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# Analysis and Design of Decision Support System for Improving School Education Quality Case Study: SMK Aero Dirgantara Islamic Village

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**Abstract:** *With the increase of education quality can build new reliable generation achievers. Analysis and design of decision support system is a tool that can help SMK Aero Dirgantara Islamic Village improve its education quality. The application will be built for helping school manager tasks such as: improving teacher performance, Measuring student performance, determination of poor students scholarship, selecting outstanding teachers and providing scholarships. This research focuses on the analysis and design decision support system for improving education quality using weighted product method and voting Borda method. This research is conducted by referring to previous journals related to academic decision support system.*

**Keywords:** *Decision Support System, Voting Borda, Weighted Product, analysis and system design, academic quality, Unified Modeling Language.*

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## I. INTRODUCTION

SMK Aero Dirgantara Islamic Village is a private-owned aviation school. The quality of education in this school is quite good but due to the lack of standard systems in managing education in schools so that the results of the process and output will be less than optimal.

One of the factors that make the success of the quality of education is the mindset of educators. Education is highly instrumental for students in shaping good and bad characters in school. Because with good education is expected to emerge the next generation of nation that has quality in society, nation and state.

The decline in the quality of education in schools is due to the lack of management by the school regarding the performance of teachers in schools that teach, and lack of good leadership and managerial skills so that the quality of students becomes decreased.

So, in this case, it takes analysis and design that can help improve the quality of the school, among others: managing teacher performance, measuring student performance, providing scholarships and selection of teachers or students achievers. So with the analysis and design of a system is expected when implemented will improve the quality of education in schools.

## II. RESEARCH METHODS

### 2.1. Materials Research

Materials Research conducted refers to previous journals that discussed about decision support applications related to improving the quality of education such as: Selecting outstanding teacher or selection of exemplary teachers, performance appraisal, providing scholarship, measuring student performance, selection of majors. The previous journal discussed the conclusion that the system was built with several methods such as the method of AHP (analytical hierarchy process), SAW (simple additive weighting), WPM (Weighted Product Model), WSM (weighted sum model), Borda, Naive Bayer. In this case will only uses 2 methods of weighted product method and Voting Borda Method.

### 2.2. Decision Support System

Decision Support System (DSS) is a system capable of providing problem-solving and communications capabilities for problems with semi-structured and unstructured conditions. This system is used to assist decision making in semi-structured situations and unstructured situations, where nobody knows exactly how decisions should be made (Turban, 2001). [7]

Decision support system aims to guide or provide predictions and directs the user information in order to make good decision-making.

### 2.3 Software Development Method

The method used in the development of this software is the prototype model method. Prototype model is a technique to collect certain information about user information needs quickly. Focusing on presentation of those aspects of Software that will appear to customer or user (for example input approach and output format).

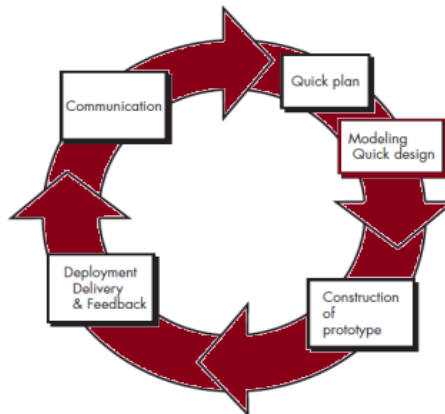


Figure 1. Prototype model

The prototype method starts from the communication stage. The software development team meets with stakeholders to determine the needs of the currently known software and to describe areas where further definitions for the next iteration. [4]

Iteration planning of prototype making is done quickly. After that modelling is done in the form of "quick design". The design of fast design is based on the representation of software aspects that will be seen by end users (e.g. user interface design or display format). The rapid design is the basis for starting construction of prototype manufacturing. [4]

The prototype is then left to the stakeholders to evaluate the pre-made prototype and provide feedback that will be used to improve the requirements specification. Iteration occurs when the developer makes improvements to the prototype. [4]

### 2.4 Quality of Education

Quality of Education in schools is defined as the ability to manage operationally and efficiently on school-related components. So as to generate added values against the components according to norms or standards applicable.

To measure the quality of education of course required indicators. According to Sallis (2005: 1-2) revealed there are many good quality indicators in educational institutions. Among others: 1) high moral values; 2) excellent examination results; 3) the support of parents, business, and the local community; 4) plentiful resources; 5) the application of the latest technology; 6) strong and purposeful leadership; 7) the care and concern for pupils and students; 8) a well-balanced and challenging curriculum. [6]

### 2.5 Weighted Product

The Weighted Product (WP) method uses multiplication to attribute ratings, where the rating of each attribute must be raised by the weight of the attribute in question. The process is similar to normalization (Sri Kusumadewi, 2006). [3] Example calculation method weighted product as follows:

Obtain the weight as follows C1 = 2, C2 = 3, C3 = 5.

