



IMPLEMENTATION OF THE NAÏVE BAYES ALGORITHM IN THE DESIGN OF INFORMATION SYSTEMS FOR THE DEVELOPMENT OF STUDENT ACADEMIC ACHIEVEMENT

Hartatik^{1*}, Elvina Yuliani²

^{1,2}Departement of Informatics Engineering, Vocational School, Universitas Sebelas Maret, Surakarta, Indonesia
Corresponden Author: hartatik.uns@gmail.com¹

Abstract

The research conducted in this journal is the design of an information system on the development of student achievement using the Naive Bayes algorithm. The purpose of research and development of this system is to help students find predictions of early graduation and allow the admin to find out progress and forecasts of active student graduation. This research begins with the design of the business process of the actor who will see the prediction of graduation. In designing the application, FR tables, use case diagrams, use case scenarios, class diagrams, and sequence diagrams are created. Then proceed with database design in the form of Entity Relationship Diagram (ERD), Relationship Between Tables (RAT) and table design. After designing the database, a user interface design is made in the form of a mockup. The result of the research in this final project is creating a Student Achievement design of Development Information System with the Naive Bayes Algorithm. This information system comes from application design, database design, user interface design, and system testing design which is then implemented to calculate graduation predictions based on student academic achievement.

Keywords: Graduation Prediction Calculation, Naive Bayes Algorithm, Information System, Achievement Index, Academic Achievement, Gaussian Distribution

INTRODUCTION

Teaching and learning activities are important activities carried out in the educational process. Where in its implementation, there is the interaction between students and teachers. In the interactions, there is an exchange of knowledge and norms applied within the scope of education. The real results of successfully implementing the teaching and learning process can be seen in the student's learning achievement. It can be seen from the final results of the teaching and learning process, namely the students' final grades each semester. If the student's final score is good, it indicates his learning achievement is good, and transferring knowledge from teacher to student can be said to be successful. So it can say that the final grade indicates student learning achievement in the course. In addition, he takes feedback on various things such as his abilities, fatigue, shortcomings, and potential (Siagan, 2003).

The problem that arises from the results of the lecture process is that not all functions produce good results as desired. Undesirable effects can be obtained as a result of several factors. If this happens, it can make it difficult for students to graduate on time. In addition, it can also affect the quality of the study program in that students are active. In the first academic

year, student learning outcomes can cause various problems that will impact the next semester. Therefore, evaluation of the success of implementing a study program at a university is seen from student learning outcomes. For this reason, in this study, the implementation of the Naive Bayes method use to help predict student academic achievement using the Semester Achievement Index (IPS) score (Hartatik, 2020), (Jananto, 2013).

Students' graduation times can be predicted using an information system designed and built by this study (Farida & Maulidina, 2018). (Nurrohmat & Nugroho, 2015). Furthermore, several previous studies applied the regression analysis method in predicting student achievement (Putratama & Supono, 2018), (Akil, 2018). Therefore, the purpose of Designing a Student Achievement Development Information System with the Naive Bayes Algorithm is to design and create a Student Achievement. Development Information System with the Naive Bayes Algorithm and apply the theory that has been obtained in lectures in making the Student Achievement Development Information System with the Naive Bayes Algorithm.

As for the development of "Design of Information Systems for Student Achievement Development with the Naive Bayes Algorithm," there are several problems in the research, including:

1. Actors involved are Admin, Super Admin, Lecturer, and Student.
2. Student Achievement Development Information System with Naive Bayes Algorithm is a web-based information system.
3. The data that became the test sample came from student data in XYZ College
4. This system uses the Naive Bayes algorithm.
5. This system uses a Mysql database.

METHOD

The waterfall method is the research methodology used in implementing the design of the Student Achievement Development Information System with the Naive Bayes Algorithm. The waterfall method is a method that takes a systematic and sequential approach to build a system. Therefore it is very suitable for use in making this information system.

The waterfall method's process is that a system's quality is carried out sequentially. The resulting system will be of good quality because its implementation is gradual, so it is not focused on certain stages. The stages of this method are:

1. Needs Analysis

The requirements analysis phase is carried out by analyzing the user's needs, the software and hardware needed in system development, and other requirements in making databases.

Analysis of hardware requirements on this system is a laptop with the following minimum specifications Intel i3 1.8 GHz Processor, with a hard disk with at least 1GB of free space. And 2GB of RAM. Analysis of software requirements that help build this system is Windows 7 Operating System, XAMPP, Notepad++ v.5.9.3, PHP Programming Language, Google Chrome and MySQL Server.

