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Designing Academic Data Visualization Dashboard Using Google Data Studio at SMPN 8 Pariaman

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Abstract

This study aims to use Google Data Studio to produce an academic data visualization dashboard system to display information, which can manage academic data, namely teacher attendance data and student grades, to provide decision-making support for decision makers in the monitoring process and evaluate school internal processes and monitor student grades at SMPN 8 Pariaman School. The type of research used is the R&D (Research and Development) approach SDLC (Systems Development Life Cycle) method with a prototype model. The stages carried out are communication, planning, modeling, construction and handover (handover). The system testing method studied uses questionnaire guidelines for functional testing to test system functionality to verifiers and usability testing to test system usability and suitability of functions and services to users. Based on the results of the validator functional test study, the results of meeting the functional requirements with both a value of 1 and 89% of the feasibility value of the system usability test are classified as very feasible. Therefore, it can be concluded that the academic data visualization dashboard system using Google Data Studio meets the requirements and is very suitable as a support for SMPN 8 Pariaman School in processing academic data on teacher attendance and student grades.

Keywords: Academic Data, Dashboards, Data Visualization, Google Data Studio

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1.0 INTRODUCTION

Academic development refers to the development of students and lecturers who are continuously evaluated and monitored by school officials. Monitoring is the stage of assessing whether the activities carried out are in accordance with the plan, identifying problems that arise so that they can be overcome immediately, assessing whether the way of working and management used is appropriate to achieve the objectives and the relationship between them (Kumala et al., 2018). The monitoring and evaluation process uses data and information obtained from academic data. This applies to all schools, both elementary, junior high, and high school.

SMPN 8 Pariaman is a junior secondary education unit located in North Tungkal, North Pariaman District, Pariaman City, West Sumatra. Based on observations with the Curriculum Representative, it is known that there are still difficulties in monitoring and evaluation because the processing of academic data such as teacher attendance and student grades is still carried out manually. Attendance is an important part in any educational institution. Attendance is one of the important pillars that supports and motivates every activity (Rahmalisa et al., 2020). Another problem in handling student grades is that teachers still use calculator calculations and data storage that has not been computerized to handle student grades, resulting in difficulties in managing student grades. If an error or delay occurs in the process. To make this arrangement easier, the best step is to use a computerized system to make work easier. Thus, if there is an error during numerical data processing can be minimized without spending a lot of time and energy (Ratna Sari et al., 2021). During the implementation of monev, the data that has been processed still makes it difficult for schools to present academic data (teacher attendance and student performance) because it has not been displayed visually to display academic data information that is more useful and quickly understood. Thus supporting its use as a tool to support decision makers in monitoring and evaluating progress in school and student achievement. Visualization is a term widely used to describe information in graphical form, thus helping in understanding every state of the data, with visual context being the main focus when displaying data (Maciej Serda et al., 2018).

2.0 LITERATURE REVIEW

Data, Information and Academic Data

Data is a source of information that is still raw (Puspaningrum et al., 2020). Data is a record of facts, concepts or clues that must be processed into information that people can understand (Yuliana et al., 2021). Information is a fact that does not yet have meaning (meaning) so it needs to be handled by processing it to be more meaningful (Kaharu & Sakina, 2016). The results of this data processing will later become information (Pratama Zanofa, A., & Fahrizal, M. 2021). While academic is a field that studies curriculum or learning with the aim of adding information about education or learning under the control of schools or educational institutions (Saputra et al., 2022). Through the exposure of the previous researchers, it was concluded that academic data is a record of facts, concepts or instructions that must be processed in the field of studying curriculum or learning with the aim of adding information about education or learning to educational institutions or schools.

Data Visualization

Data visualization is one of the techniques used to convey data and information and make it a visual object (Saputri et al., 2021). Visualization is the design of images, graphs or animations to display information, in different explanations data or attributes can be analyzed or reported (Lestariningsih et al., 2016). It can be concluded that data visualization is a technique to examine data with a different appearance from the original data and analyze it to convey data and information and make it a visual object.

Dashboard

Dashboard is a visual display of important information needed to understand and manage an organization that is managed so that it can complete the presentation and visualization of data, by using a dashboard system, strategic data and information can be displayed online, quickly, and easily (Darman, 2018). It can be concluded that a dashboard is a tool that shows a visual display of information to understand and control the field of the organization managed at one level, which serves to speed up the decision-making process, measure organizational performance, and monitor ongoing processes.

