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Visualization of Alumni Performance Using Dashboard to Support Higher Education Decision Making

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Abstract

Universities in Indonesia create fierce competition. Alumni have an essential role for the educational institution, not only as a tool for measuring the performance quality and ability of education implementation but also as the standard or feedback to the perfection of the education system. One effective data presentation model is the dashboard system seen from the complexity, interactivity, and informative data presented. Therefore, this study aims to build a dashboard system at Universitas Muhammadiyah Yogyakarta (UMY). This study utilized the dashboard life cycle method in its implementation. This method had six stages: project initiation, design, construction, testing, launching and monitoring. This method allowed the study to show data on the number of judicium students, the number of graduates, the average GPA of the alumni, the average study period of alumni, and the number of alumni per graduation level for the 2012/2013 to 2017/2018 academic year, according to the accreditation forms and needs analysis. The dashboard system can provide information about alumni at UMY from 2012 to 2017. The dashboard system is ready to be applied as a decision-making tool, particularly as a strategy for improving the quality and empowering strategy for alumni of the university.

Keywords: *alumni, dashboard system, dashboard lifecycle*

1. Introduction

Alumni have an essential role in an educational institution as a tool to measure the performance quality, run education, and a benchmark or feedback for improving the education system. A system that can manage or track computer-based alumni can help improve alumni documentation [1]. However, this documentation will not be adequate without the visualization of data information that monitors the ups and downs of the alumni's performance. Furthermore, alumni performance can be used as an assessment in assessing a university. Universities can also use alumni data through business intelligence (BI) model to make future policies. BI is an effective instrument in the decision-making process to improve the performance of an agency [2]. BI in a tertiary or educational institution is expected to develop strategies, program plans, and actions to improve the quality and high competitiveness in the education realm. One useful data presentation model is the dashboard viewed from the complexity, interactive, and informative data presented [3],[4].

Meanwhile, the educational dashboard system contains graphics and supporting text as data presentation tools [5]. It follows the needs of universities or educational institutions requiring an information system that can summarize and process data, especially alumni data. The graph is considered capable of representing the summary of data in a system. The text in the dashboard system functions solely as a code or supporting marker of the graph. It can ease the heads of state universities or other educational institutions to control and

monitor the increase or decrease in alumni quality in a short time to make decisions quickly and swiftly.

A data warehouse is a system taking and combining data at a specific time from a data source into a normalized data store or dimensional data store [6-8]. Data warehouses usually store chronic historical data and are used for business intelligence and other analytical activities. In the data warehouse, transactions do not always occur in the data source. Usually, the data are updated in collections [9]. However, currently the data warehouse is still used to display information that is more focused on university academic activities with limited dimension [10]. A good academic dashboard is able to display 2 sides of representation, namely from the university and from the user (i.e., student) even though the student has graduated. In addition, the use of a visually appealing dashboard with a recorded track record will provide alumni with a better understanding of determining future achievements. This system can also be an added value for universities to see the performance of alumni as well as a means of promotion for prospective new students. Therefore, this study raises the theme of a dashboard system that is intended for alumni so that it can be considered by the university in determining the direction of university development policies. Furthermore, the system is designed by processing data that has been stored in the data warehouse. Furthermore, the data is represented in a multidimensional database and visualized using Tableau.

The remainder of this paper is organized as follows. Section II presents the methods. Section III describes the experimental results. Section IV provides discussions and Section V summarizes the conclusion.

2. Method

In this research, the dashboard lifecycle methodology [11,12] was utilized to manufacture the dashboard system. This methodology consisted of six stages, as shown in Figure 1. This methodology employed repeated cycles to achieve maximum results.

