Bayes Implementation in Decision Support Systems Student Satisfaction Evaluation of Services

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Abstract- Dehasen University (Unived) Bengkulu is one of the private universities that is committed to improving service quality standards and continuously strives to improve and dissect in meeting the expectations of its customers, namely students. Good service quality is a guarantee desired by every student in conducting lectures. Then it is necessary to build a decision support system with the application of Bayes calculations in evaluating University services to students, because qualified services will get the attention of the public. The results of this measurement can be used by university leaders to improve and improve services in fulfilling student rights so that the quality of unived education will be better and improved

Index Terms- Fuzzy Serqual, Service, Agricultural Extension)

I. INTRODUCTION

Quality service is the main goal of every college, this is a guarantee of the quality desired by students. The level of student satisfaction becomes the benchmark of excellence of a college so that required criteria for service standards. In improving the quality of service requires measurement of services to students, because the quality of service will get the attention of the community [1].

Dehasen University (Unived) Bengkulu is one of the private universities that is committed to improving service quality standards and continuously strives to improve and dissect in meeting the expectations of its customers, namely students. In an effort to improve the quality of Dehasen University, various forms of human resources, facilities, facilities and infrastructure have been provided for students, lecturers and students provided by foundations and universities. This is done in addition to increasing the quality standard of education at Unived as well as to meet student expectations related to the services received and fulfillment of student rights.

In order to improve the performance of the university in carrying out its obligations to improve service quality, it is necessary to know the level of student satisfaction with university services. Therefore it is necessary to know how much the level of satisfaction felt by students, for the efforts made by the university in providing student satisfaction with services in fulfilling student rights, student satisfaction measurements are held, the results of these measurements can later be used by university leaders to improve and improving services in fulfilling student rights so that the quality of unived education will be better and improved.

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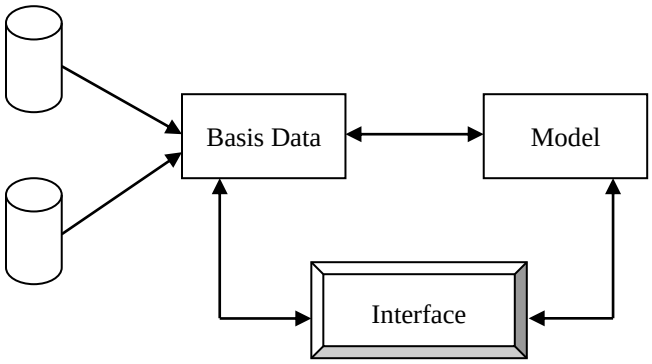
Decision support systems are an excellent method for evaluating student satisfaction with services. This research uses study Bayes for Decision Support System (SPK) evaluates student satisfaction with university services. Bayes Method is a classification method using probability and statistical methods based on the Bayes theorem [2]. The purpose of this study is to make a decision support system in evaluating students of the services provided by the university using the Bayes method. Evaluation of student satisfaction with university services include the following fields: Student Affairs, Library, Academic and Student Administration Bureau (BAAK), Facilities and infrastructure and finance available at Dehasen University Bengkulu. This study focused on the rare steps of building a decision support system with the application of Bayes calculations in service evaluation [3].

II. LITERATURE REVIEW

2.1. Decision Support System

Decision Support System (SPK) is designed to support all stages of decision making ranging from identifying problems, selecting relevant data, determining the approach used in decision making percentages, to evaluating alternative choices [4]. Specifically SPK is a system that supports the work of a manager or group of managers in solving semistructural problems by providing information or proposals leading to certain decisions [5].



Fgr. 1. Decision Support System Components

2.2. Service

According to [6] every action or activity that can be offered by one party to another party, which is basically intangible and does not result in any ownership. Service is the behavior of producers in order to meet the needs and desires of consumers for the achievement of satisfaction to consumers themselves.

2.3. Service Satisfaction

Satisfaction is the level of one's feelings after comparing the perceived performance compared with his expectations, so that the level of satisfaction is a function of differences between the perceived performance with the desired expectations. Satisfaction is an evaluation tool where the alternative chosen is at least the same or exceeds expectations, while dissatisfaction can arise if the expected results are not achieved [7].

2.4. The performance

Performance is an achievement achieved by employees in carrying out a job in an organization. Achievement means the achievement of work. It shows that performance is very closely related to productivity [8].