Example data as follows:

Table 1. Weighted Product

Participant	Criteria		
	C1	C2	C3
A	70	72	81
B	62	71	82
C	52	61	65

The first stage is to calculate the weight of the first by knowing C1 = 2, C2 = 3, C3 = 5 add everything and then divide by the weight of the already known example of calculation as below:

$$w_1: \frac{2}{2+3+5} = 0.2 \quad w_2: \frac{3}{2+3+5} = 0.3 \quad w_3: \frac{5}{2+3+5} = 0.5$$

Then determine the value of vector s by squared and multiply that value. all the criteria in the table above is a benefit if there any cost criteria then the weight that is squared will be worth minus (-) example of the calculation like this :

$$s_1 = (70^{0.2})(72^{0.3})(81^{0.5}) = 79,492$$

$$s_2 = (62^{0.2})(71^{0.3})(82^{0.5}) = 74,075$$

$$s_3 = (52^{0.2})(61^{0.3})(65^{0.5}) = 60,820$$

Then calculate the Vi vector by entering the calculated S1 value which is 79.492. After that add the value of vector S1 + S2 + S3 = the results, then divide by S1. Example of the calculation is below:

$$v_1 = \frac{79.492}{79.492 + 74.076 + 60.820} = 0.358822$$

$$v_2 = \frac{74.076}{79.492 + 74.076 + 60.820} = 0.352092$$

$$v_3 = \frac{60.820}{79.492 + 74.076 + 60.820} = 0.289084$$

The highest result is the winner means the rank 1 = A, rank 2 = B, rank 3 = C

### 2.6 Voting Borda

The Voting Borda method is a method used in group decision support systems for single or multiple winning selections, in which voters conduct rankings on the selected participants. The Voting Borda method determines the winner of an election by providing a certain number of outcomes for each participant in accordance with the positions set by each voter. The winner will be determined by the number of final results collected or obtained by each participant such as the following:

Table 2. Voting Borda

Participants	Ranks				Scores	Final Results
	1	2	3	4		
A	3	4	1	1	18	0.26086
B	2	6	2	0	20	0.28985
C	2	3	3	2	15	0.21739
D	1	4	5	0	16	0.23188
Weights	3	2	1	0	69	

It is known there are 4 participants that are done A, B, C, D is done by filling the questionnaire and got the data as follows A participant get the rank 1 as much as 3 participants who fill the questionnaire, rank 2 as much as 4 and so on. Then how to count multiply the number obtained to number weights of example  $3 * 3 = 9$ ,  $4 * 2 = 8$ ,  $1 * 1 = 1$ ,  $1 * 0 = 0$  then add the result of the score so then the score got to 18 for participant B, C, D did the same as previous say. when it has got the overall value then add all the score the result will be 69 then do the divided results from those already added with those not yet so the result is like this for example  $18/69 = 0.26086$ ,  $20/69 = 0.28985$  and so on. The highest value of the final result is the winner.

### 2.7 The Unified Modeling Language (UML)

UML is a graphical language for visualizing, specifying, constructing, and documenting the artifacts of a software-intensive system. The UML gives you a standard way to write a system blueprints, covering conceptual things such as business processes and system functions, as well as concrete things such as classes written in a specific programming language, database schemas, and reusable software components. [5] Example of UML such as use case diagram, activity diagram, sequence diagram, class diagram.

## III.RESULTS AND DISCUSSION

### 3.1 analysis of system requirements

This application is intended to improve the quality of education in schools. This application will be made with web-based because the web has advantages in user interaction that can easily run on most operating systems such as Windows, Linux, Mac as long as have a browser. And also the web has other advantages that can be accessed anytime using a laptop, Smartphone, Computer.

In the analysis and design of this system will be made with weighted product method and Voting Borda. Both of the methods will be used in this design analysis. The weighted product calculation method using multi-criteria is more suitable for selection, assessment, aid, and prediction of student performance. Voting Borda method is more suitable for selection and assessment. The category of assessment and election will use both of the methods and in comparison to getting more optimal results.