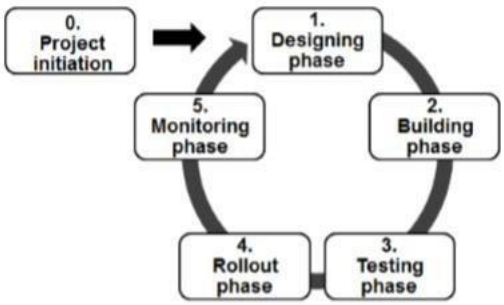

Figure 1. Diagram of dashboard lifecycle

In Figur 1, project initiation is the stage where a needs analysis was carried out (1). The designing phase is where a dashboard design was made, such as technical solutions, KPI creation, and testing (2). The building phase is the stage of implementing the dashboard construction using selected additional tools (3). The testing phase aimed to test the suitability of the dashboard system built to meet the requirements at the beginning of the manufacture of this system (4). The rollout phase was where the dashboard system was ready for release and user use (5). The monitoring phase monitored the dashboard, evaluated feedback, and prepared for the next iteration (6). Finally, The process start again from desaining phase. For each iteration, the providers make improvements to the dashboard, therefore, the more the iteration, the good the dashboard will be.

3. Results

3.1 Test Results

Figure 2 is a series description of this stage.

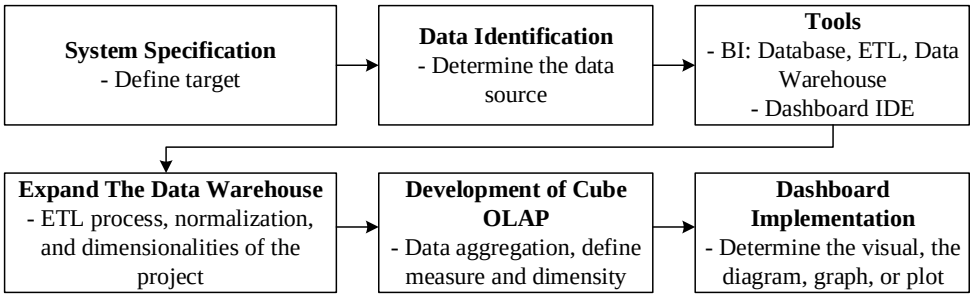

Figure 2. Development of Performance Dashboard

a. Requirement Specifications

The requirements specification was carried out by interviewing the Information Systems Bureau (BSI) at Universitas Muhammadiyah Yogyakarta (UMY), observing and analyzing accreditation forms based on Book III Guidelines for the Formation of Forms from the National Accreditation Board for Higher Education in the Standard 3 section for Students and Graduates. At this stage, the user needs and the purpose of the system were collected. The results of this stage produce the following information:

1. Number of judicium students
2. Number of graduates
3. Average GPA
4. Average study period
5. Number of graduates per graduation predicate

b. Data Sources and KPI Identification

This stage deals with the selection of tables used in this study, taken from the UMY database. The establishment of the Key Performance Indicator (KPI) is shown in Table 1. The use of KPI was based on observational analysis of accreditation forms, Rector's Decree on graduation predicate, and direct interviews with staff from related education programs.

Table 1. Key Performance Indicator

No.	Required Information	Indicator
1.	Number of judicium students per year	• University level • Education program level • Faculty level • Study program level
2.	Number of graduates per year	• University level • Education program level • Faculty level • Study program level
3.	Average GPA per year	• University level • Education program level • Faculty level • Study program level
4.	Average alumni study period per year	• University level • Education program level • Faculty level • Study program level
		• Associate's Degree: a. Cumlaude b. Very satisfying c. Satisfying d. Without predicate

No.	Required Information	Indicator
5.	Number of graduates per graduation predicate per year per education program	• Bachelor's Degree: a. Cumlaude b. Very satisfying c. Satisfying d. Without predicate • Master's Degree: a. Cumlaude b. Very satisfying c. Satisfying d. Without predicate • Doctoral's Degree: a. Cumlaude b. Very satisfying c. Satisfying d. Without predicate

c. Technology Selection

The choice of technology included determining data warehouse development procedures and selecting system development tools. In this study, a data warehouse was developed with the NDS + DDS architecture.

d. Data Warehouse Development

The architecture used was the NDS + DDS architecture, as shown in Figure 3.

