

# Web-Based Student Payment Administration Information System Using The Waterfall Method

Mahmud Mustapa<sup>1\*</sup>, Erwin Gatot Amiruddin<sup>2</sup>, Ezra Maharani Chaniago<sup>3</sup>, Ummiati Rahmah<sup>4</sup>

<sup>1,4</sup>Electronics engineering education, Universitas Negeri Makassar, Indonesia  
<sup>2,3</sup>Informatics Engineering, Universitas Teknologi Akba Makassar, Makassar, Indonesia

## Abstract

This research aims to develop an Information System that can assist the school admin in providing the validation process for tuition payments, speed of access, and completeness in providing information. This research aims to overcome administrative challenges that often occur in schools, such as errors in recording payments, late payments, and the difficulty of tracking payment history to save time and effort previously spent processing payments manually. The research method used is the Waterfall method. This application will make it easier for the finance department to record student tuition payments method was chosen because of its deep capabilities and describes a flow or stages that run like a waterfall from one stage to the next. This approach relies heavily on good initial planning because changes made in the early stages may be difficult or expensive to implement in later stages. Based on the results of system design and black box testing, it can run well, and user responses also provide very good responses, with 94% of respondents giving very good responses and 0% saying good and quite good. Based on these findings is hoped that it can be used more efficiently and also ensure data security and can store the results of the data that has been processed.

**Keywords:** Queuing Applications; Client Server; SDLC Prototype Model.

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## Introduction

An academic institution needs to manage management effectively to meet educational needs (Aliyyah et al., 2019). Apart from the teaching activities carried out by teachers to students, there are also school financial administration activities. This financial management involves the process of recording financial data related to Education Development Contributions (SPP) paid by students every month (Baehaqi & Yulia, 2023). SPP is a routine payment obligation that must be fulfilled by students and is used by schools to support various student learning activities (Search, 2023). SPP payments are made according to a predetermined schedule (Unmul, 2023). The information system will make it easier for the Muhammadiyah Ambon Vocational School agency to process data (Muhamad et al., 2023). Along with the development of computer technology and information technology, it is time for schools to develop efficient and effective information systems to be able to improve the quality of communication with students, (Rochman et al., 2018), (Astriyani et al., 2020). The research method used is the Waterfall method. This application will make it easier for the finance department to record student tuition payments (Alfisyakhrin et al., 2023), (Hartomi, 2021).

The use of this tuition payment information system is to overcome administrative challenges that often occur in schools, such as errors in recording payments, late payments, and the difficulty of tracking payment history to save time and effort previously spent processing payments manually (Sudipa et al., 2023). With this system, SMK Muhammadiyah Ambon can increase accuracy and transparency in the tuition payment process (Hikmah & Muqorobin, 2020). Based on the results of observations, the Muhammadiyah Ambon Vocational School information system also allows the school to manage payment data better (Ramadani, 2023), (Fonna, 2019). They can easily track and manage student payment data digitally, as well as produce accurate and detailed financial reports (Azizah et al., 2020). Based on the problems faced by SMK Muhammadiyah Ambon, the author created the title "Website Based Spp Payment Information System" to assist the admin in serving the SPP payment validation process, speed of access, and completeness in providing information (Susanto, 2018). By creating a website-based tuition payment information system, it is hoped that it can be used more efficiently and also ensure data security and store the results of data that has been processed (Iskandar, 2022).

\*Corresponding author.

E-mail address: mahmudmustapata@gmail.com (Mahmud Mustapa)



## Method

The research method for the Web-Based Student Payment Administration Information System employs the Waterfall Method, a structured and linear approach to software development. The Waterfall Method is characterized by a series of distinct phases, including requirements gathering, system design, implementation, testing, deployment, and maintenance (Farikah et al., 2019). Each phase in the Waterfall Method is well-defined, allowing for clear documentation and understanding of the project's progress. This approach is particularly suitable for projects with well-established and stable requirements, providing a comprehensive framework for planning, execution, and evaluation throughout the development lifecycle of the Web-Based Student Payment Administration Information System (Iskandar et al., 2022), (Wijanarko & Pangestuti, 2021) namely as follows:

### 1. Data collection technique

#### a. Study of Literature

In its implementation, the author carried out an analysis based on the information or documents obtained and looked for reference sources from previous research (Data, 2014). The reference search process is carried out in various places, such as libraries, journals, archives, articles, books, and also via the Internet online.