The output of this application as follows:

- Assessment report from questionnaire for example: teacher performance appraisal, leadership assessment.
- Election reports from questionnaires for example: selection of outstanding teachers, selection of exemplary teachers, election of head of activities, election of OSIS chairman.
- Prediction reports on student performance using the results of the study.
- Reports of scholarships for underprivileged students are taken based on the results of the study and the student's financial.
- Reports review results from student questionnaires, teachers, leaders.

Other additional output:

- Comparative method report between Weighted Product and Borda on election and assessment categories that aims to find out whether there are differences in the value of the results on the system to be built.

### 3.2 System Design Phase

Analysed system must be done before system development by using UML such as activity diagrams, class diagrams, sequence diagrams, and use case diagrams. Mock ups the website display build after UML analysis phases are done.

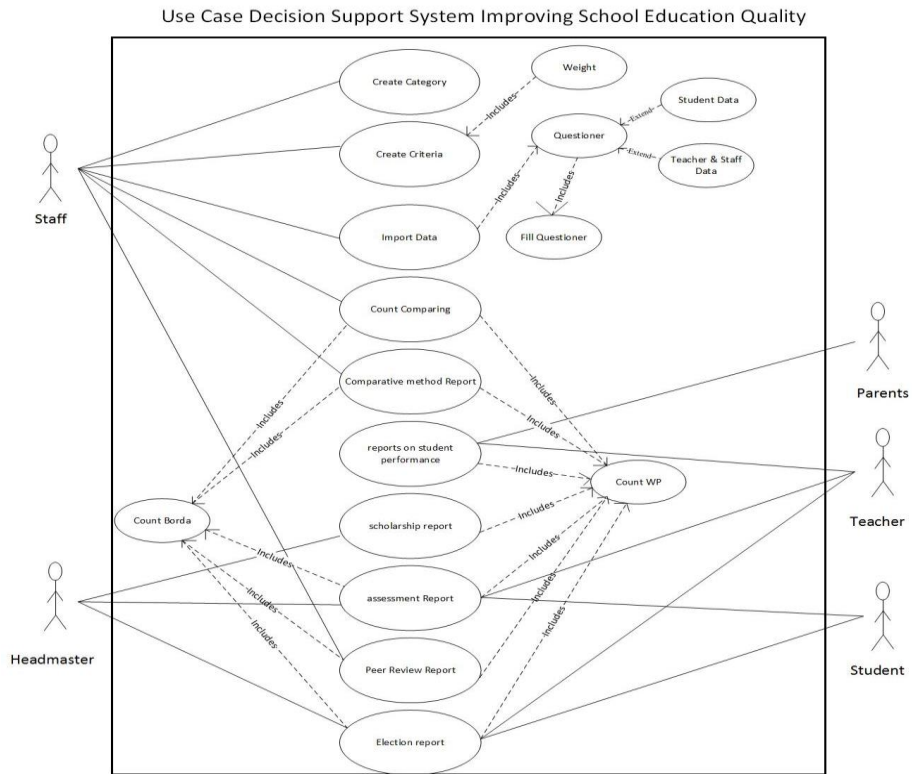


Figure 2. Use Case Diagram

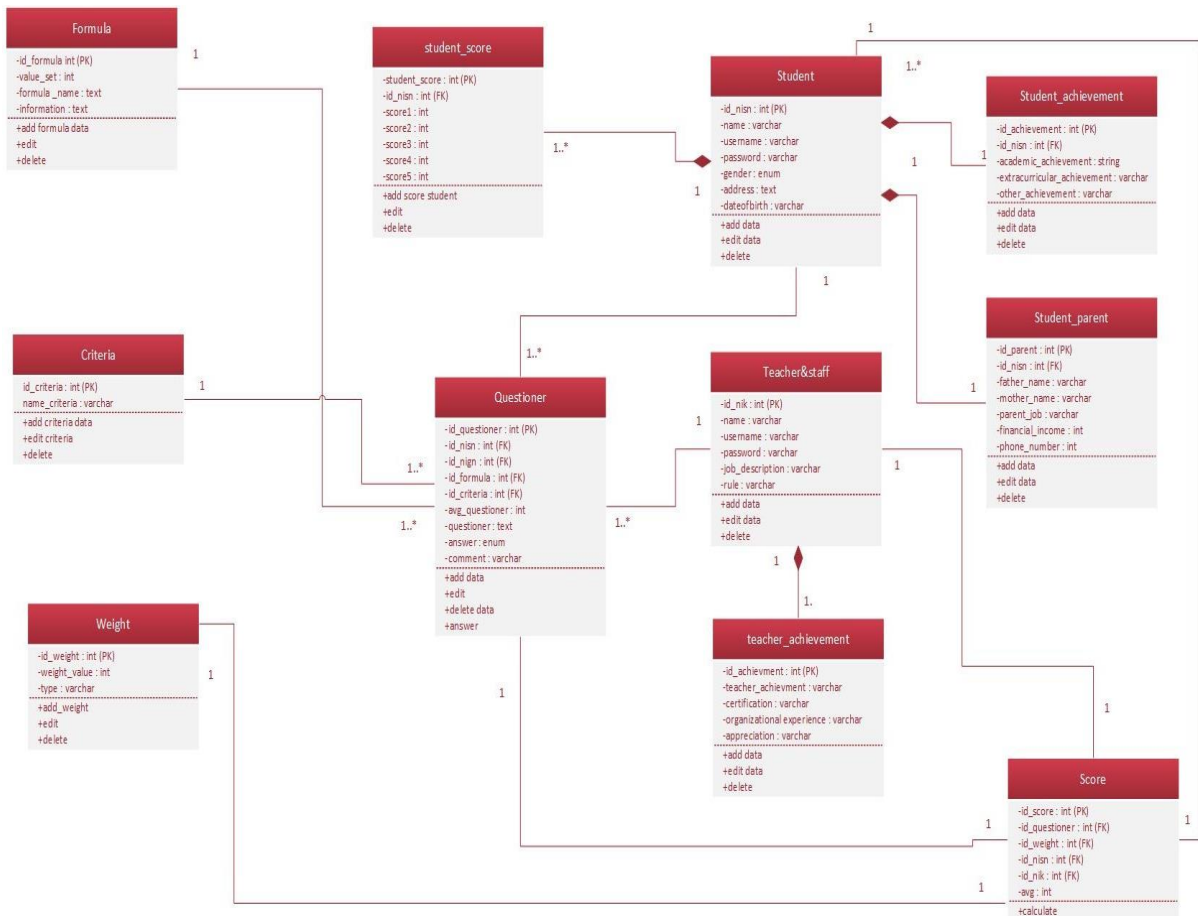


Figure 3. Class Diagram

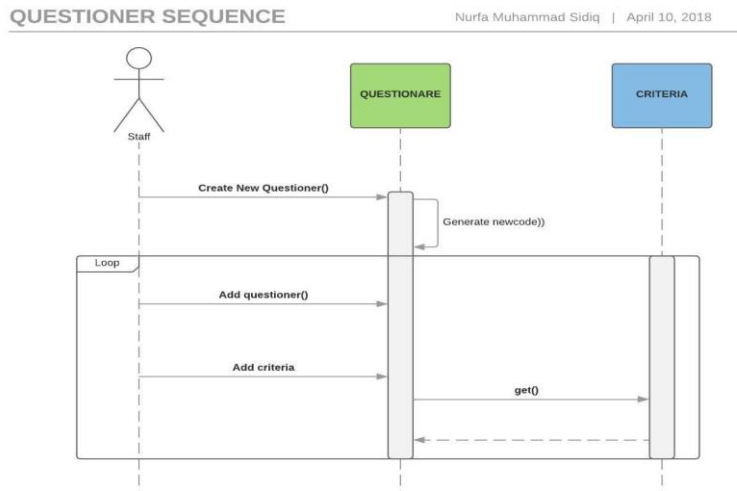


Figure 4. Questionnaire Sequence Diagram

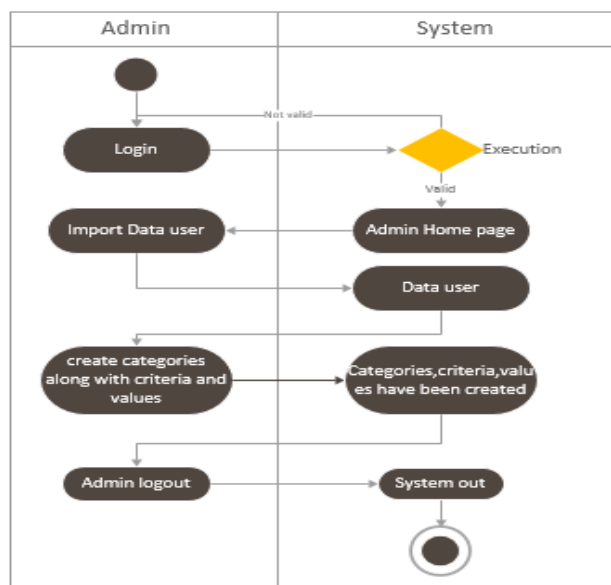


Figure 5. Activity Diagram Admin process of making the questionnaire