2. System Design

The purpose of this stage is to provide an overview of what will be done and how it will look. This stage fulfills all user needs according to the results analyzed, such as the Student Achievement Development Information System display design with the Naive Bayes Algorithm and helps define the overall system architecture. The documentation produced from the system design stage includes the creation of Use Case Diagrams, Entity Relationship Diagrams (ERD), Use Case Texts, Activity Diagrams, and interface design (Afkarina & Furqon, 2019), (Amiruddin & Ishak, 2018).

3. Coding (Writing Program Code)

Writing program code is the stage of translating the system design that has been made into commands that the computer understands using a programming language. This stage is a real stage in working on a system. This system programming language used is PHP and MySQL database.

4. Testing (Program Testing)

Testing is carried out to ensure that the software follows its design and that all functions can use properly without any errors.

5. Operation and Maintenance

This stage is the last in the waterfall method. After that, the system can implement implementation. Maintenance includes correcting errors not found in the previous steps, improvements to the performance and development of system units, and program maintenance. An administrator can do system maintenance to improve the system's quality so that it is much better.

RESULT AND DISCUSSION

In designing a website-based information system using the naive, Bayes method, the information system business processes include admin inputting student databases. The student database is in the form of student data that has passed so that it can be used as training and

testing data. In addition, the admin can input guidance, lecturer, student, batch, and student score data.

Then the inputted student data will be processed using the Naive Bayes algorithm, which uses the probability of several factors influencing student study time. The factors that become the parameters taken are regional origin, average national exam scores and student achievement index from semesters 1 to 6 for diploma level III and 1 to 8 for strata I level. After calculating, the results of graduation predictions will be displayed for tested test data. The business process of designing an information system can be seen in Figure 1.

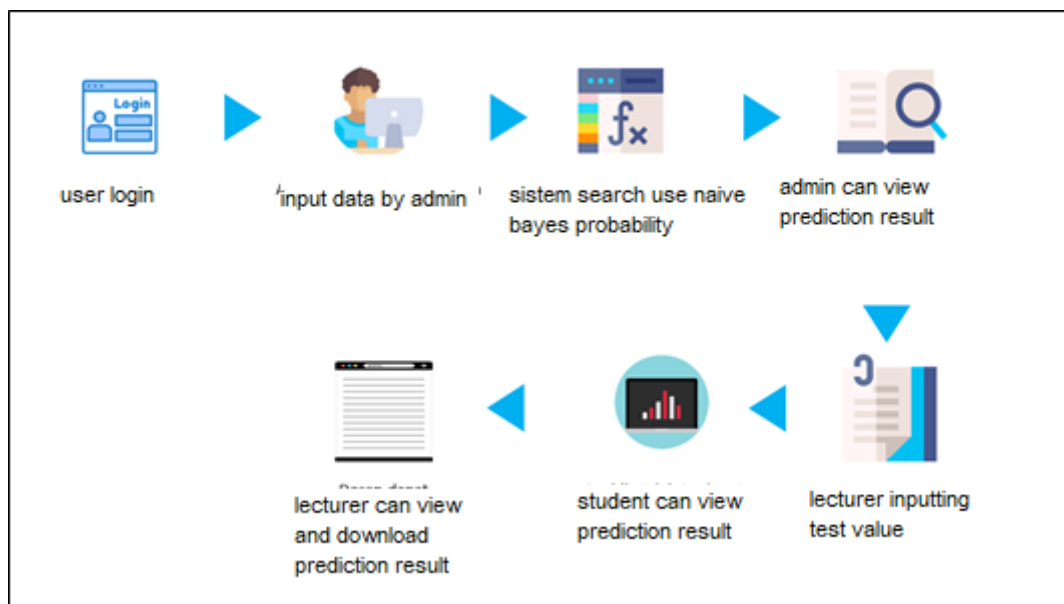


Figure 1 Business Process Information System Student Achievement Development

Functional requirements are used to determine the operational processes of the application carried out by actors who have access to system processes. The applicable requirements(FR) contained in the Achievement Development Information System can be seen in Table 1.