#### b. Interview

Interviews are a data collection method applied in every research activity to obtain information related to the problems researched by the author (Moleong & Edition, 2004). In this process, the author involves various parties who have a relationship with the system to be developed, to understand the objectives of the research being carried out. The parties involved include teachers, financial staff, Administrative staff (TU), and school principals.

#### c. Observation

The observation method is used to obtain a clear understanding of the current implementation of the system (Hanifah, 2014). This technique is used to directly analyze teacher activities in recording tuition payments and to record problems that arise. The aim is for the author to be able to analyze the processes that have taken place and design a new system that will be developed so that it remains in line with the existing system.

#### d. Questionnaire / Survey

The survey method is a data collection method that involves giving several questions/written statements to respondents to measure attitudes toward the design being made (Rukajat, 2018), (Morrisan & others, 2012).

### 2. System Design Methods

In this system, procedures are described using UML. UML is depicted using a use-case diagram, and then each process that will occur is explained in an activity diagram (Kurniawan, 2018). The actors involved in it are as follows:

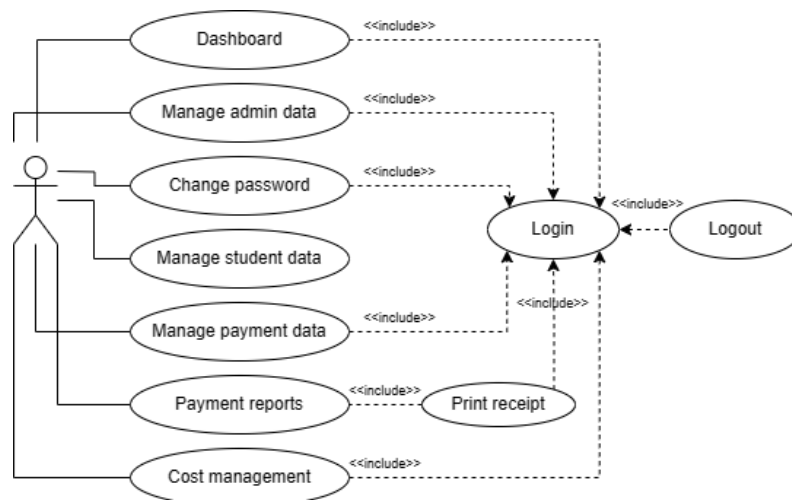


Figure 1. Use Case

### 3. Class Diagrams

A class Diagram, commonly called a class diagram, is a type of UML structural diagram that clearly describes the structure and description of the classes, attributes, methods, and relationships of each object (Muslihudin & others, 2016). Class diagrams are static in the sense that class diagrams do not illustrate what interactions occur when the classes are related, but explain what interactions occur (Setiawan Rony, 2021). The following is the Class Diagram of the tuition payment information system at SMK Muhammadiyah Ambon.