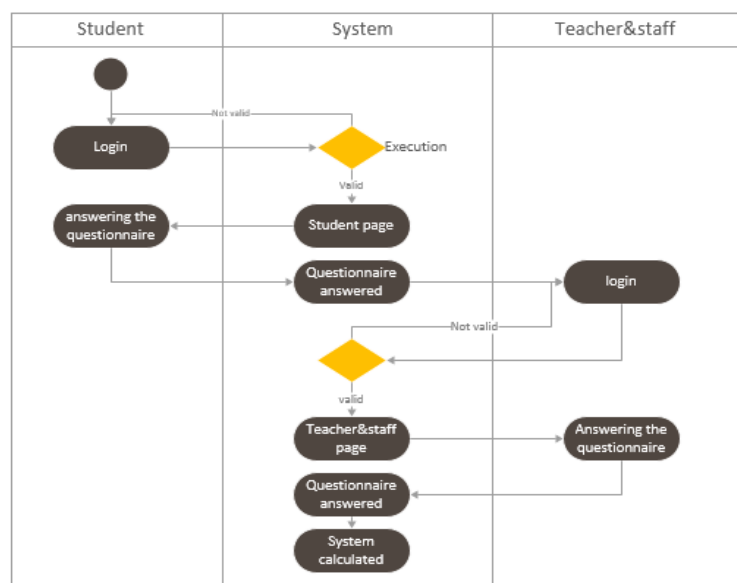


Figure 6. activity diagram Student and teacher filled in the questionnaire

### 3.2.1 Admin Prototype Design

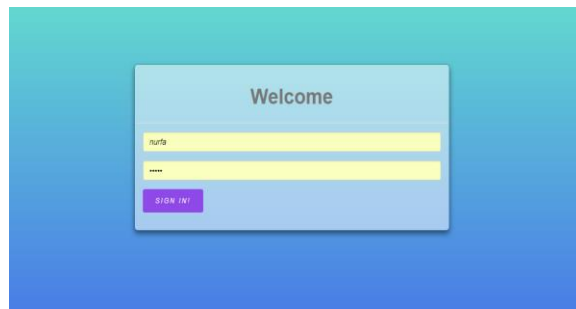


Figure 7. Admin Home Page

Figure 7 shows the prototype design for administrator login admin must fill in the username and password first before entering the category.

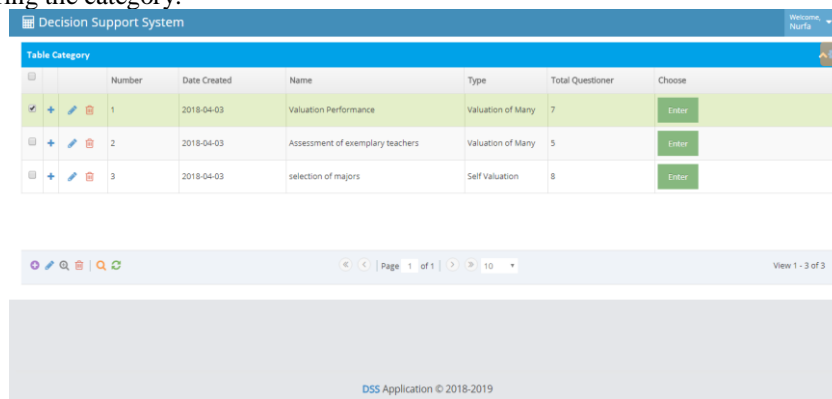


Figure 8. Admin Category page

Figure 8 below shows the table category table view. The admin must input data in advance to create a decision-making system.

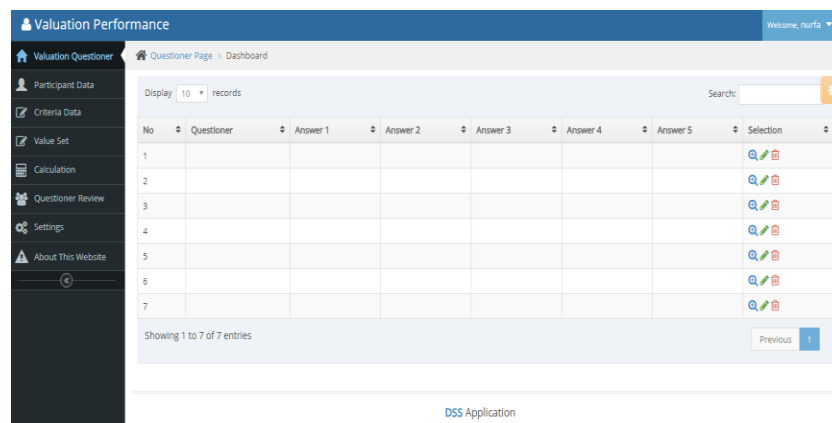


Figure 9. Admin Home Page

Figure 9 shows the home page display admin which is filled with menus as follows:

- Home or questioner: the page containing the questionnaire table.
- Participant data: the page containing the candidate to be assessed.
- Data criteria: contains the assessment of the criteria weights.
- Value set: the set value page containing the values to be used for the questionnaire value.
- Calculation: this page contains calculations and rankings according to the method selected.
- Questioner / peer review: the page that displays the results of the questionnaire filled by students, teachers, staff.
- Settings: page to set about the user, open registration, Close registration, assessment, an announcement of the winner, Users data import.

### 3.2.3 User Prototype Design

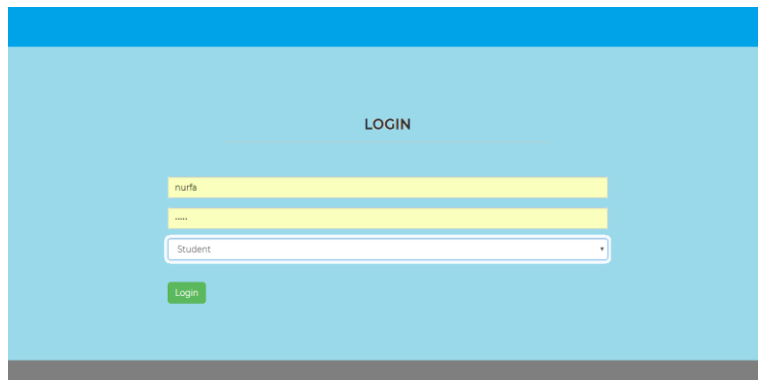


Figure 10. User Login Page

Figure 10 described below is a user prototype design. On this page there will be 3 users who can login: Students, Teachers and Staff each users has their own username and password.

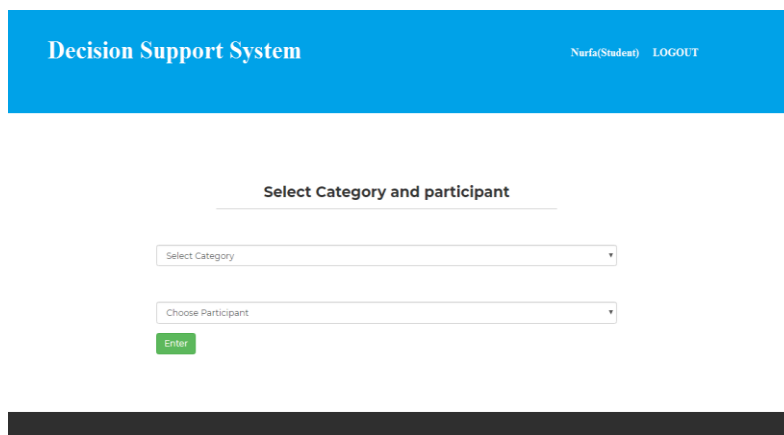


Figure 11. User selection page

Figure 11 shows selecting categories and participants to be assessed based on the questionnaire