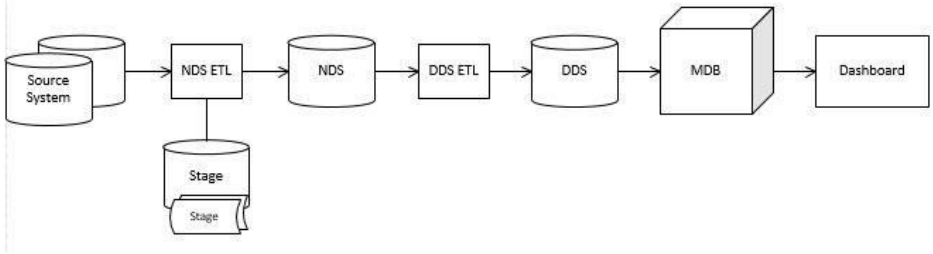

Figure 3. Data warehouse system diagram

1. Data sources

The details of the data source used in this study are as follows:

- Acd_Student
- Acd_Graduation_Period
- Acd_YudisiumAcd_Graduation_Reg
- Mstr_Register_Status
- Mstr_Department
- Mstr_Faculty
- Mstr_Term_Year
- Mstr_Education_Program_Type

2. Stage area

The source database tables were moved to the stage area, which in this study was a database in the local and server systems. This removal process is called the Extract, Transform, Load (ETL) process without changing the contents and data types of the table. Tables having passed the ETL process and stored in the stage area were apart of normal relations in the source data.

3. Normalized Data Store (NDS)

This normalization was performed on data redundancy, forming relationships between tables, balancing data types, and eliminating invalid data. This normalization occurred in each table. Table 2 presents the ETL process documentation in each table.

Table 2. Normalized Data Store

Stage area	Normalized Data Store (NDS)
Acd_Student	nds_acd_student
Acd_Graduation_Period	nds_acd_graduation_period
Acd_Yudisium	nds_acd_yudisium_fix
Acd_Graduation_Reg	nds_acd_graduation_reg
Mstr_Register_Status	nds_mstr_register_status
Mstr_Department	nds_mstr_Department
Mstr_Faculty	nds_mstr_faculty
Mstr_Term_Year	nds_mstr_term_year
Mstr_Education_Program_Type	nds_mstr_education_program_type

4. Dimensional Data Store (DDS)

In the dimensional data store, tables that have previously been through the normalization process went through the dimension development process. The DDS ETL documentation is depicted in Table 3.

Table 3. Dimensional Data Store

Normalized Data Store (NDS)	Dimensional Data Store (DDS)
nds_acd_student	dim_acd_student
nds_acd_graduation_period	dim_acd_graduation_period
nds_acd_yudisium_fix	dim_acd_yudisium
nds_acd_graduation_reg	dim_acd_graduation_reg
nds_mstr_register_status	dim_mstr_register_status
nds_mstr_Department	dim_mstr_department
nds_mstr_faculty	dim_mstr_faculty
nds_mstr_term_year	dim_mstr_term_year
nds_mstr_education_program_type	dim_mstr_education_program_type

Then, a relation was determined of factual tables, as shown in Figure 4.