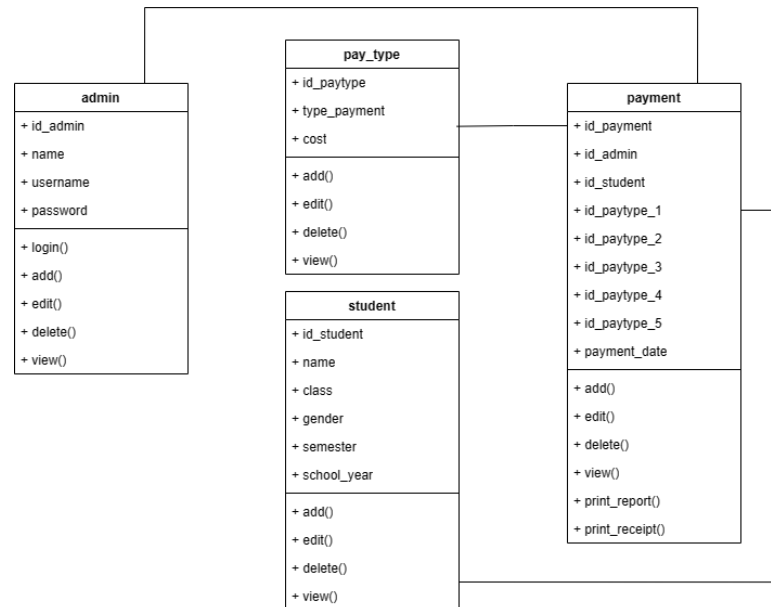


Figure 2. Class Diagram

### 4. Systems Analysis

#### a. Information Needs Analysis

Based on observations, it can be concluded that the conventional method of paying tuition fees has weaknesses in data management. One of these weaknesses is the difficulty in searching for data which requires time and effort, especially when the amount of existing data is quite large (Yamalia & Siagian, 2019). Storing ever-increasing data becomes difficult, and there is a risk of damage and loss of data during the storage process. In addition, communication was carried out with financial staff to find out general problems that often arise in conventional tuition payments. Based on this needs analysis, it is targeted that this website-based tuition payment information system can fulfill the appropriate function for user needs in managing tuition payments through the use of a computerized system. Requirements analysis is carried out to understand the requirements needed to design the system. Here are the results of the analysis as follows:

- 1) Information Requirements: The information desired for the system design process includes: Student Data and Data on Donation Payment Fees
- 2) System Usage: System usage requirements involve identifying the user groups who have access to the system being designed. In this design, there is one user category, namely admin. Admin is a component of the administration that is responsible for managing all stages of SPP payments as a whole.

#### b. System Feasibility Analysis

System feasibility analysis is a study that contextualizes and calculates the criteria for system design to determine whether the system is worthy of being upgraded to become a perfect system (Sutabri, 2012). The following is a system feasibility analysis:

- 1) Technological Feasibility: The technology required to develop a system design already exists. The network connections, hardware, and software required to design and run this system have been obtained.
- 2) Legal Feasibility: The system design to be designed and this document comply with legal aspects. The information and data applied for the analysis and design of this system do not conflict with the law and

come from relevant research objects. In addition, approval has been obtained from SMK Muhammadiyah Ambon regarding the use of the required information and data.

3) Operational Feasibility

The design of this system is designed to make it easier for administrators to manage school tuition payment data.

c. Software Requirements Analysis

To run the tuition payment information system at SMK Muhammadiyah Ambon, the following can be used: PHP, HTML, MySQL, XAMPP, and Web Browser.

5. Framework of Thought

Researchers intend to develop a web-based tuition payment information system that is expected to help and simplify the management of payment data, as well as improve the use of technology in education. The development of this information system will use a waterfall model which consists of several stages, namely analysis, planning, implementation, and testing (Wahid, 2020). To ensure the quality of the software produced, testing is required which refers to quality standards.

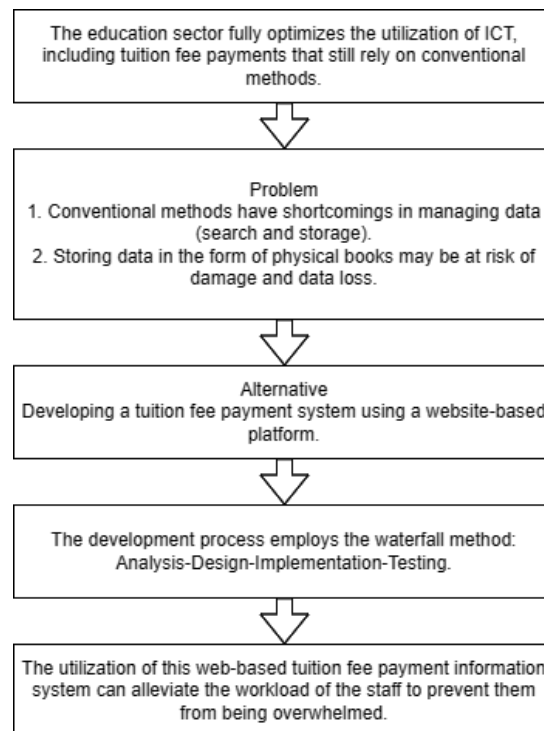


Figure 3. Framework of Thought

## Results and Discussion

### Results

The results of research on Web-Based Student Payment Administration Information Systems Using the Waterfall Method are as follows:

1. Black Box Testing

The Blackbox method is a software testing method that focuses on functionality, especially on input and output, aiming to verify that the system runs as expected (Patria, 2023). Testing the SPP payment information system using the black box method (Mayefis et al., 2023). The following is an explanation of the test method that will be carried out, Table 1:

Table 1. Black Box Testing

Description	Testing Activities	Expected results	Results
Login Page	User Fill in the username and password and click the login button.	The application displays the main / home admin page.	Valid
Dashboard Page	Enter the dashboard page.	The application displays a dashboard page containing icons for the user to choose according to what is needed.	Valid
Admin Data Page	Users can choose the options to add data, edit data and delete data.	The application displays options according to what the user selects/wants.	Valid
Fee Settings Page	Users can set the SPP type, and click the save button.	Displays the changed costs and the cost settings saved successfully.	Valid
Student data page	User Click the add student data option. Fill out the form to add student data and click save. Click the edit button. Click the delete button.	The add student data page appears which contains columns for entering data. Student data is successfully saved and opens the student data page. Displays the student data edit page. Student data has been successfully deleted.	Valid
Data page payment	The user clicks the add button and clicks save. The user clicks the print receipt option. Click the edit button. Click the delete button.	The add data page displays and student data has been successfully saved. Displays the page for printing student receipts. The edit student data page appears. Student data has been successfully deleted.	Valid
Add payment data page	Users click the add payment data button on the payment data page and click save.	Displays the add payment data page which contains student data, and displays the total tuition payments and student payment data successfully saved.	Valid
Payment report page	Users will filter by selecting the options as needed, namely date, semester, and class, and click print.	Displays receipts that have been filtered by the user and the admin can print payment reports.	Valid
Password change page	The user fills in the old password and new password then clicks the change password button.	The password change page displays successfully.	Valid

## 2. System Implementation

The website-based school tuition payment information system at SMK Muhammadiyah Ambon can make things easier admin section in serving the SPP payment validation process. The following is how to use the website so that it runs according to its function.

### a. Login Page

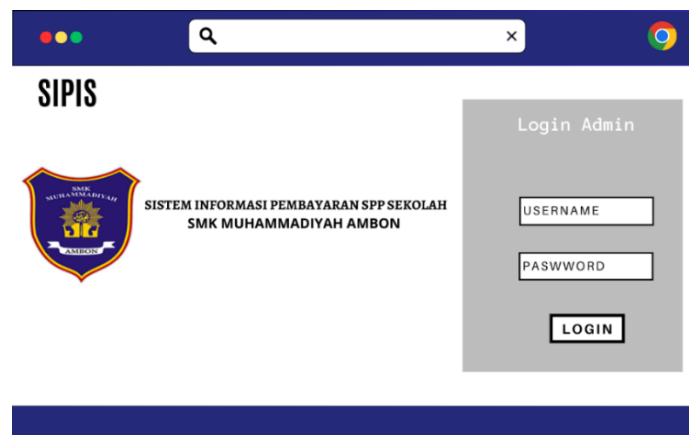


Figure 4. Login page

On the login page, the admin must first enter the username and password, so he can log in to the system. The login display is the main display that appears when accessing the system.

b. Dashboard page

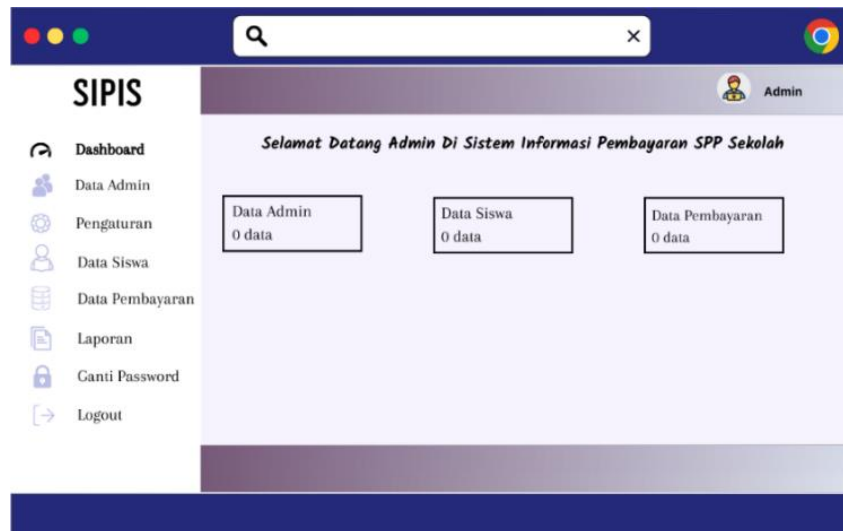


Figure 5. Dashboard page

The Dashboard page is the first display that appears after the admin successfully logs in.

