

Improving Quality of Academic Advisory Information with Executive Information System

Eileen Heriyanni, Suparto Darudiato



Abstract: Executive Information System (EIS) is part of Business Intelligence (BI) which offering method for combining and mapping information from each different source into a holistic view [8], information visualization and dashboard usage [16] so that the Executives can analyze and assess from several viewpoints for planning choices and future acting strategies [8]. This research focuses on the Executive Information System (EIS) as the main solution for Executives of Student Advisory Center (SAC) in Bina Nusantara (BINUS) University. EIS Lifecycle Development is used as a main method to build EIS SAC. Information mapping from various source done with Extract Transform Load (ETL) and stored at data warehouse and then shown as combined dashboard, graphics and text. Technology Acceptance Model (TAM) is a model that explains and predicts how a User receives and uses a technology. In this research, TAM is used as a method for evaluate EIS SAC, which measured through four viewpoint such as Perceived Usefulness that show how the technology helped enough for improving the Executives work performance; Perceived Ease of Use that show how the technology will reduce the effort required, both physically and psychologically in completing the Executives work; Attitude Toward Using that show how the technology give a positive impact on work performance; and Behavioral Intention to Use that show the intention to implement and use the technology. The needs of students' information in each SAC sub unit is different and each sub unit provides its own data needed to be able to produce the information needed. Through the EIS SAC, information from different sources in each sub unit can be presented more quickly, more easily, and at the same time as a tool for Executive SAC BINUS University to determine choices and action strategies on low-achieving students.

Keywords: EIS Lifecycle Development, Executive Information System, Business Intelligence, Student Advisory Center, Technology Acceptance Model, Perceive Usefulness, Perceived Ease of Use, Attitude Toward Using, Behavioral Intention to Use

I. INTRODUCTION

As an educational institution, Board Management of Bina Nusantara University (BINUS) has been appointed Student Advisory Center (SAC)

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to foster low-achieving students in order to improve their academic qualities (hard skill) and soft skills. SAC consists of three sub units; the first unit is Personal Development that helps to develop student's personal intrapersonal and interpersonal skill through trainings or seminar or workshop. The second unit is called Mentoring that helps to improve academic achievement through mentoring or tutoring, and counseling that provides counseling services as well as motivating students.

Each sub unit has its own information system to manage the required data. When the SAC Manager wishes to see low-performing student reports, each sub-unit should withdraw reports from its proprietary information system and then be combined and processed to produce the desired information. The process is complex, and it can take several days for this report to be given to SAC Manager.

Technologies that can be adapted by top level executives are Executive Information System (EIS). The EIS is part of Business Intelligence (BI) that offers methods for combining and mapping information from each different source into a holistic view [8], visualizing information and using dashboards [16] so that the Executive can analyze and judge from several points of view for planning options and strategies to act in the future [8].

The formulation of the problem to be answered in this research is 1) how the EIS can present information from various sources? and 2) how is the information presented in the EIS application to assist the SAC Manager in determining the choice and strategy of acting against low-achieving students?

The purpose of this research is to build an EIS that can: 1) present information from various sources through EIS and 2) as a tool for SAC Managers to determine the choice and action strategy against low achieving students in order to improve the quality of information in SAC.

II. PROPOSED SYSTEM

This research uses EIS Development Life Cycle [10] shown in Figure 1, consisting of 6 stages plus release evaluation stage, which in design and construction stage will use EIS model [12] shown in Figure 2, and the release evaluation stage using the Technology Acceptance Model (TAM) [5] shown in Figure 3.

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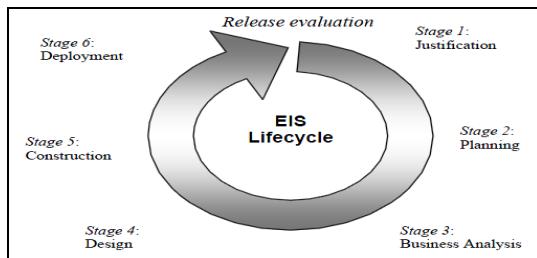


Figure 1. EIS Development Lifecycle [10]

Every stage to build EIS in this research can be described below.