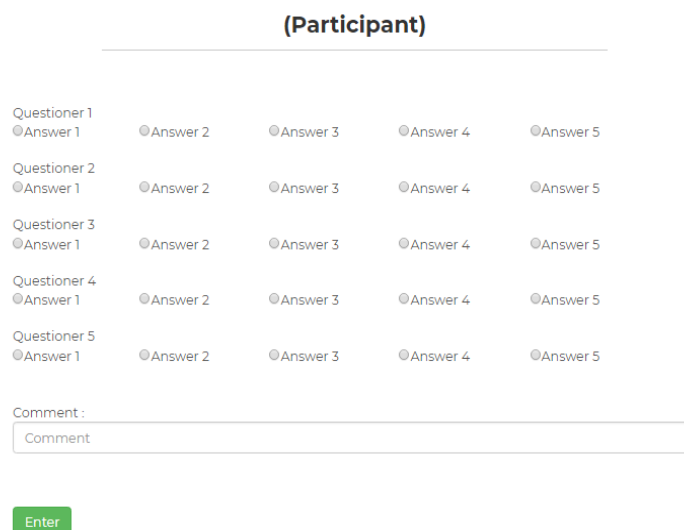


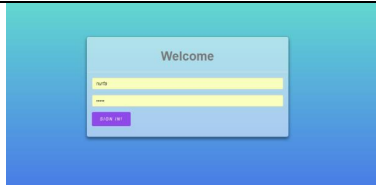
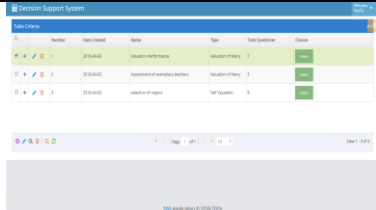
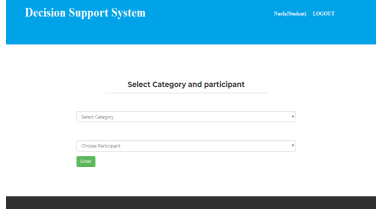
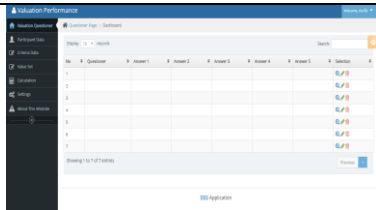
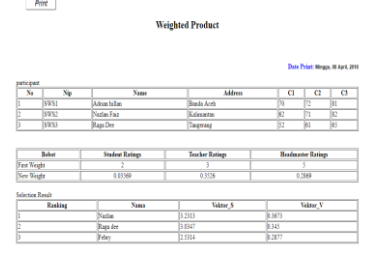
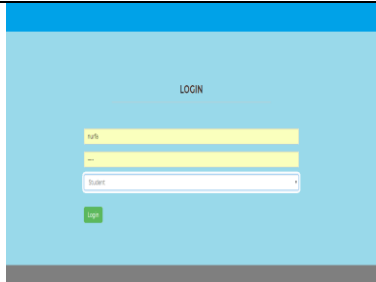

Figure 12. User Questioner Page

Figure 12 sample of student page questionnaire filling. For other users such as teacher & staff, the questionnaire will be different depending on the admin who has made it.



3.3 Scrum Black box testing

Table 3. Black Box Testing

No	Purpose	Test example	Expected result	Tested by	Testing date
1	to check the admin login system should be running or not		admin can login if the username and password are correct input username and password can use symbol	Nurfa	
2	to check if it can do CRUD on the admin category page		system now can do create,read,update,delete at the admin category user must input according to the specified database type	Nurfa	
3	to select category and participant		the system can execute correctly without any error	Nurfa	
4	check CRUD on the data questionnaire		questionnaire now can do create, read, update, delete input must specified to database type	Nurfa	
5	test print out data system weighted product method		System can print out data and can calculate correctly	Nurfa	
6	Check login session between each user		User, teacher, and staff can login simultaneously without crashing each other	Nurfa	
7	performing questionnaires on student, teachers and headmaster		All user can answer the questioner and edit them user cannot leave the page without filling out the questionnaire	Nurfa	

### 3.4 Specification

Recommended laptop or computer specifications to build the system:

Hardware:

- Processor Intel i5-4210U CPU @ 1.70GHz.
- Ram 4gb.
- VGA Intel® HD Graphics Family.
- Hard disk at least 250 GB.
- 14 inch monitor.
- Printer Epson L210.

Software:

- OS windows 7 ultimate or more.
- Browser google chrome dev.
- Database system MySql 5.0.10.
- Programming language PHP,Java script, Html,Css,jQuery.
- Using sublime text 3,Adobe Dreamweaver, Notepad ++ for editing source code.

### 3.5 Database design

The picture below is a database table design application of decision support system to improve the quality of education:

No	Attributes	Type	Length	information
1	id_nisn	int	10	Primary key
2	name	varchar	30	
3	username	varchar	30	
4	password	varchar	30	
5	gender	Enum(Woman,men)		
5	adress	text	50	
6	dateofbirth	date		

No	Attributes	Type	Length	information
1	Id_questioner	int	3	Primary
2	Id_nisn	int	10	Foreign key
3	Id_nik	int	3	Foreign key
4	Id_formula	int	3	Foreign key
5	Id_criteria	int	3	Foreign key
6	questioner	text	50	
7	Asnwer	enum(answer 1 – 5)		
8	Comment	text	50	

No	Attributes	Type	Length	information
1	id_achievement	int	10	Primary key
2	Teacher_achievement	varchar	30	
3	certification	varchar	30	
4	Organizational_exprience	varchar	30	
5	appreciaton	varchar	30	

No	Attributes	Type	Length	information
1	Id_criteria	int	3	Primary
2	Name_criteria	varchar	30	