c. Admin Data Page

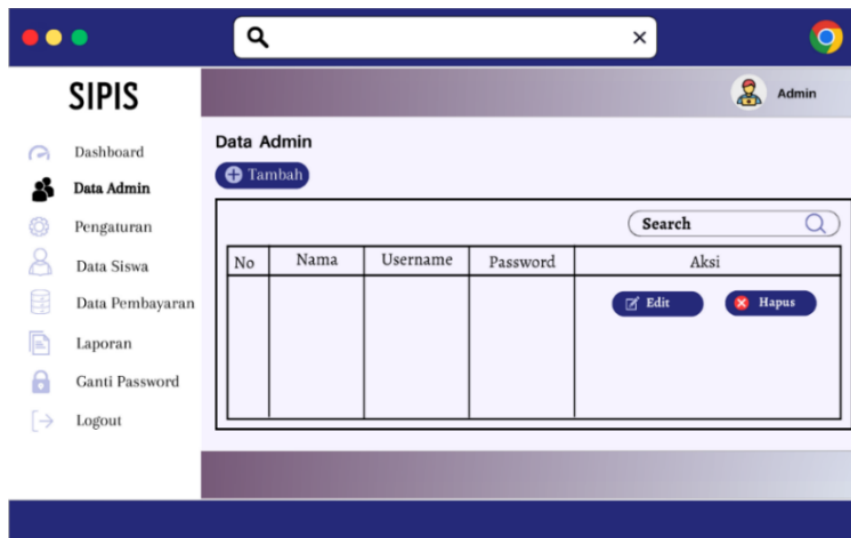


Figure 6. Admin Data Page

On the admin data page is the interface that appears when the admin clicks the admin data menu. In this view, admins can edit, add, and delete admin data.

d. Student Data Page

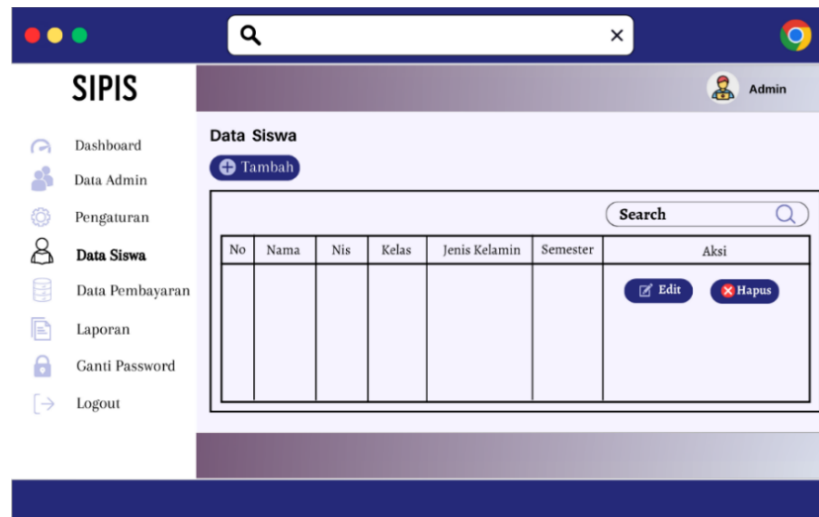


Figure 7. Student Data Page

The student data page is the interface that is displayed when the admin clicks on the student data menu. admin can add, edit, and delete student data.

e. Payment Data Page

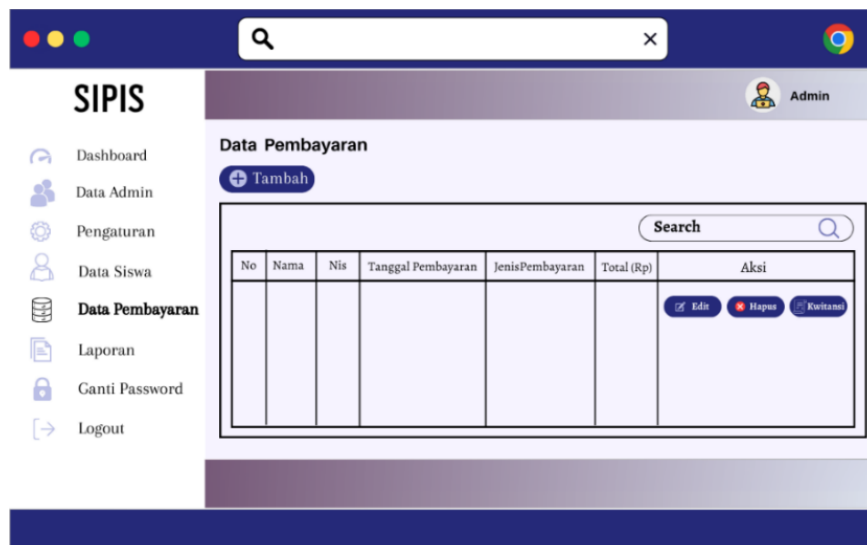


Figure 8. Payment Data Page

The payment data page is the interface that appears when the admin clicks the payment data menu. In this view, the admin can add, print receipts, delete, and edit payment data.

f. Add Payment Data page

Figure 9. Add Payment Data page

The add payment data page is the interface that is displayed when the admin selects the add payment data option on the payment data page.