1. 1st Stage: Justification

Describes business problems in SAC, identifies the needs and opportunities that exist in SAC, and proposes EIS as a preliminary solution assessed by the cost benefit analysis contained in a business case assessment report.

2. 2nd Stage: Planning

Record SAC capabilities in supporting and completing EIS projects so that can give detail information for future EIS project planning.

3rd Stage: Business Analysis

The actual needs of SAC which already known in the first stage, should be mapped using the use case diagram. The obtained data are mapped into Entity Relationship Diagram (ERD). The metadata structure in this research will be combined into one in metadata design on 4th stage.

4. 4th Stage: Design

EIS design refers to the EIS model. The EIS design also describes the EIS architecture, describes how the EIS will be built along with the technologies which will be used, and user interface design using sequence diagrams, class diagrams, navigation diagrams and storyboards. Data design is shown in the form of star schema. While the detailed design of EIS SAC metadata in this research will be explained in 5th stage on the EIS SAC metadata section.

5. 5th Stage: Construction

At this stage, EIS SAC development based on EIS model, Extract Transform Load (ETL) process, and detailed EIS SAC metadata are built.

▪ Extract

Reading data from one or more databases, retrieving excel files and hardcopy documents that containing information, annotations, and news used by SAC during its operational process.

▪ Transform

Converts the previous form of data to another form of data which will be needed later in order to be stored easily in the data warehouse. The type of used data warehouse in this research is independent data mart.

▪ Load

Put the transformed data to independent data mart.

After ETL process, the metadata is translated. The explanation of the metadata repository is summarized in ETL development and EIS SAC metadata. The next step is to code the program which linked to independent data marts.

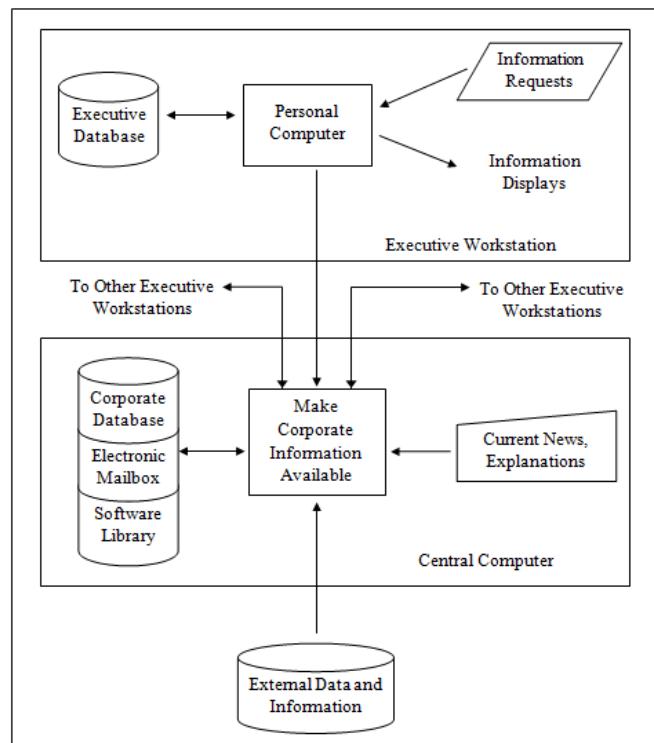


Figure 2. EIS Model [12]

6. 6th Stage: Deployment

EIS application has been completed, so the training of how to use the application should be scheduled. The final documentation of the EIS application and future maintenance mechanism should be prepared.