System Design Software

1. AppSheet

AppSheet is an online development platform that allows users to create no-code mobile apps, making them simpler and easier to use, starting from cloud-based data sources (spreadsheets, excel, cloud SQL, and more). AppSheet apps are built from data sources like Google Sheets, Excel, Cloud SQL, Salesforce, and other similar connectors. App user activity is synchronized with connected data sources (Nugroho, 2021). In the planning of this system the appsheet is used as a user interface.

2. Google Sheets (spreadsheet)

Google Spreadsheets is a web-based application that allows users to create, update, edit spreadsheets and share data online. The Ajax-based program is compatible with Microsoft Excel and CSV (comma-separated value) files. Tables can also be saved in HTML format (Maciej Serda et al., 2018). In this case Google Spreadsheets is used as the database of the system.

3. Google Data Studio

Google data studio is a data visualization program designed as an easy-to-use tool to represent complex data sets in an attractive and clear way (Maciej Serda et al., 2018). Google Data Studio is an easy-to-use data visualization application that offers an interesting and clear way to present complex data sets (Syam et al., 2022). Google Data Studio in system design is used as an output interface in the form of data visualization in the form of dashboards.

3.0 METHODOLOGY

This research adopts the methodology and prototype model of R&D (Research and Development) SDLC (System Development Life Cycle). The data collection methods used were observation, interviews and documentary research. When conducting research using a prototype model, the model often means that the customer defines a common set of software objectives but cannot define detailed requirements for software functionality and

features. In these and many other situations, the prototype paradigm can provide the best approach (Aditya et al., 2021).
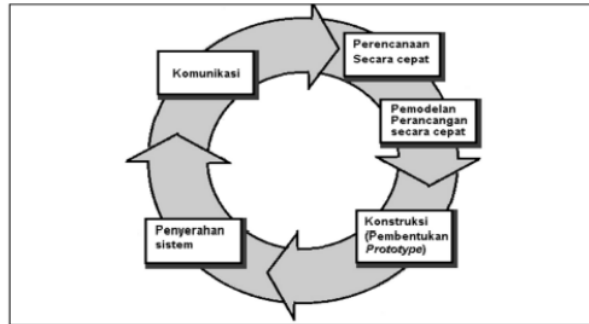

Figure 1. stages of prototyping model (prototype)

The stages of prototyping are as follows: Communication: In the early stages of prototyping, existing problems and other information needed to build the system are identified. Planning, this step is done by determining resources based on system needs, developing specifications, and determining goals based on communication results. Modeling, at this stage the prototype made using the design system is compared to the client to see if it meets the wishes or still needs to be reevaluated. Construction, this stage is used to build prototypes in the form of design implementation and testing of the system built. Submission, this step is necessary to obtain feedback from users, which is the result of evaluation of previous steps and the implementation of the developed system. The system testing approach under study uses functional testing questionnaire guidelines to test system functionality to verifiers and usability testing to test system usability and suitability of functions and services to users.

Data analysis techniques

1. Test functionality, Software qualifies or is expected to qualify good functionality when X value is greater than 0.5 and close to 1. Here's the formula used (Kartiko, 2019):

$$X = 1 - \frac{A}{B}$$

2. Usability test, before conducting usability testing first test the validity and reliability of the questionnaire with other users (different respondents) from usability testing as follows:

a. Questionnaire Validity Analysis, used to measure the validity or absence of each questionnaire item based on questionnaires given to system users (respondents), by comparing R Calculate > R Table then the item is considered valid. R Calculate Obtained using the correlation formula (Yusup Program Studi Tadris Biologi & Tarbiyah dan Keguruan, 2018).

$$r_{xy} = \frac{n(\sum x_i y_i) - (\sum x_i)(\sum y_i)}{\sqrt{(n(\sum x_i^2) - (x_i)^2)(n(\sum y_i^2) - (y_i)^2)}}$$

Figure 2. Correlation Formula

To determine the criteria for validity values are found in table 1.

Table 1. Validity Test Value Criteria

No	Value (%)	Category
1	>0,9	Very Valid
2	0,7 - 0,9	Valid
3	0,4 - 0,7	Enough Valid
4	0,2 - 0,4	Less Valid
5	<0,2	Very Not Valid

Source: Aplikasi et al (2019)

b. Questionnaire Reliability Analysis, used to measure questionnaires as indicator variables. It is considered trustworthy or reliable when responses to its statements are consistent or stable over time. If the Cronbach Alpha coefficient > 0.70 then the question is declared reliable. Reliability uses the Cronbach Alpha reliability coefficient formula (Ghozali, 2018).

$$r_i = \frac{k}{(k-1)} \left\{ 1 - \frac{\sum si^2}{st^2} \right\}$$

To find out the types of reliability test values can refer to table 2.