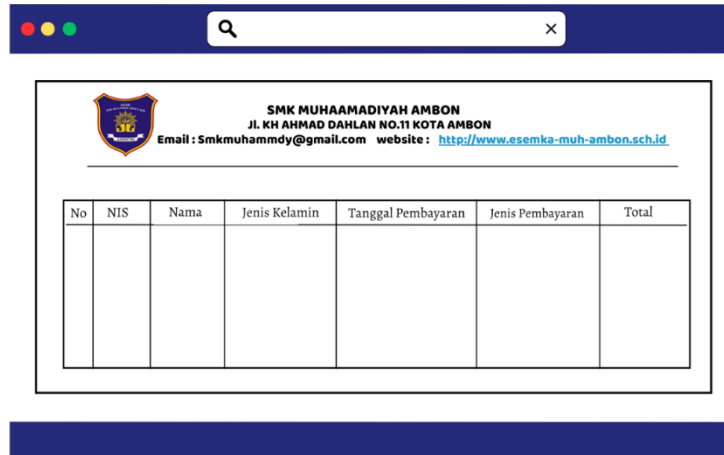
g. Payment Report Page

Figure 10. Payment Report Page

The payment report page is the interface that is displayed when the admin clicks the payment report menu. Admin can filter reports according to date, class, and semester.



#### h. Reports Page

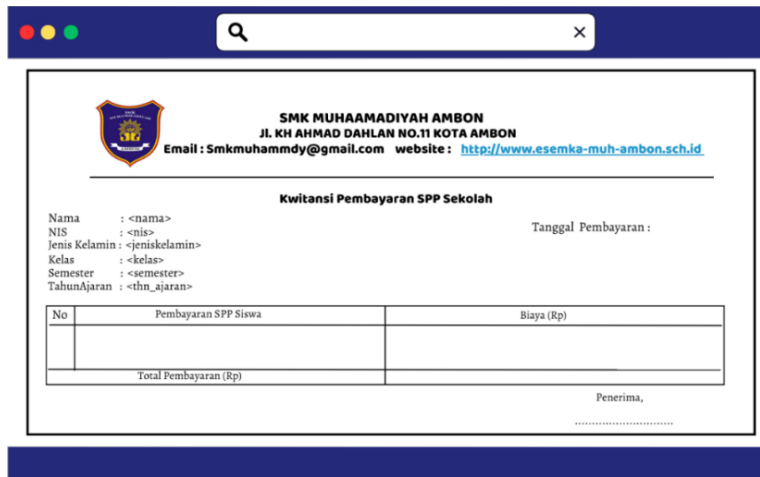


No	NIS	Nama	Jenis Kelamin	Tanggal Pembayaran	Jenis Pembayaran	Total

Figure 11. Report page

The payment report display is the interface that appears when the admin successfully filters the data and selects the print option.

#### i. Payment Receipt Page



**Kwitansi Pembayaran SPP Sekolah**

Nama : <nama>      Tanggal Pembayaran :  
NIS : <niss>  
Jenis Kelamin : <jeniskelamin>  
Kelas : <kelas>  
Semester : <semester>  
TahunAjaran : <thn\_ajaran>

No	Pembayaran SPP Siswa	Biaya (Rp)
Total Pembayaran (Rp)		

Penerima,

Figure 12. Payment Receipt Page

The payment receipt page is the interface that is displayed when the admin clicks the receipt option on the payment data page.