7. Release Evaluation

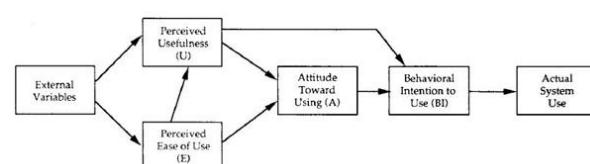


Figure 3. Technology Acceptance Model (TAM) [5]

Evaluation of EIS SAC application using TAM variables. It consists of Perceived Usefulness, Perceived Ease of Use, Attitude Toward Using and Behavioral Intention to Use. The four variables are used as a basis for the assessment size in this study, whether the quality of SAC information is improved or not by looking at the evaluation results. The evaluation is done by distributing questionnaires to all Executive in SAC. The questionnaire contains some questions that indicate the four variables in TAM with the purpose of:

- Variable Perceived Usefulness

Proving that the presence of the EIS SAC is improving SAC Executives' work performance by presenting a qualified information.

- Variable Perceived Ease of Use

Indicating that the presence of the EIS SAC can less effort of manual process which normally required to complete SAC Executives' work.

- Variable Attitude Toward Using

Showing that the presence of the EIS SAC have a positive impact on the SAC Executives' work because it can present a qualified information. As the result, work performance increases and less the manual effort that usually required to complete the work.

- Behavioral Variables Intention to Use

Showing the desire to continue using EIS SAC because it is giving a good result from Perceived Usefulness variables, Attitude Toward Using variables, and Behavioral Intention to Use variables.

The used scores to fill the questionnaire ranged from number 1 to 5, where the number 1 indicates the lowest while the number 5 indicates the highest.

III. RESULTS

A. Stage 1: Justification

1) Problems

In the operational activities, SAC using:

- STUSI (Student Information System)

Used by sub unit Counseling to get active student data in current period, display student's payment status, lecturing schedule between student and lecturer, and student score and grading result for each semester. STUSI owned by another Division, called Student Registration and Service Center (SRSC) and implemented from 2000 in SRSC. However, for supporting SAC operational activity then SRSC open the access to STUSI application for SAC.

- SACIS (SAC Information System)

Used by sub unit Personal Development for record student and their parent's data, student's grade and score, student's GPA, history of training activity and seminar which held by SAC, and as a back end of SAC's web in order to maintain the content of SAC's web. SACIS is implemented in 2006.

- BES (Back End SAC)

Has been implemented in 2008. BES is only used by sub unit Mentoring for its daily operation, such as mentoring monitoring, tutoring monitoring, and maintain the registration of Duta Binusian and Mentee through SAC web. BES also generated report which related to mentoring and tutoring in order to make monthly reporting process of sub unit Mentoring easier.

- The information also taken by query process from OLTP database.

- File excel / word / power point which was created by SAC Staff / Officer / Supervisor that containing the minutes of the meeting, activity evaluation, related information from the other center, internal memo, decision letter etc.

In reporting process, every sub unit generates their own report by manually editing, merging, and summarizing from the generated report from their own information system, query result data, and file excel/word/power point which was

created by SAC Staff / Officer / Supervisor. After finished, the report will be sent to the SAC Executives in excel format and presented by using power point. After that, SAC Executives must read all report and process it again according to his / her needs in excel and power point file for reporting to Vice Rector Student Affairs and Community Development. This long process inefficient and ineffective, and even allow the occurrence of human error because of miscalculation or logic error when querying data from OLTP.

2) Initial Solution

EIS SAC will be used the usual data sources which SAC used in daily operational then it will be processed using Extract, Transform, Load (ETL) and stored in a data warehouse. EIS SAC will be running on a web platform which can be easily accessed from web browser with available internet connection. So, this means EIS SAC can be accessed anywhere and anytime. This also improve efficiency and effectiveness in term of system implementation. When building EIS SAC, there are several phases that will be gradually worked on, such as:

1) Phase 1

Collect all commonly used data source by SAC for their daily operational activity then analyzed in order to design the ETL process.

2) Phase 2

ETL all data source that used by SAC. This was the long and difficult phase in order to build database for an EIS SAC application. Start from read all the existing data source, transforming the data, and save to the data mart. Later, data mart will be connected to the EIS SAC application.