III. METHODOLOGI

Evaluation of students' satisfaction with services is not good or good, the evaluation must be based on service criteria determined by the university. The level of satisfaction is the value of the number of each criterion in each section of service. This value is obtained from each criterion divided by the total weight of each criterion. The stages in the Bayes method use the following equation [9] - [11]:

1. Calculate the Weight of Each Criteria
$$\mathbf{B}\boldsymbol{k} = \sum_{i=1}^{n}\left(\sum_{j=1}^{oi} \boldsymbol{oi}\right) \quad (1)$$
In equation 11, $\boldsymbol{i}$ is a statement to, $\boldsymbol{n}$ is a lot of statements, $\boldsymbol{j}$ is a choice to, $\mathbf{oi}$ is the number of choices for the statement $\boldsymbol{i}$ and Bk is the weight of each criterion.
2. Calculating the Total Weight Value
$$\mathbf{B}\boldsymbol{total} = \sum_{k=1}^{l} \boldsymbol{Bk} \quad (2)$$
In equation 12, k is the criteria to, $\boldsymbol{l}$ is the number of criteria, Bk is the weight for each criterion, B_{total} is the total of the weights. The next step is to find the probability value for each criterion with equation 3.
3. Calculating the Probability Value
$$\mathbf{P}\boldsymbol{k} = \frac{\mathbf{B}\boldsymbol{k}}{\mathbf{B}\boldsymbol{total}} \quad (3)$$
In equation 4, $\mathbf{B}\boldsymbol{k}$ is the weight of each criterion, $\mathbf{B_{total}}$ is total weight, $\mathbf{P}\boldsymbol{k}$ is probability per criterion.
Evaluation of student satisfaction is said to be good based on the criteria that have been set if the resulting ≥ score ambang threshold value of each criterion (**A***k*) [12] [10]. The threshold value for each criterion obtained based on equation 4 is a value.
$$\mathbf{A}\boldsymbol{k} = \frac{\mathbf{B}\boldsymbol{k}}{2} \times \mathbf{P}\boldsymbol{k} \quad (4)$$
Equation 5, $\mathbf{B}\boldsymbol{k}$ is the weight value for each criterion, $\mathbf{P}\boldsymbol{k}$ is the probability of each criterion. If a student satisfaction evaluation score is set both of each criterion is $\mathbf{Y}\boldsymbol{k}$, by using equation 5.

$$\mathbf{B} = \begin{cases} \mathbf{Y}\boldsymbol{k} > \mathbf{A}\boldsymbol{k} = \mathbf{B} \\ \mathbf{Y}\boldsymbol{k} \leq \mathbf{A}\boldsymbol{k} = \mathbf{TB} \end{cases} \quad (5)$$

4. Calculates the overall threshold value
$$\boldsymbol{Atotal} = \mathbf{A1} + \mathbf{A2} + \mathbf{A3} \ldots . \mathbf{A_n} \quad (6)$$
Equation 7, the index of each criterion is $\mathbf{1}, \mathbf{2}, \mathbf{3} \ldots \boldsymbol{n}$. If **Y** is the total value of all criteria, University Services are said to be good (B) if the value is obtained > of the total threshold value ($\mathbf{A_{total}}$), and declared not good (TB) if the value is obtained ≤ from the total threshold value ($\mathbf{A_{total}}$), as in equation 7.
$$\mathbf{Y} = \begin{cases} \mathbf{Y} > \boldsymbol{Atotal} = \mathbf{B} \\ \mathbf{Y} \leq \boldsymbol{Atotal} = \mathbf{TB} \end{cases} \quad (7)$$
Based on the results of the evaluation of student satisfaction obtained if the service is said to be good (B), then it can be grouped again included in the criteria of very good or not. University services are said to be very good (SB) if the value produced > from the threshold value is good ($\mathbf{A}_{\boldsymbol{Very\ Good}}$) [11], can be calculated like equation 8 and equation 9.
$$\mathbf{SB} = \begin{cases} \mathbf{A_{total}} < \boldsymbol{Y} \leq \mathbf{A}_{\boldsymbol{Very\ Good}} = \mathbf{B} \\ \mathbf{Y} \geq \mathbf{A}_{\boldsymbol{Very\ Good}} = \mathbf{SB} \end{cases} \quad (8)$$
$$(\mathbf{A}_{\boldsymbol{Very\ Good}}) = (\mathbf{2} \times \boldsymbol{A_{total}}) \times {}^{\mathbf{3}}/_{\mathbf{4}} \quad (9)$$

To calculate the data collection value of each criterion in equation 10.
$$\mathbf{X}\boldsymbol{k} = \mathbf{X_1} + \mathbf{X_2} + \mathbf{X_3} \ldots \mathbf{X_n} \quad (10)$$

In equation 11, $\mathbf{X}\boldsymbol{k}$ is the result value for each criterion, and $\mathbf{X1}, \mathbf{X2}, \mathbf{X3} \ldots \mathbf{X}\boldsymbol{n}$ is the answer to each statement of each criterion. The data collection value is generated based on equation 11.
$$\mathbf{Results} = \mathbf{X_k} + \mathbf{P_k} \quad (11)$$

IV. RESULTS

4.1. Result

Recapitulation of student satisfaction levels for university services for the year academic 2019/2020 obtained from the sum of each respondent's score score divided by the number of respondents. The recapitulation results of each university service and the weight of the sum of each service can be seen in Table 1.