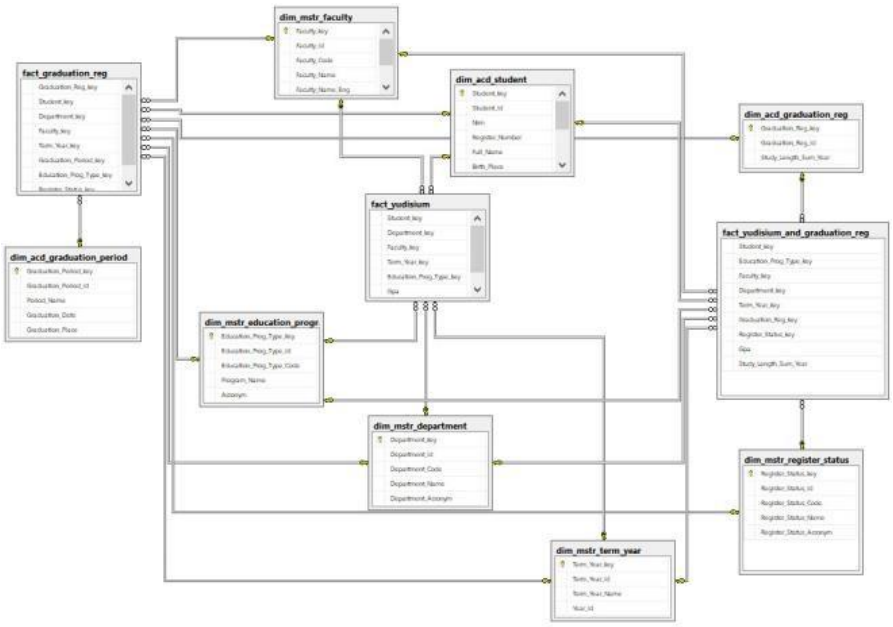

Figure 4. Factual table relations

5. Multidimensional Database (MDB)

This study built three cubes due to adjustments to key performance indicators, namely the number of students in each analysis object. This stage determined what would be used for analysis to ease dashboard system development. The results of this process produced cubes stored on the Analysis Service server. This process is illustrated in Figure 5.

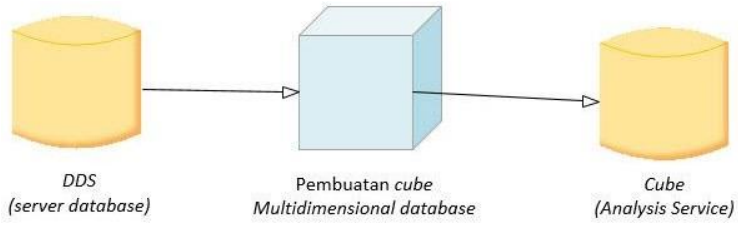

Figure 5. Cube forming process

e. Implementation of dashboard performance

The last step was determining the presentation form of the created data warehouse. The data warehouse presentation was presented in a dashboard on the desktop using the Tableau Desktop application. This study developed a data warehouse into four dashboards presented into one display.

3.2 Building phase

This stage is the dashboard development stage. An example of the results of dashboard development is shown in Figure 6.