Table 2. Validity Test Value Categories

No	Coefficient Reliability	Category
1	>0,9	Very Reliable
2	0,7 - 0,9	Reliable
3	0,4 - 0,7	Enough Reliable
4	0,2 - 0,4	Less Reliable
5	<0,2	Unreliable

Source: Ghozali (2018)

After testing the validity and reliability of the questionnaire, then a usability test was carried out with respondents who were different from the validity and reliability test. The formula used to test usability is as follows (Saragih, 2017) :

$$\text{Index (\%)} = \frac{\text{Total Score}}{\text{Top Rated}} \times 100$$

To see the quality of the system built can use the categories in table 3.

Table 3 Usability Factor Assessment Category

No	Interval	Category
1	20% -35,99%	Very Unworthy
2	36% -51,99%	Not Worth It
3	52% -67,99%	Pretty Decent
4	68% -83,99%	Proper
5	84% -100%	Very Worth It

Source: Saragih (2017)

4.0 RESULTS AND DISCUSSION

Result

1. Planning Outcomes

The academic data visualization dashboard system was designed with Google Data Studio, developed using Appsheet as the user interface, spreadsheet as the database, and Google Data Studio as the visual dashboard. Visualize data with functions and services provided. The results of system design can be seen in figure 3.
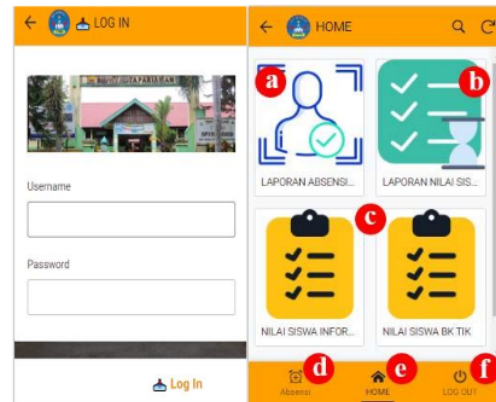
Figure 3. System Design Results

Based on the results of the system design, there is a login page that allows to proceed to the main page (home) by entering the username and password. On the main menu (home) there are several menus and buttons as follows:

a. Attendance report menu, contains a recap of teacher attendance reports integrated in the dashboard in Google Data Studio as shown in figure 4.
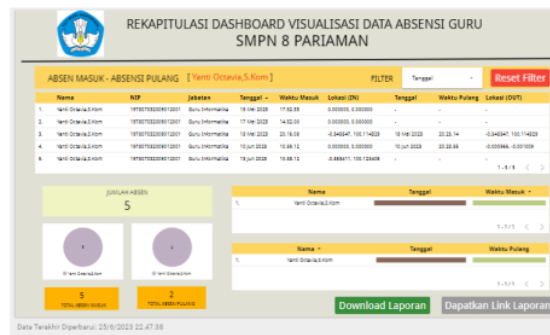

Figure 4. Attendance Report Dashboard

b. Student grade report menu, contains a recap of student grade reports integrated as a dashboard in Google Data Studio, as shown in figure 5.

Figure 5. Student Grade Report Dashboard

c. This menu includes entering and processing student grades calculated automatically by the system for each subject the teacher is concerned with.

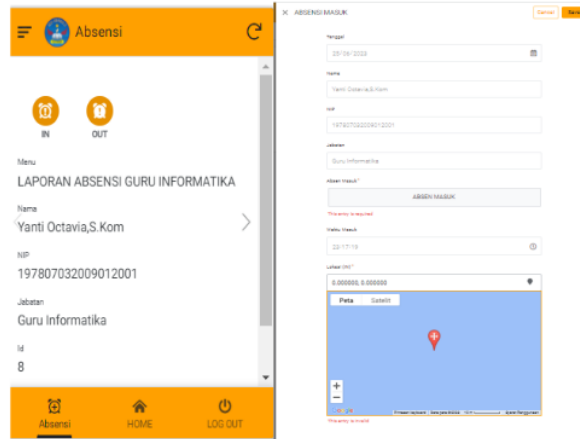d. The attendance button, used to calculate teacher attendance in (IN) and out (OUT) through the system.

Figure 6. Attendance Display in and Out

e. Home button, containing the main menu of the system displayed as figure 3.
f. Log Out button, used to log out of the system.

2. Planning Testing
System testing uses two stages, namely:

a. Functionality: The resulting system is first tested for system functionality created by validators. The symbol A obtained is the number of invalid functions = 0 and the symbol B is the sum of all functions = 31. The results of the characteristic questionnaire processing as shown in table 4.

