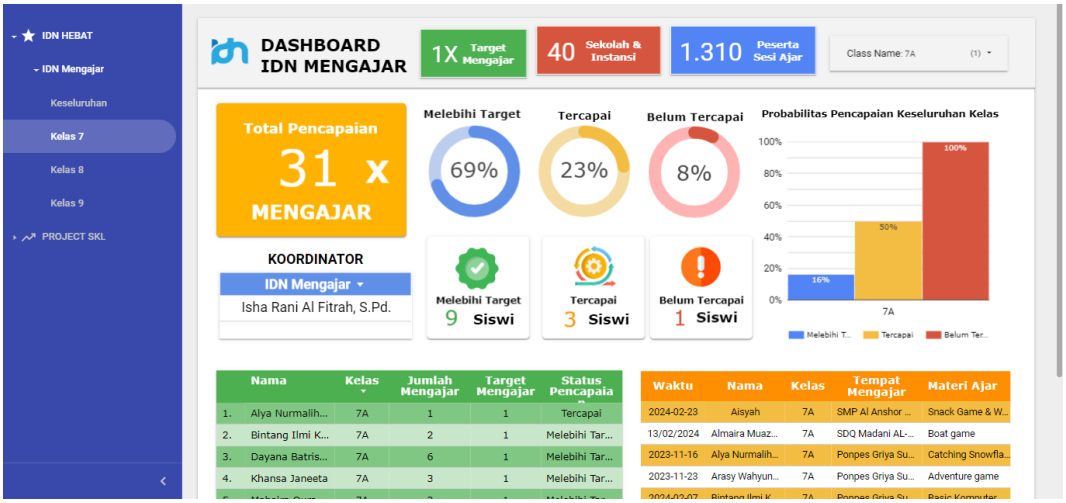

Figure 6. Display of IDN Teaching Dashboard for Class 7A

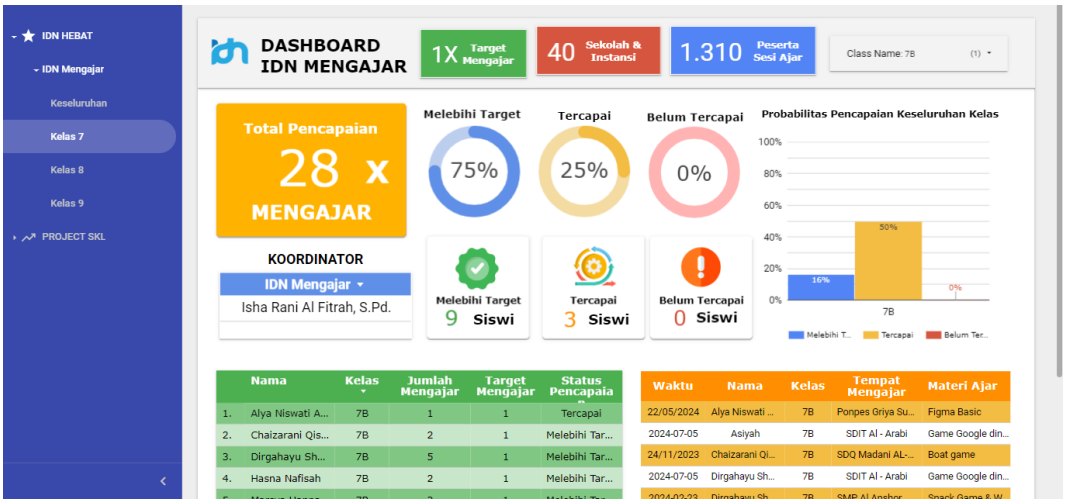

Figure 7. Display of IDN Teaching Dashboard Class 7B

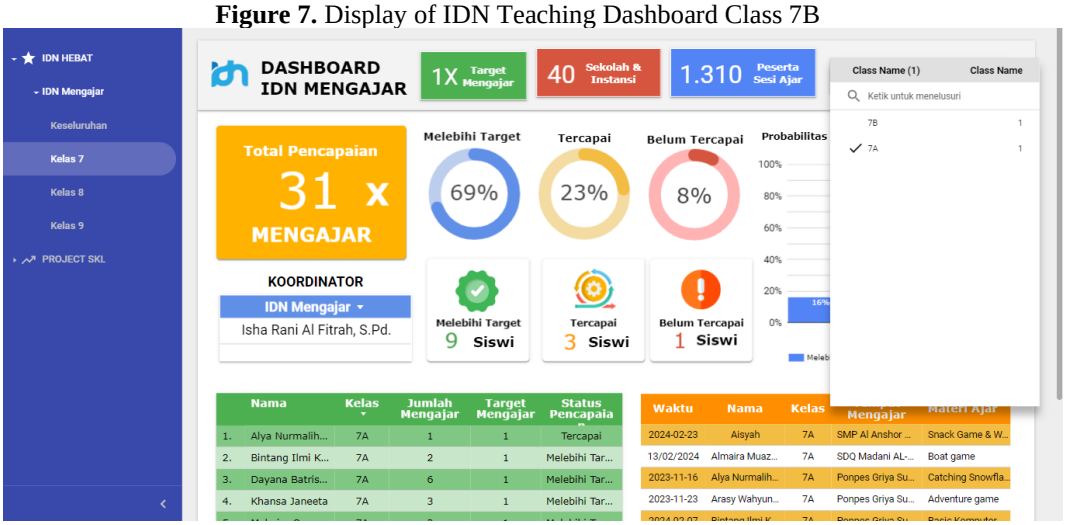

Figure 8. Grade Level Filter Dashboard View

Dashboard Link: [Great IDN Dashboard for Teaching Activities]