3) Phase 3

Programming the Graphical User Interface (GUI) of EIS SAC application depends on SAC Executives' needs.

4) Phase 4

Alpha and Beta Testing of EIS SAC application to detect error / bug in the application before doing User Acceptance Test (UAT) and Evaluation.

5) Phase 5

UAT and Evaluation is done in this stage so the application can be implemented and used immediately.

B. Stage 2: Planning

Specification for running EIS SAC Application as follow:

Table 1: EIS SAC Application Specification

Specification	Requirement	
	Client Side	Server Side
Processor	Intel Pentium Dual Core	Intel XEON Processor
Memory	1GB	2 GB
Software	Browser: Chrome, Mozilla Firefox, Internet Explorer, Safari, Opera	Windows Server 2008
Hard disk	2 GB	500 GB
Network	LAN / internet	LAN / internet



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EIS SAC project will be built gradually following the phases that have been declared in Stage 1: Justification. The used database on SAC's current running system will be used and processed through ETL then the result will be used as a new database in EIS SAC application. EIS SAC will be built in web based in order to match the EIS characteristic in information and communication navigation.

EIS SAC will be implemented as a system which help Executives needs in accessing and analyzing information from various sources efficiently and effectively, so that EIS SAC can be used as a tool to determine the choice and action strategy especially in the case of low-achieving students.

C. Stage 3: Business Analysis

After doing interview and direct discussion, it is noted that SAC needs summarized information and it can be presented using graph and text. This information must accurate, correct, accountability and can be presented to higher level management and easy to understand. The following are SAC needs:

- Graph that represent overall SAC operational activities, such as students, SAC activities / programs and performance.
- Detailed report that represent SAC operational activities such as students, SAC activities / programs and performance.
- Analysis working sheet which can be used for analysis need of SAC development per semester as well as per year as a form of work monitoring.

The following is the use case from EIS SAC which can be summarized as SAC needs.

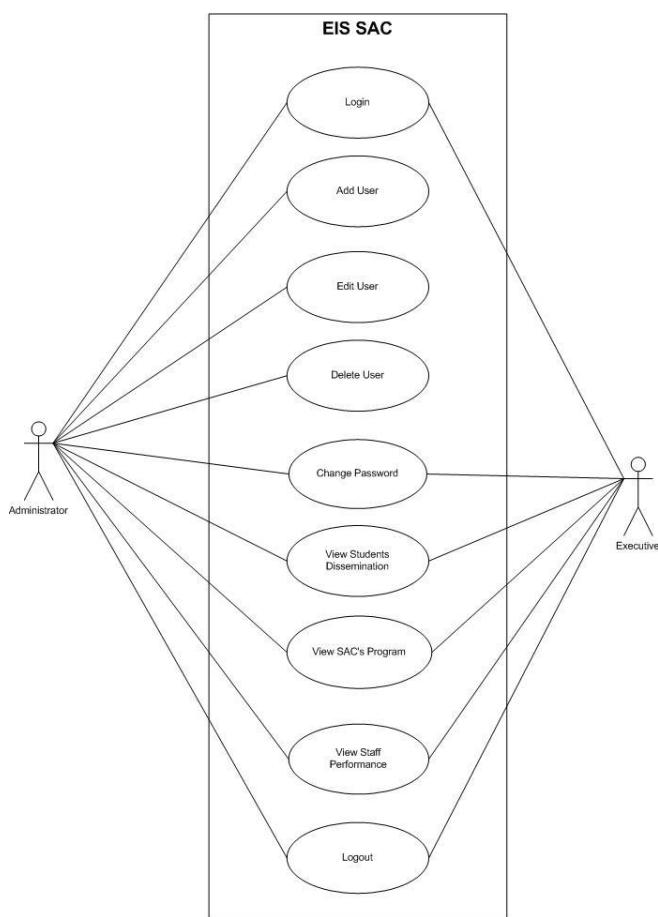


Figure 4. EIS SAC Use Case

D. Stage 4: Design

The architecture of EIS SAC application will follow the EIS Model [12] which can be described on Figure 5, while the needs of network for EIS SAC application described on Figure 6. EIS will be built using web-based technology, PHP with SQL Server database. PHP has been chosen because it has various library for making EIS corresponding with the EIS characteristic, e.g. flexible, user friendly, have GUI which combining text and graphic, and doing drill down process. Database in EIS are using SQL Server 2008 because SAC desktop application using SQL Server 2008 too, so it makes easier to integrate data source to the data destination.