Table 4 Functionality Test Analysis Results

No	Result	Information
X = 1-A/B = 1-0/31	1	Qualify

b. Usability, this is done to test the usability of the system made by taking into account the suitability of its features and services for future system users. Before conducting usability testing, validity and reliability testing are first carried out as follows:
1) Validity trial, measuring the validity or invalidity of each question item based on the questionnaire given to users (respondents). The results of the questionnaire processing for validity are as shown in table 5.

Table 5 Validity Test Analysis Results

Question items	R-table	r-calculate	Information
X1	0.6319	0,8065	Valid
X2	0.6319	0,8620	Valid
X3	0.6319	0,8079	Valid
X4	0.6319	0,7117	Valid
X5	0.6319	0,7165	Valid
X6	0.6319	0,8340	Valid
X7	0.6319	0,8158	Valid
X8	0.6319	0,7371	Valid
X9	0.6319	0,8703	Valid
X10	0.6319	0,8250	Valid
X11	0.6319	0,7038	Valid
X12	0.6319	0,7467	Valid
X13	0.6319	0,8560	Valid
X14	0.6319	0.7597	Valid
X15	0.6319	0.8186	Valid

The results of data processing in table 5 above can be concluded that variable X produces a value of R Calculate greater than R Table which means that all items are valid.

2) Reliability testing, the extent to which the system created based on questionnaires given to system users (respondents) is consistent and reliable (reliable). The results of processing reliability questionnaires as shown in table 6.

Table 6 Results of Reliability Test Analysis

Item	Reliability coefesion	cronbach's Alpha	Information
X	15 item statement	0,953	Very Reliable

From the results of data processing in Table 6 above, it can be concluded that Cronbach's alpha coefficient of all statements of each variable is greater than 0.70. Cronbach's alpha value of question variable X is 0.953 which means it is very reliable.

After the validity and reliability tests were carried out, usability tests were then carried out with respondents who were different from the previous tests. The results of the usability questionnaire processing are as shown in table 7.

Table 7 Results of Usability Test Analysis

No	Aspects Dimension Research	Total score count	Top marks	Usability Results index (%)	Category
1	*Reliability*	135	150	90%	Very Worth It
2	*Responsiveness*	135	150	90%	Very Worth It
3	*Assurance*	131	150	87%	Very Worth It
4	*Empathy*	129	150	86%	Very Worth It
5	*Tangibles*	135	150	90%	Very Worth It
		War - War		89%	Very Worth It

Based on Table 7 above, it can be concluded that the usability results of the academic data visualization dashboard system using Google Data Studio are 89% with very feasible criteria.

Discussion

From the analysis of the questionnaire results data against the usability test of the academic data visualization dashboard system using Google Data Studio, the results of the usability test assessment of the system were obtained, as shown in figure 7.
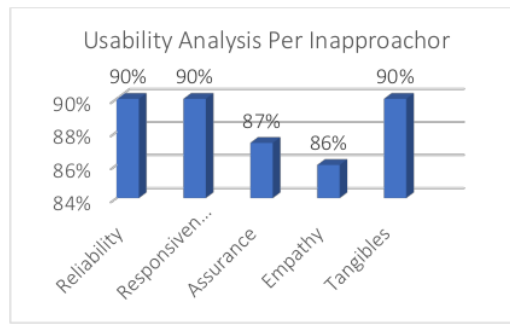

Figure 7. Percentage of spread usability value per indicator

Based on figure 7 it can be seen that the resulting system is declared reliable, the results of reliability indicators show a value of 90% with a very decent category that can be concluded the system can provide good service, accurate data and service as expected. In another indicator, namely responsiveness, the indicator also obtained the results of the indicator showed that it got a value of 90% with a very decent category, meaning that the system provides fast information services, helps improve services and helps store data quickly. In the assurance indicator, obtaining a value of 87% with a very decent category means that the system has guaranteed data security, the data displayed is up-to-date and valid. The empathy indicator scored 86% in the very decent category that means the system is easily accessible and provides the data needed. In the last indicator, tangible (tangible) obtained a value of 90% with a very decent category that clearly states that the system is interesting, communicative and easy to understand.

5.0 CONCLUSION

Based on the results of the research that the author has done, it can be concluded that the author has succeeded in designing an academic data visualization dashboard system using Google Data Studio to manage academic data at SMPN 8 Pariaman. Tests that have been carried out using functionality tests on validators produce a value of 1 so that they meet good functional requirements and usability tests that have been carried out using questionnaires produce a very feasible system with a figure of 89% feasibility.

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