Table 1 Recapitulation Results of Student Satisfaction Level Against University Services

No	University Services	Satisfaction Level Recapitulation	Number of Criteria Weights
1	Student Services	17,61	24
2	Library Services	32,89	44
3	BAAK services	51,60	68
4	Facilities and Infrastructure Services	67,87	92
5	Financial Services	45,18	60

The next step is the application of the Bayes method. The implementation phase of the Bayes method starts with calculating the values for weighting per service, probability per service, threshold per service and setting threshold values for the level of student satisfaction with University services as follows.

1. Weight per criterion is obtained by equation 1, namely by adding up the values weight for each question contained in each service.
   a. Weight per criteria for Student Services
   $Bk1 = 4 + 4 + 4 + 4 + 4 + 4 = 24$
   b. Weight per criteria for Library Services
   $Bk2 = 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 = 44$
   c. Weight per criteria for BAAK Services
   $Bk3 = 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 = 68$
   d. Weight per criterion for Infrastructure Services
   $Bk4 = 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 = 92$
   e. Weight per criteria for Financial Services
   $Bk5 = 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 + 4 = 60$
2. Total Weight values are obtained based on equation 3, namely by adding overall weight value for each service.
   $BT = 24 + 44 + 68 + 92 + 60 = 288$
3. Probability results for each criterion are obtained based on equation 3, viz by dividing the weight value of each service by the total weight.
   a. Probability for Student Services
   $Pk1 = {}^{24}/_{288} = 0{,}083$
   b. Probability for Library Services
   $Pk2 = {}^{44}/_{288} = 0{,}153$
   c. Probability for BAAK Services
   $Pk3 = {}^{68}/_{288} = 0{,}236$
   d. Probability for Infrastructure Services
   $Pk4 = {}^{92}/_{288} = 0{,}319$
   e. Probability for Financial Services
   $Pk5 = {}^{60}/_{288} = 0{,}208$
4. To get the Total Probability by adding each value probability of each service
   $Bk1 = 0{,}083 + 0{,}153 + 0{,}236 + 0{,}319 + 0{,}208 = 1$
5. Threshold value for each service criterion is obtained according to equation 5, by dividing the value of the weight of each service then the results are multiplied by the value of propobality of each service.
   a. Threshold for Student Services
   $Ak1 = \frac{24}{2} \times 0{,}083 = 1$
   b. Threshold for Library Services
   $Ak2 = \frac{44}{2} \times 0{,}153 = 3{,}361$
   c. Threshold for BAAK Services
   $Ak3 = \frac{68}{2} \times 0{,}236 = 8{,}028$
   d. Threshold for Facilities and Infrastructure Services
   $Ak4 = \frac{92}{2} \times 0{,}319 = 14{,}694$
   e. Threshold for Financial Services
   $Ak5 = \frac{60}{2} \times 0{,}208 = 6{,}250$
6. The total Threshold results are obtained by equation 6, namely by adding the overall threshold for each university service.
   $AT = 1 + 3{,}361 + 8{,}028 + 14{,}694 + 6{,}250 = 33{,}333$
7. Very good threshold value is obtained according to equation 9, by multiplying the total threshold with a value of two then the result is multiplied by the value of three quarters.
   a. Very Good Threshold for Student Services
   $AVery\ Good\ 1 = (2 \times 1) \times {}^{3}/_{4} = 1{,}5$
   b. Very Good Threshold for Library Services
   $AVery\ Good\ 2 = (2 \times 3{,}361) \times {}^{3}/_{4} = 5{,}042$
   c. Very Good Threshold for BAAK Services
   $AVery\ Good\ 3 = (2 \times 8{,}028) \times {}^{3}/_{4} = 12{,}042$
   d. Very Good Threshold for Facilities and Infrastructure Services
   $AVery\ Good\ 4 = (2 \times 14{,}694) \times {}^{3}/_{4} = 22{,}042$
   e. Very Good Threshold for Financial Services
   $AVery\ Good\ 5 = (2 \times 6{,}250) \times {}^{3}/_{4} = 9{,}375$
8. Excellent Total Threshold for all University services
   $ATVery\ Good = 1{,}5 + 5{,}042 + 12{,}042 + 22{,}042 + 9{,}375 = 50{,}001$

4.2. Discussion

The stage of applying Bayes Method in processing the results of the questionnaire recapitulation to the service of the Dehasen University Bengkulu. Based on the recapitulation of

respondents' answers, the average score obtained by respondents for each university service can be seen in Table 2.