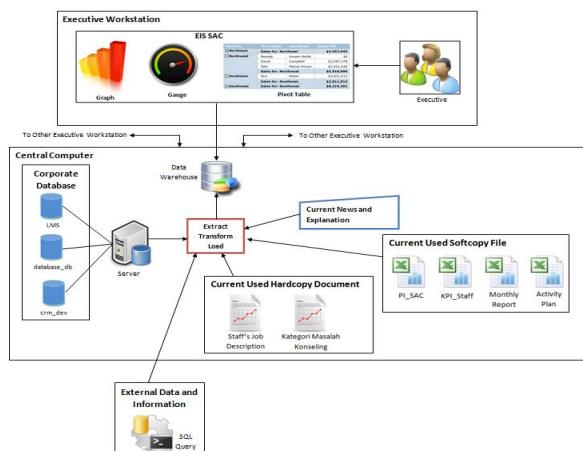


Figure 5. Architecture of EIS SAC

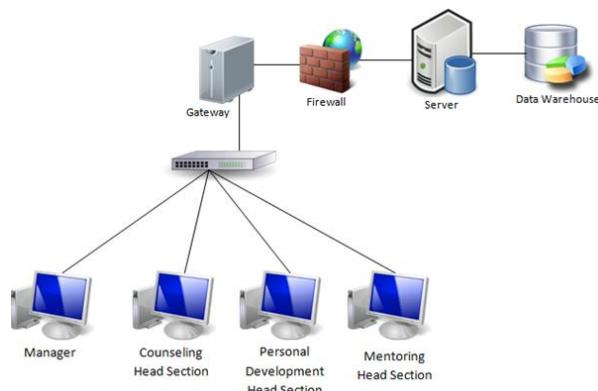


Figure 6. SAC Network Needs

The design of independent data mart will be shown by star schema design below.

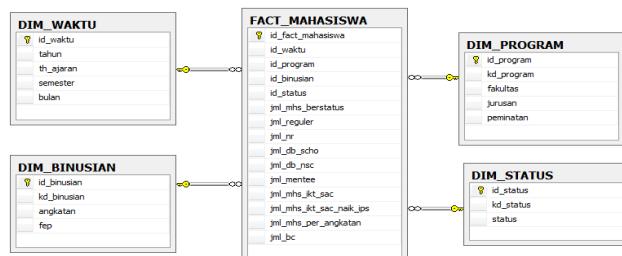


Figure 7. Star Schema of Dashboard, Detailed Dashboard, and Pivot Table on Student Distribution and Student Sub Menu

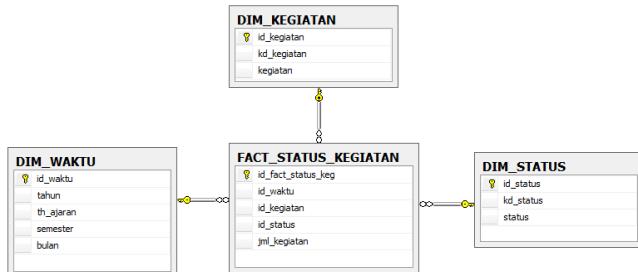


Figure 8. Star Schema of Dashboard, Detailed Dashboard, and Pivot Table on Activity Status