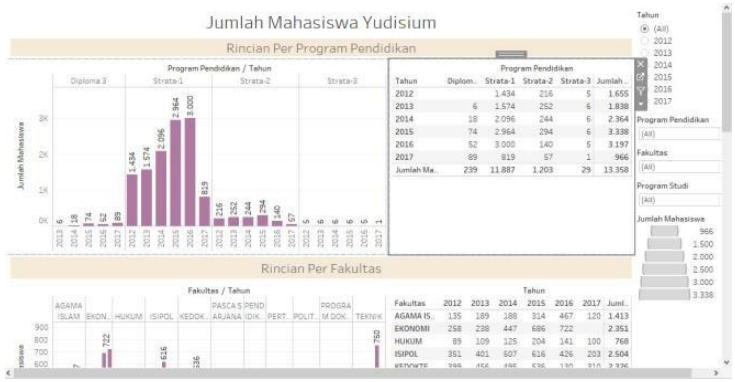

Figure 6. The number of judicium dashboard

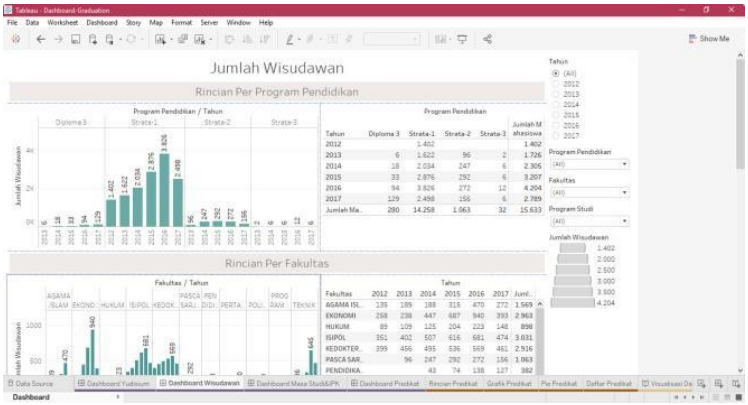

Figure 7. The number of graduates dashboard

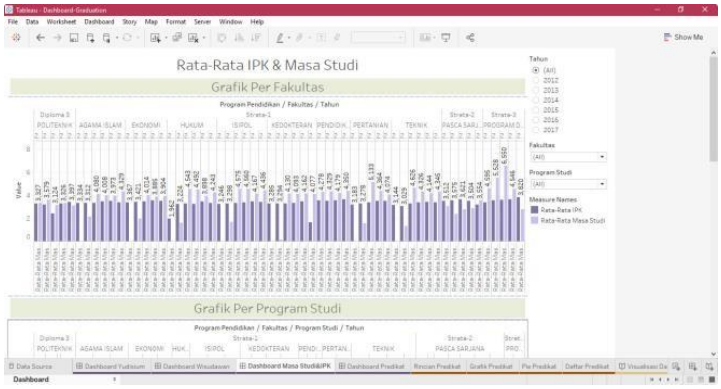

Figure 8. Average GPA and study period dashboard

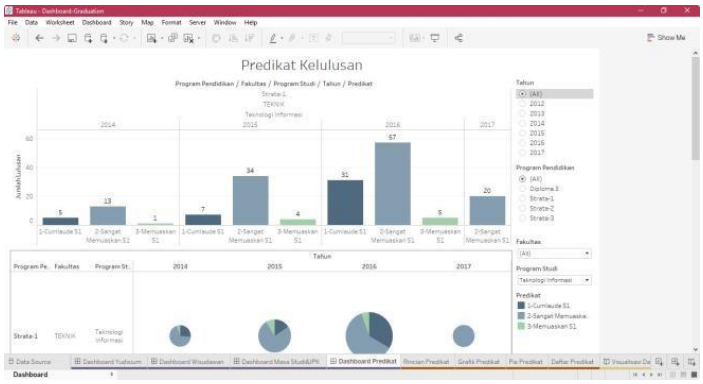

Figure 9. Graduation predicate dashboard

This study went through one normalization process. The first normalization (1NF) was the process by which data were filled with null values. The normalization process was only carried out once because the data at the UMY database table did not have a partial and transitive dependency and had complete data records.

After conducting all stages of the research method, it can be seen that all data and functions on the dashboard run following the design made. The system can show data from the number of judicium students, the number of graduates, the alumni average GPA, the alumni average study period, and the number of alumni per graduation predicate at UMY from 2012 to 2017. The system can display alumni data per education program, faculty, study program, and year.

These results indicated that the research purpose was achieved, namely creating data visualization alumni of UMY using the dashboard system. However, in this study, there is still the possibility of updating data to be displayed. Thereby, the monitoring phase is necessary for updating data on the dashboard system.

4. Conclusions

The lifecycle dashboard method has been successfully implemented to visualize alumni data information at Universitas Muhammadiyah Yogyakarta (UMY). The dashboard system can provide data and information about alumni from 2012 to 2017. The system is ready to be used as a decision support tool at UMY, specifically as a strategy to improve the quality and empowerment of the alumni. System development testing can be a source of data evaluation material. Data that can be used for analytical purposes are those sourced in 2013, 2014, 2015, and 2016 because they are close to complete and have little redundancy.

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