Final Results of Testing

In this case, the author will describe the implementation steps carried out in completing the Dashboard Great IDN based Cloud by applying the Naïve Bayes at Looker Studio, based on the theory and material that has been studied by the author are as follows.

1) Data Collection: The first step in implementation is to collect relevant data from a variety of sources, including reports from coordinators and academic records.
2) Designing an Estimate of Work: Designing an estimated workload is an important step in ensuring that this project is completed on time. This process includes the identification of all tasks that need to be performed, including data collection and preparation, algorithm implementation, dashboard design, and results analysis. Then, an estimate of the time required for each task is carried out based on the complexity and available resources, as well as the allocation of needed resources such as manpower, software, and hardware. Furthermore, a project scheduling is created that includes all important tasks and milestones, setting the order in which tasks are executed to ensure efficiency. Finally, regular monitoring and evaluation of project progress is carried out to ensure that the project is running as planned, with adjustments in case of deviations from the schedule.
3) Data Preparation: Once the data is collected, the next step is to clean up and prepare the data for analysis. This process involves handling lost data, normalizing the data, and encoding categorical variables into a format that can be processed by Naive Bayes' algorithm. The prepared data is then imported into Google Sheets for further analysis.
4) Implementation of Naïve Bayes' Algorithm: The Naive Bayes algorithm was used to calculate the probability of student achievement in the IDN Teaching program. The steps taken include:
    a) Calculation of Prior Probability: Calculates the initial probability for each achievement status class (Target Exceeded, Achieved, Unachieved) and class probability based on existing data.
    b) Likelihood Probability Calculation: Calculates probability probability for relevant features, such as achievement status probabilities by class.
    c) Posterior Probability Calculation: Combines the prior probability of achievement status, class prior probability and achievement status likelihood probability based on class to calculate posterior probability, which is used to determine classes based on achievement status.
5) Creating a Dashboard in Looker Studio: The data from the analysis is then imported into Looker Studio for visualization. The steps taken include:
    a) Dashboard Design: Design an intuitive and informative dashboard layout, including charts and tables that display achievement probability data.
    b) Data Integration: Integrate data from Google Sheets into Looker Studio to display analysis results in real-time.
    c) Data Visualization: Create visualizations that help users understand the distribution and patterns of student achievement, such as probability charts, percentage achievement status, and details of teaching activities.
6) Analysis and Interpretation of Results: Once the dashboard is created, the next step is to analyze and interpret the results. Users can use the dashboard to:
    a) Evaluating Performance: Evaluating the teaching performance of each student and class based on the calculated probability of achievement.
    b) Pattern Identification: Identify significant patterns in the data, such as classes that are consistently achieved, exceed targets or even not achieved.
    c) Decision Making: Making data-driven decisions for future program and strategy improvements.

User Response Results

The IDN Hebat Teaching Activity Dashboard has been piloted to coordinators, teachers and the IDN Akhwat School to get input on its effectiveness. Feedback is collected through questionnaires, interviews, and user observations. The results of the questionnaire showed a high level of satisfaction, with users stating that the dashboard was easy to use, informative, and helpful in monitoring and evaluating student achievement. The interviews showed that teachers and coordinators felt helped in identifying students who needed attention and made it easier to manage data and make reports. Observations show that users quickly understand and use the dashboard, improving their work efficiency. Overall, users feel the dashboard improves efficiency and helps them make data-driven decisions with informative visualizations. Recommendations for further development include the addition of predictive analytics features, integration of data from other sources, and improvements to the dashboard display and navigation. The IDN Hebat Teaching Activity Dashboard received a very good response and successfully achieved the goal of helping to monitor and evaluate student achievements, with feedback that will be used for further development to provide greater benefits for IDN Akhwat School.

CONCLUSION

The study concludes that the Naive Bayes algorithm was effectively applied to IDN Teaching achievement data at IDN Akhwat School, accurately determining student achievement status, with the highest

accuracy (89%) for students exceeding targets, particularly in class 9A. The IDN Teaching dashboard, implemented using Looker Studio, enhanced monitoring efficiency, data access, and analysis, receiving positive feedback from users for its usability. The cloud-based system provided centralized data storage, fast access, and strong collaboration capabilities, contributing to improved teaching quality and data-driven decision-making. Future research should explore other machine learning algorithms and conduct longitudinal studies to further enhance prediction accuracy and understand the long-term impact of digital tools on student outcomes.

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