### Discussion

System testing or respondent assessment in the tableRespondents' assessment regarding the web-based tuition payment information system at SMK Muhammadiyah Ambon, by referring to respondents' responses to design decisions, the assessment can be done using a Likert scale. The Likert scale applied in this research is in the number range 1 – 5, as stated in the following tables 2 & 3:

Table 2. Likert Scale

Description	Number
Strongly Agree (SS)	5
Agree (S)	4
Doubtful (RG)	3
Disagree (TS)	2
Strongly Disagree (STS)	1

Table 3. Questions for Respondents

No	Question	Select a Response Option				
		SS	S	RG	TS	STS
1	Is the flow plan appropriate?					
2	Is the design of the school tuition payment system easy to understand?					
3	Is the school tuition payment system design equipped with complete features?					
4	Does the design of the school tuition payment system present information enough?					
5	The design of the school tuition payment system is designed to meet relevant needs?					

The next step is to carry out calculations to obtain:

1. Ideal Score

Determining the desired score is done by applying the formula:

**Criterion Score** = Scale value x Number of respondents (1)

Table 4. Ideal Score

Formula	Scale
5 x 10 = 50	SS
4 x 10 = 40	S
3 x 10 = 30	RG
2 x 10 = 20	TS
1 x 10 = 10	STS

2. Rating Scale

The next step is to determine the rating scale value & interval range based on the values contained in Table 5. With the following conditions:

Table 5. Rating Scale

Response Score	Scale
41 - 50	SS
31 - 40	S
21 - 30	RG
11 - 20	TS
0 - 10	STS

The next step is to carry out calculations for each question using the formula  $\text{Result} = \text{Answer Scale} \times \text{Scale Value}$ . This total is obtained by adding up the results of all questions, seen in table 6.

Table 6. Question Values

Respondent	Question				
	1	2	3	4	5
1	5	5	5	5	5
2	4	4	5	5	5
3	5	5	5	5	5
4	5	5	5	5	5
5	5	5	5	5	5
6	4	4	4	4	4
7	5	5	4	4	4
8	5	5	5	5	5
9	4	4	4	4	4
10	5	5	5	5	5
Number of Values	47	47	47	47	47

Table 7. Response Ratio

Question To	Response Ratio (Total Score: Sum of Ideal Scores)*100%
1	(47: 50) 100% = 94% ×
2	(47: 50) 100% = 94% ×
3	(47: 50) 100% = 94% ×
4	(47: 50) 100% = 94% ×
5	(47: 50) 100% = 94% ×
<b>Final Amount</b>	<b>94%</b>

Answer Percentage Range

Score 0% - 20% = Strongly Disagree

Value 21% - 40% = Disagree

Score 41% - 60% = Doubtful

Score 61% - 80% = Agree

Score 81% - 100% = Strongly Agree

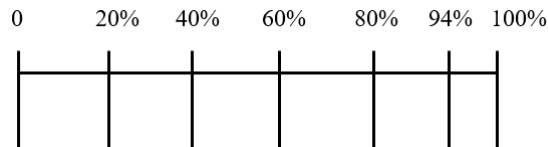


Figure 13. Range of Answer Percentages

As explained above, it can be concluded that the interpretation output from the questionnaire evaluated by 10 respondents and 5 questions produced a percentage level of 94% within the time mentioned previously. Based on the specified criteria, if the score is 94% it can be concluded that the score is getting closer to the position of the "strongly agree" & "agree" category, therefore the design of this school tuition payment information system can be very well received by respondents.

## Conclusions and Suggestions

### Conclusions

Based on the system analysis above, it can be concluded:

1. Overcoming the problem of processing SPP payment data which is still manual and prone to being damaged & scattered is by implementing a technology-based SPP payment system, such as a web-based application. By utilizing technology, the payment process can be done digitally, reducing human error and speeding up the administration process. Payment data can be stored safely in a protected database system & easily accessed again if needed.
2. By designing and building a system, schools can increase efficiency and accuracy in managing tuition payments. A website-based system allows the payment process to be carried out online, makes it easier to access and record data, and allows schools to better track payments. This will create a better user experience for students, and school administrative staff.

### Suggestions

Based on the results of this research, there are several suggestions for further development:

1. For future researchers, it is hoped that this information system can be expanded into an application that can become a reference & contribute to the development of information systems, especially in the tuition payment process used by SMK Muhammadiyah Ambon.
2. For future researchers, if the implementation of this information system is successful in the form of an application, it is recommended to add a feature that allows monitoring of students who have not made payments. Therefore, it is also important to set system access permissions so that not only the treasurer can access it, but also the school principal and homeroom teacher to monitor the school tuition payment process.
3. The SPP payment information system that has been developed still has a simple appearance and process. Therefore, further development needs to be carried out by adding payment transfer facilities.

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