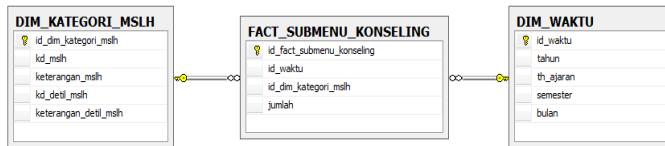


Figure 9. Star Schema of Dashboard, Detailed Dashboard, and Pivot Table on SAC Activity Program Sub Menu – Counseling

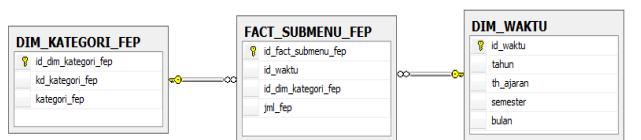


Figure 10. Star Schema of Dashboard, Detailed Dashboard, and Pivot Table on SAC Activity Program – FEP

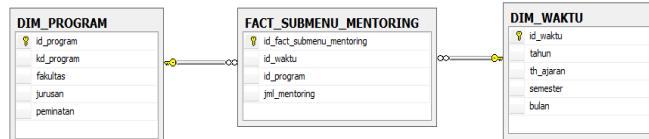


Figure 11. Star Schema of Dashboard, Detailed Dashboard, and Pivot Table on SAC Activity Program Submenu – Mentoring

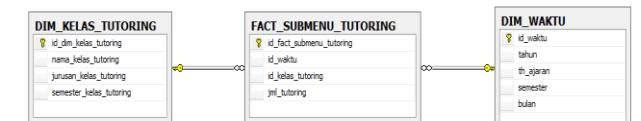


Figure 12. Star Schema of Dashboard, Detailed Dashboard, and Pivot Table on SAC Activity Program Submenu – Tutoring



Figure 13. Star Schema of Dashboard, Detailed Dashboard, and Pivot Table on SAC Activity Program – Seminar



Figure 14. Star Schema of Dashboard, Detailed Dashboard, and Pivot Table on SAC Activity Program – Training

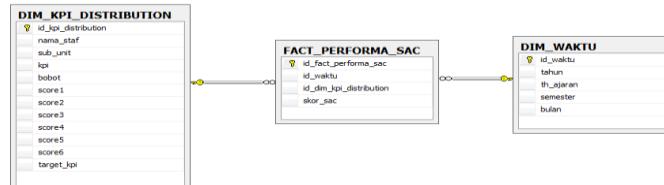


Figure15. Star Schema of Dashboard, Detailed Dashboard, and Pivot Table on SAC Performance

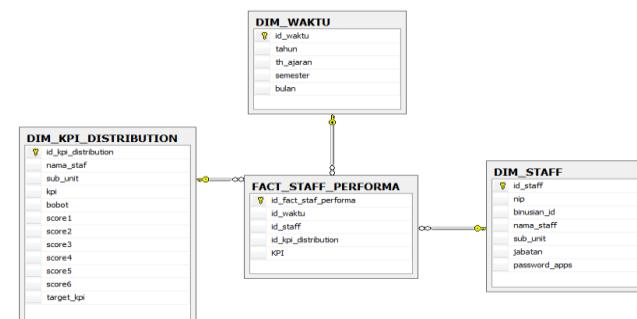


Figure 16. Star Schema on Staff Performance Submenu

E. Stage 5: Construction

This stage is starting with reading process from data source and transformed it into standardized data that linked to the data structure and its content, then stored into data mart. The used tool for doing ETL process is SQL Server Integration Services (SSIS). It is chosen because current running data source using SQL Server 2008 and SSIS Supported, so it is easier to do ETL process by using SSIS. The step by step to do ETL process for EIS SAC application can be read below on Figure 17.



Figure 17. ETL Process of EIS SAC

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Figure 17 starts with start time to process ETL data. ETL process was start with reading data source first. Data sources which were read are STUSI, SACIS, BES, excel file and hardcopy document which already changed to excel file. After all data source already read, next step is doing transformation process which consist of data cleaning, combine the existing data, standardized data, and aggregated data. Data that has been transformed become simpler and consistent then stored to the independent data mart.