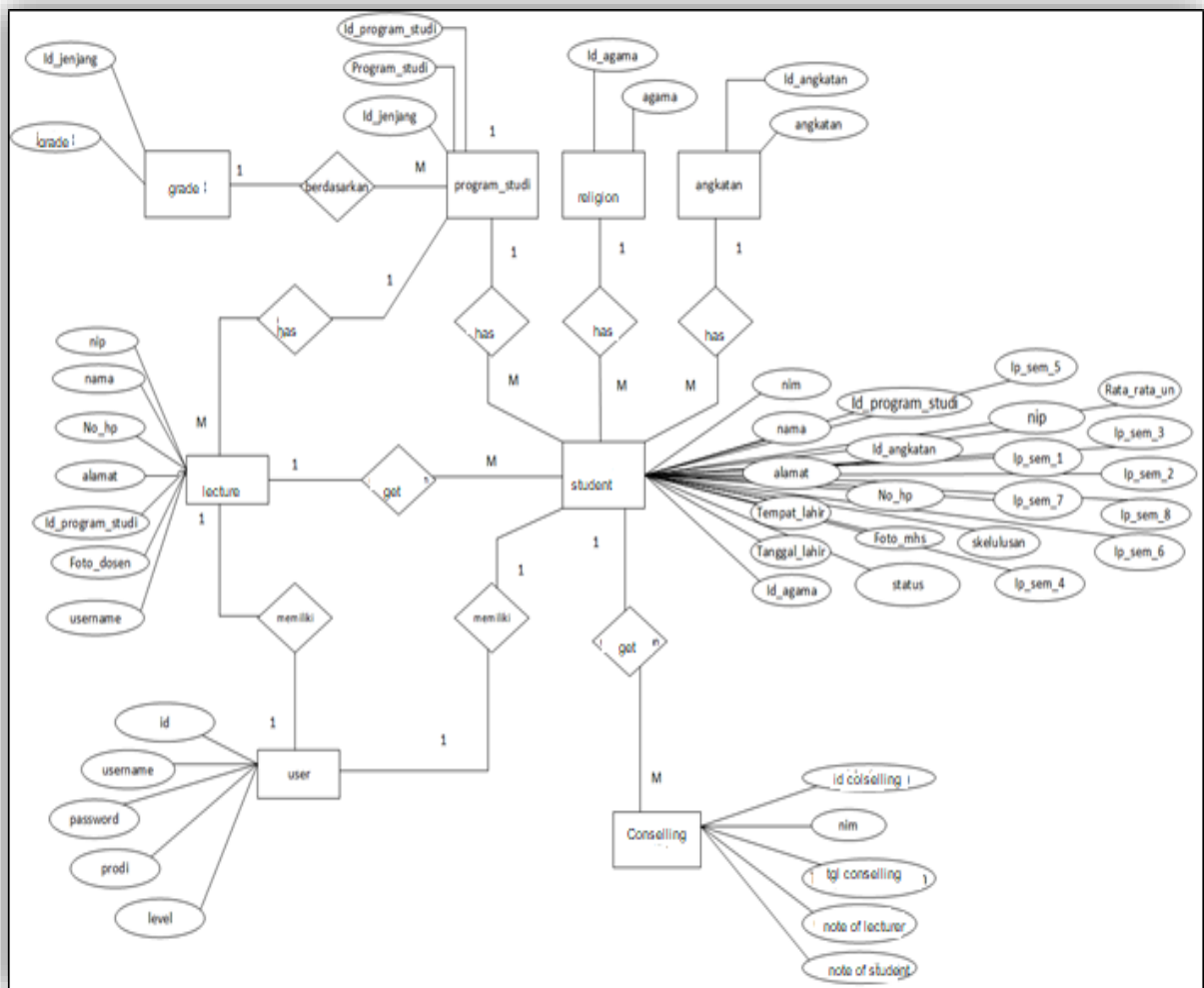
Table 1 FR Student Achievement Development Information System

| No FR | FR | Actor | Dependency |
|-------|--------------------------------------|--------|------------|
| PP01 | The system can accept login | Sistem | - |
| PP02 | The system can display student data | Admin | PP01 |
| PP03 | The system can add student data | Admin | - |
| PP04 | The system can edit student data | Admin | PP02 |
| PP05 | The system can delete student data | Admin | PP02 |
| PP06 | The system can display lecturer data | Admin | PP01 |