Table 2. Recapitulation Results of Student Satisfaction Levels Against University Services

University Services	Average Respondent Score
Student Services	17,61
Library Services	32,89
BAAK services	51,60
Facilities and Infrastructure Services	67,87
Financial Services	45,18

The next stage, calculates each criterion from university services based on the answers given by respondents. Answers from respondents were divided by the number of respondents so that the average value obtained for each service. The next step is to find the results of calculations based on equation 11, which is the average number of respondents per service criterion multiplied by probability per criterion.

a. Student Services Criteria
   Results $= 17{,}61 \times 0.083 = 1{,}468$
b. Criteria for Library Services
   Results $= 32{,}89 \times 0{,}153 = 5{,}025$
c. Criteria for BAAK Services
   Results $= 51{,}60 \times 0{,}236 = 12{,}183$
d. Criteria for Facilities and Infrastructure Services
   Results $= 67{,}87 \times 0{,}319 = 21{,}681$
e. Criteria for Financial Services
   Results $= 45{,}18 \times 0{,}208 = 9{,}413$

The next step is to compare the results of the data collection with the Very Good Threshold can be seen in Table 3.

Table 3. Comparison of Student Satisfaction Bayes Calculation Results Against Threshold Very Good

University Services	Results	Very Threshold Good	Conclusion
Student Services	1,468	1,5	Good
Library Services	5,025	5,042	Good
BAAK services	12,183	12,042	Very Good
Facilities and Infrastructure Services	21,681	22,042	Good
Financial Services	9,413	9,375	Very Good
Total	49,769	50,001	Good

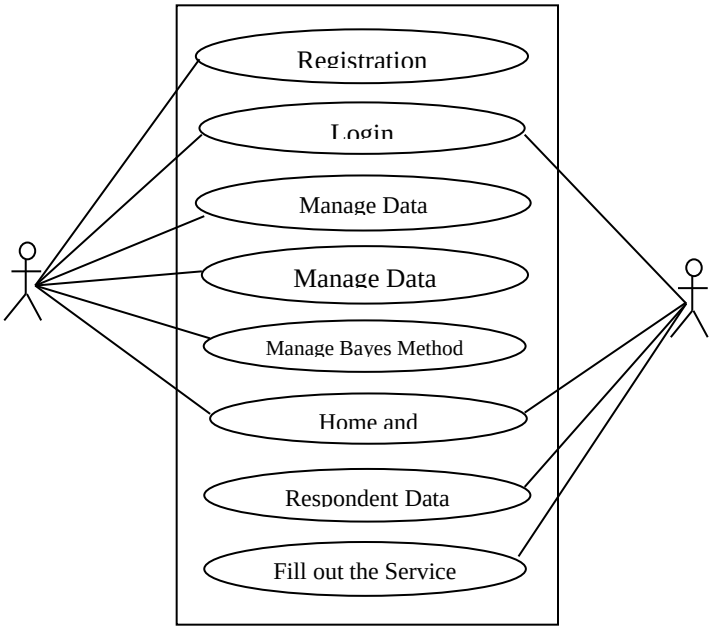
4.2.1. Design Features

The design features possessed by the decision support system evaluating the level of satisfaction can be seen in table 4 below. The design features are intended to facilitate two types of users, namely administrators and Respondents (students). Administrators are staff who are given the right to manage a number of data such as managing student satisfaction data on university services, respondent data and managing various information relating to evaluating student satisfaction. Respondents are all students who obtained a token given the right of access to get information as well as who gives the right to provide answers to services that have been felt during lectures given by the university. This feature is very useful to facilitate system users, namely administrators and respondents. Administrators as an extension of the quality assurance agency to maintain the evaluation of student satisfaction levels so that they can run continuously in carrying out their functions properly, while respondents from their side this feature is very helpful for respondents in assessing the services they have received during lecture activities.

		Use of level evaluation systems student satisfaction	
		administrator	Respondent /student
Fitur	Registration	✓	
	Manage respondent data	✓	
	Manage data management services	✓	
	Manage evaluation management	✓	
	Information	✓	✓
	Manage profile data		✓
	Evaluating		✓

4.2.2. System Requirement Design

The next step is to design a supporting system for the benefits contained in the use of case diagrams, which show the relationship between actors and the system. Based on Figure 2, there are two actors involved namely admin and respondent. Admin can manage all existing data while respondents can manage accounts, request and evaluate services received during lectures that are entitled as students using the format determined by the system.



Fgr. 2. Use Case Evaluation Diagram

of Student Satisfaction

V. CONCLUSION

The results of this study are the making of a decision support system evaluating the level of student satisfaction with university services, the design that has been produced will then be used by researchers to proceed to the next stage which is to build a decision support system for evaluating student satisfaction levels based on web, then implementing it. The purpose of this implementation phase is to prepare all activities for the implementation of the system so that in accordance with the design determined together, in this case the system built can assist the university in evaluating the services that have been provided to students to improve service quality standards and provide various information about service evaluation results activities.

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