No	Attributes	Type	Length	information
1	Id_formula	int	3	Primary
2	Value_set	int	3	
3	Formula_name	varchar	30	
4	information	text	100	

No	Attributes	Type	Length	information
1	Id_weight	int	3	Primary
2	weight	int	3	
3	Name_weight	varchar	30	

No	Attributes	Type	Length	information
1	id	int	3	Primary
2	admin_name	varchar	30	-
3	username	varchar	30	
4	password	varchar	30	

**student\_achievement**

No	Attributes	Type	Length	Keterangan
1	<u>Id_achievement</u>	<u>int</u>	3	Primary
2	<u>Id_nisn</u>	<u>int</u>	10	Foreign key
3	<u>Academic_achievement</u>	<u>varchar</u>	30	
4	<u>extracurricular_achievement</u>	<u>varchar</u>	30	
5	<u>Other_achievement</u>	<u>int</u>	30	

**Student parent**

No	Attributes	Type	Length	Keterangan
1	<u>Id_parent</u>	<u>int</u>	3	Primary
2	<u>Id_nisn</u>	<u>int</u>	10	Foreign key
3	<u>Father_name</u>	<u>varchar</u>	30	
4	<u>Mother_name</u>	<u>varchar</u>	30	
5	<u>Parent_job</u>	<u>varchar</u>	30	
6	<u>Financial_income</u>	<u>Int</u>	11	
7	<u>Phone_number</u>	<u>int</u>	12	

**Category**

No	Attributes	Type	Length	information
1	<u>id_category</u>	<u>int</u>	3	Primary
2	<u>Category_name</u>	<u>varchar</u>	30	-
3	<u>type</u>	<u>varchar</u>	30	
4	<u>Total_questioner</u>	<u>int</u>	3	
5	<u>Date_created</u>	<u>date</u>		

**Score**

No	Attributes	Type	Length	information
1	<u>Id_score</u>	<u>int</u>	3	Primary
2	<u>Id_questioner</u>	<u>int</u>	3	Foreign key
3	<u>Id_weight</u>	<u>int</u>	3	Foreign key
4	<u>avg</u>	<u>int</u>	4	
5	<u>Id_nisn</u>	<u>int</u>	10	Foreign key
6	<u>Id_nik</u>	<u>int</u>	3	Foreign key

**Student score**

No	Attributes	Type	Length	Keterangan
1	<u>Id_score</u>	<u>int</u>	3	Primary
2	<u>Id_nisn</u>	<u>int</u>	10	Foreign key
3	<u>Score1</u>	<u>int</u>	3	
4	<u>Score2</u>	<u>int</u>	3	
5	<u>Score3</u>	<u>int</u>	3	
6	<u>Score4</u>	<u>int</u>	3	
7	<u>Score5</u>	<u>int</u>	3	

**Teacher&staff**

No	Attributes	Type	Length	information
1	<u>Id_nik</u>	<u>int</u>	3	Primary
2	<u>name</u>	<u>varchar</u>	30	
3	<u>username</u>	<u>varchar</u>	30	
4	<u>password</u>	<u>varchar</u>	30	
5	<u>Job_desccription</u>	<u>varchar</u>	30	
6	<u>rule</u>	<u>varchar</u>	30	

#### IV. CONCLUSIONS

Based on the results of the analysis and design that have been described above, It can be drawn the conclusions:

- An assessment of employee or teacher performance in schools aimed at building professionalism, exemplary personality, and good socialism in the school environment.
- System selection of teachers or students achievers, the goal for schools is to improve the image of institutions in the community on. And for teachers and students can increase motivation, Discipline and compete in academic achievement.
- There is a measurement of student learning outcomes that help to improve students' performance in schools based on the results of studies and grades. The goal of this system is improving the academic quality of the student.
- There is a system of providing scholarships to the student underachievers who are less capable. So that schools do not need to look for student data again because there is already a system that do it. The benefit for students is to encourage students to continue their education and expected to go to a higher level.
- The results of questionnaires filled by students, Teachers, Staff will be displayed on the admin Page so that the admin or staff can see the data of the questionnaire filled by the user.
- If implemented the built system has been analyzed based on user needs.

#### V. ADVICE

Suggestions that can be drawn for analysis and design are possible for further development of the system can be expanded such as merging with school academic school system so as to produce a more flexible and useful system for schools.

Then other suggestions for the implementation of the system can be continuously evaluated and developed in accordance with the situation and conditions that exist in the school and taken the best method for calculation and ranking.

If the system has been implemented it is necessary to have training for admin in operating in this decision support system.

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