| | | | |
|------|--|-------------|------|
| PP07 | The system can add lecturer data | Admin | - |
| PP08 | The system can edit lecturer data | Admin | PP06 |
| PP09 | The system can delete lecturer data | Admin | PP06 |
| PP10 | The system can display student training data | Admin | PP01 |
| PP11 | The system can add student training data | Admin | PP10 |
| PP12 | The system can edit student training data | Admin | PP10 |
| PP13 | The system can delete student training data | Admin | PP10 |
| PP14 | The system can display data for academic guidance lecturers and students | Admin | PP01 |
| PP15 | The system can add data for student academic supervisors | Admin | - |
| PP16 | The system can change student academic supervisor data | Admin | PP14 |
| PP17 | The system can display student prediction calculation data based on class | Admin | PP01 |
| PP18 | The system can print the results of calculating student graduation predictions based on batches. | Admin | PP17 |
| PP19 | The system can display batch data | Admin | PP01 |
| PP20 | The system can add batch data | Admin | - |
| PP21 | The system can delete batch data | Admin | PP19 |
| PP22 | The system can display admin data | Super Admin | PP01 |
| PP23 | The system can add admin data | Super Admin | - |
| PP24 | The system can change admin data | Super Admin | PP22 |
| PP25 | The system can delete admin data | Super Admin | PP22 |
| PP26 | The system can display study program data | Super Admin | PP01 |
| PP27 | The system can add study program data | Super Admin | - |
| PP28 | The system can change study program data | Super Admin | PP26 |
| PP29 | The system can delete study program data | Super Admin | PP26 |
| PP30 | The system can display a graph of the student achievement index | Students | PP01 |

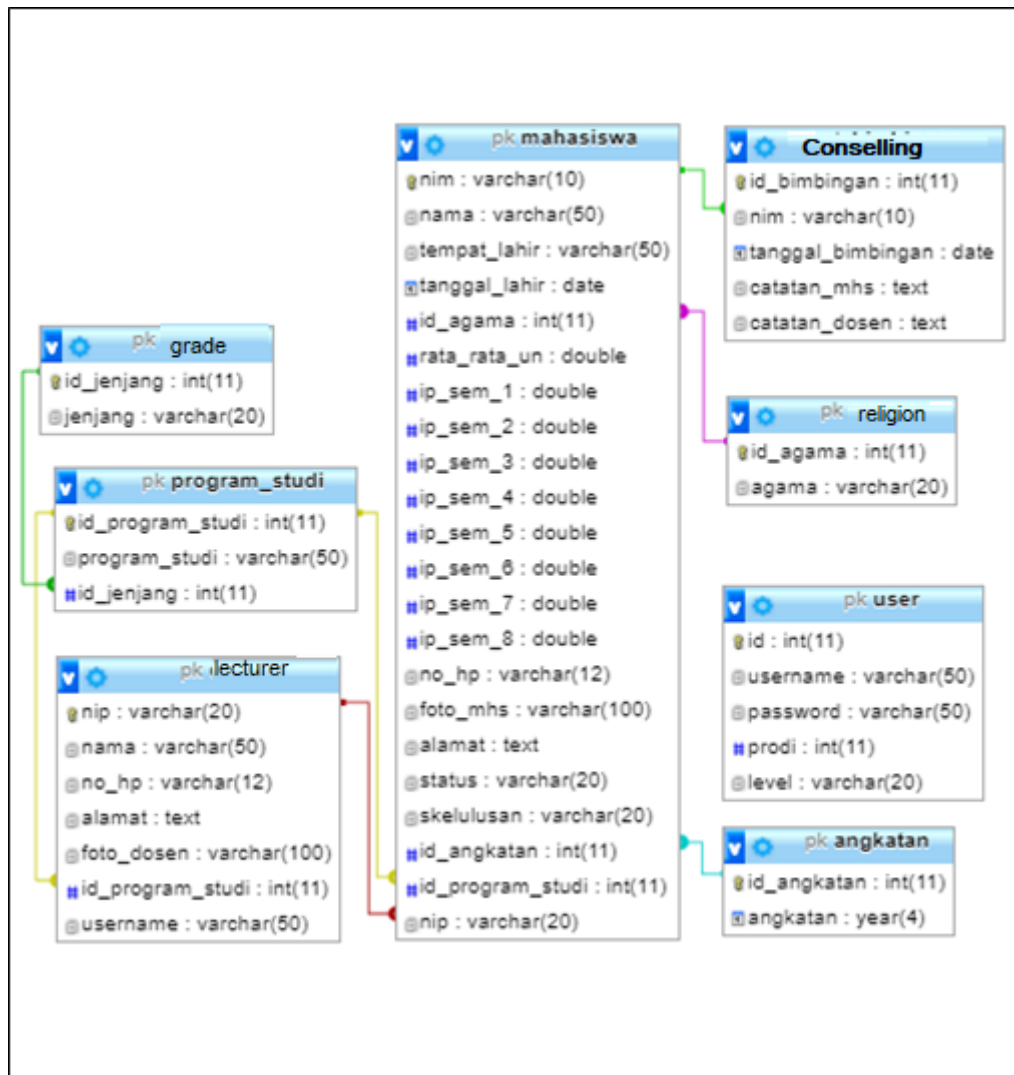
| | | | |
|------|---|-----------------------|------|
| PP31 | The system can display student guidance data according to batch | Lecturer | PP01 |
| PP32 | The system can change student achievement index data according to academic guidance students. | Lecturer | PP31 |
| PP33 | The system can display student achievement index data | Admin | PP02 |
| PP34 | The system can change student achievement index data | Admin | PP33 |
| PP35 | The system can display the user's personal information | Lecturer, Students | PP01 |
| PP36 | Sistem dapat mengubah informasi pribadi user | Lecturer, Students | PP35 |
| PP37 | The system can display academic guidance data | Lecturer, Students | PP01 |
| PP38 | The system can add academic guidance record data | Lecturer, Students | - |
| PP39 | The system can change the academic guidance record data | Lecturer, Students | PP38 |
| PP40 | The system can delete the academic guidance record data | Lecturer Students | PP38 |
| PP41 | The system can display the predicted results of logged-in students | Students | PP01 |
| PP42 | The system can print student prediction data according to academic guidance lecturers. | Lecturer | PP31 |