F. Stage 6: Deployment

After EIS application already built, EIS SAC application will be handed over to IT Division of Bina Nusantara as the formal authorization for all information technology in Bina Nusantara Group to manage go live status and daily maintenance. After that, training schedule will be planned for EIS application user. Below is the list who will be included as a participant in application training.

- SAC Manager
- Counseling Section Head
- Mentoring Section Head
- Personal Development Section Head
- SAC Data Support

G. Release Evaluation

The Evaluation of EIS SAC application will be using TAM variables, i.e. Perceived Usefulness, Perceived Ease of Use, Attitude Toward Using dan Behavioral Intention to Use. Each variable will be use as base questioner question which have been spreaded to EIS SAC application user. Questioner contain eleven question and spread out to eight EIS SAC application user, such as:

- One SAC Manager
- Three Section Head from each sub unit.
- Three Vice Section Head from each sub unit which has been pointed by Section Head.
- One Data Support as internal administrator.

The answer result from application user can be seen on the following Table 2.

Table 2: Questionnaire Results

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
Manager	4	4	4	4	3	3	3	4	4	3	3
Counseling Section Head	4	3	4	3	3	3	4	3	4	3	4
Personal Development Section Head	4	3	3	3	4	3	4	3	3	4	4
Mentoring Section Head	3	3	4	3	3	4	4	3	4	3	4
Counseling Vice Section Head	4	3	4	3	4	4	3	4	3	4	4
Personal Development Vice Section Head	4	3	3	4	4	4	4	4	4	4	3
Mentoring Vice Section Head	4	4	3	4	4	4	4	3	3	3	4
Data Support	4	3	4	3	3	4	4	3	3	3	3

This result will be processed using descriptive analysis calculation which produce standard deviation which is the

best value comes to scale $-1 < x < 1$. This questioner processing done using SPSS statistic tool. The descriptive analysis calculation from questioner can be seen on the following Table 3.

Table 3: SPSS Descriptive Analysis Calculation

	N	Minimum	Maximum	Mean	Deviation Std.
Perceived Usefulness	8	3.00	4.00	3.5833	0.50361
Perceived Ease of Use	8	3.00	4.00	3.5625	0.50402
Attitude Toward Using	8	3.00	4.00	3.4375	0.51235
Behavioral Intention To Use	8	3.00	4.00	3.5000	0.51640

Table 3 shows that:

- Perceived usefulness variable got standard deviation value as big as 0.50361. That means EIS SAC application considered pretty good for helping SAC Executive performance for doing its job, especially for determine strategy for helping NR student.
- Perceived ease of use variable got standard deviation value as big as 0.50402. That means EIS SAC quite easy to be used and operated.
- Attitude toward using variable got standard deviation value as big as 0.51235. That means EIS SAC application helping SAC Executives to reduce manual activity and give positive impact for time efficiency.
- Behavioral intention to use variable got standard deviation value as big as 0.51640. That means EIS SAC application willing to be used and implemented as soon as possible to help SAC Executives to do his / her work.

IV. CONCLUSION

EIS SAC has been completed and could produce information summary from another source using ETL process and shown as dashboard, gauge and dynamic pivot table. EIS SAC has been already implemented and used as support tools for SAC Manager to decide an option and strategy against low achieving student through the shown information on EIS SAC.

EIS SAC can improve information quality which is shown by four TAMs variable that succeeded in achieving above average values.

- Perceived usefulness variable: EIS SAC application considered pretty good for helping SAC Executives performance for doing his / her work, especially for decide strategy to helping low achieving student.
- Perceived of use variable: EIS SAC application considered easy to use and operate.
- Attitude toward using variable: EIS SAC application considered enough to help SAC Executives to reduce manual activity and give a positive impact for time efficiency.

- Behavioral intention to use variable: EIS SAC application willing to be used and implemented as soon as possible in order to help SAC Executives in helping his / her work.

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