Furthermore, the ERD used in the Student Achievement Development Information System with the Naive Bayes Algorithm can be seen in Figure 2. as follows:



Gambar 2 Entity Relationship Diagram (ERD)

The relations between tables used in the Student Achievement Development Information System with the Naive Bayes Algorithm can be seen in Figure 3. as follows:



Gambar 3 Relationships Between Tables (RAT)

To further design the login page on the system. For example, the admin login page is used for logging into the system as an admin. The login page interface design can be seen in Figure 4.

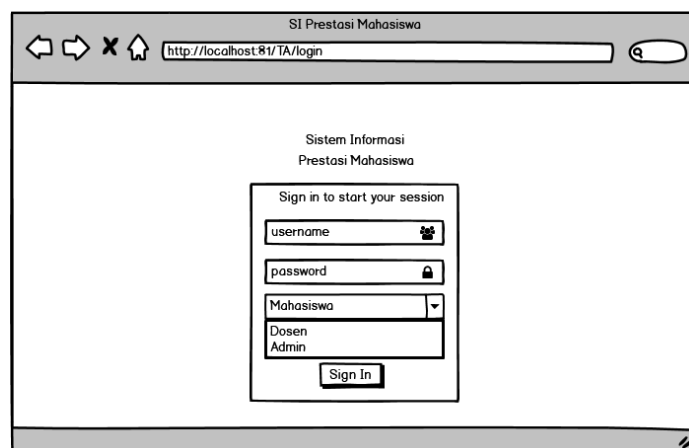


Figure 4. Login Page Design

After logging in to the system, the admin dashboard page is the start page. The interface design of the page can be seen in Figure 5.

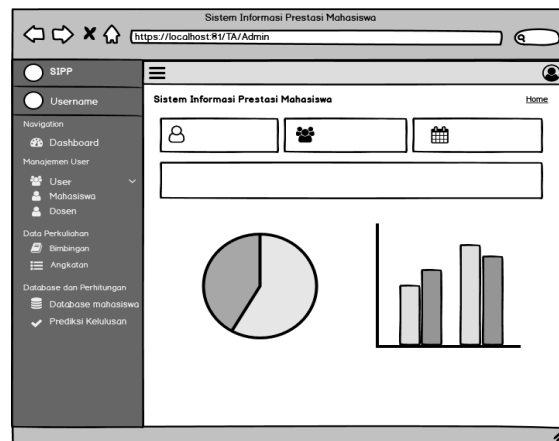
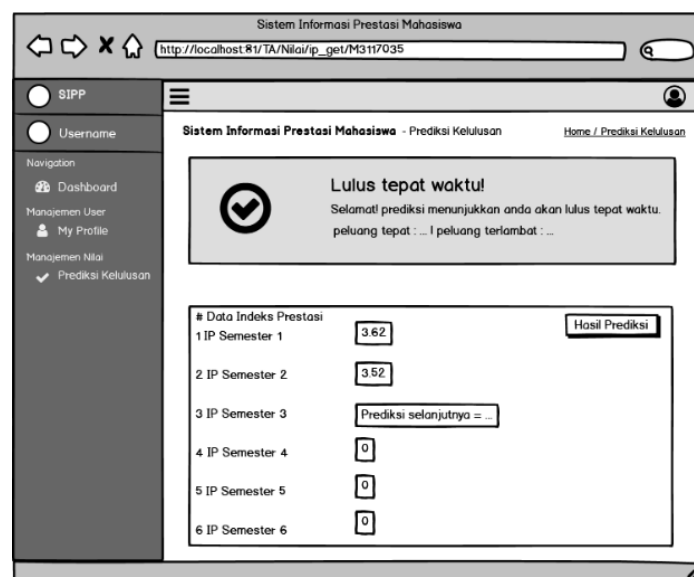


Figure 5 Admin Dashboard Page Design

The Students' graduation prediction page is the start page after the Students' graduation prediction data menu is pressed. This page displays a list of Student IP data and student graduation predictions. The interface design of the Students' graduation prediction page can be seen in Figure 6. the prediction page is the result of data integration from student and lecturer data tables, guidance lists and student lists.



Gambar 6 Perancangan Halaman Prediksi Kelulusan Students

Based on the data and use of Bayesian methods, test data is needed in the calculation test to see the suitability of the test results. The test data used can be seen in table 2.

Table 2 Illustration of bayesian

| No | Nim | IPS1 | IPS2 | IPS3 | IPS4 | IPS5 | IPS6 | UN | AD | SK |
|----|------------|------|------|------|------|------|------|-------|--------------|---------|
| 1 | Mxxxxxxx74 | 3.41 | 3.51 | 3.79 | 3.32 | 3.7 | 3.33 | 52.65 | East java | On-time |

Calculations using the information system have been successfully carried out, and for numerical data types such as the semester achievement index and the average value of the national exam, the Gaussian distribution calculation is used. As for the nominal data type, namely the area of origin, Bayes' theorem is calculated.

CONCLUSION

An achievement development information system that uses the Naive Bayes algorithm to perform numerical calculations on student data is called a Student Achievement Development Information System.

Based on the database of students who have graduated, which can then be concluded that a design of Student Achievement Development Information System with Naive Bayes Algorithm implemented using PHP programming language, CodeIgniter framework, MySQL database. And system created has four actors: Super Admin, Admin, Students and Lecturer.

REFERENCES

- Akil, I. (2018). *References and Guidelines for UML 2.4 Brief and Clear*. Surabaya: CV Garuda Mas Sejahtera.
- Afkarina, N. K., Widodo, A. W., & Furqon, M. T. (2019). Implementation of Multiple Linear Regression to Predict the Number of Interested Subjects. *Development of Information Technology and Computer Science*, 10462-10467.
- Amiruddin, & Ishak, R. (2018). Prediction of the Number of Registration Students Per Semester Using Linear Regression at Ichsan University, Gorontalo. *ILKOM Scientific Journal*, 136 -143
- Farida, I. N., & Maulidina, M. (2018). Development Of Academic Evaluation System Based On Students Achievement Index Value Predicate. *Scientific Journal of Informatics Engineering*, 12(2).
- Hartatik. (2020). Optimization of Students' Graduation Prediction Model Using the Nave Bayes Algorithm, *IJAI (Indonesian Journal of Applied Informatics)* Vol 5 No 1. Surakarta
- Jananto, A. (2013). Naive Bayes Algorithm to Find Estimated Student Study Time. *Journal of Information Technology DYNAMIC*, 18(1), 09-16.
- Nurrohmat, M. A., & Nugroho, Y. S. (2015). Applying Study Period Prediction and Graduation

Predicate of Informatics Students at the Muhammadiyah University of Surakarta Using the Naive Bayes Method. *Journal of Computer Science and Informatics*, 1(1), 29-34.

Putratama, Vidiandry & Supono. (2018), *Web Programming Using CodeIgniter PHP and Framework*. Yogyakarta: Depublish.

Siagan, S. P. (2003). *Human Resource Management*. Jakarta: Earth Literacy.