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Preface

Assalamu'alaikum warohmatullohi wabarokatuh. Welcome to ICENTRISA 2013! Welcome to Yogyakarta!

It is our pleasure to welcome you to the International Conference on Enterprise Information Systems and Applications (ICENTRISA) 2013. ICENTRISA 2013 is a scientific forum for presenting new research results and exchanging advanced ideas on enterprise information systems and applications, which ranging from theoretical and experimental to practical issues. We have invited scientists, researchers, engineers and practitioneers in the domain of interests from around the world to participate in this international conference.ICENTRISA 2013 is organized by Department of Informatics, Universitas Islam Indonesia.

The committee of ICENTRISA 2013 received 17 submissions from 6 of countries: Australia, India, Indonesia, Malaysia, Poland, and Taiwan. Each submission was reviewed by two reviewers. Based on the reviewers' recommendations, the Programme Committee accepted 10 papers (59% rate of acceptance) of which 5 papers were registered and appears in this proceedings.

We thank to all the members of the Programme Committe that contribute to the reviewing process. The PC members are from 8 countries: Australia, Bulgaria, Indonesia, Malaysia, Netherlands, Norway, Sweden and Thailand. We thank to the keynote speakers: Prof. Vilas Wuwongse (Thailand) dan Prof. Richardus Eko Indrajit (Indonesia).We also thank to all the members of the Organizing Committee for making ICENTRISA 2013 successful.

Last but not least, we sincerely thank all authors and speakers for their excellent contributions and the attendees for their participation.

Wassalamualaikum warohmatullohi wabarokatuh.

Yogyakarta, June 8 2013 Program Chair of ICENTRISA 2013

Dr. R. Teduh Dirgahayu

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University Vice Chancellor Greeting (Welcome Message)

Welcome to the 1th International Conference on Enterprise Information Systems and Application (ICENTRISA-2013). An applied, multi-disciplinary field such as Enterprise information systems (EIS) demands interaction and collaboration between practitioners and researchers. ICENTRISA is expected to be one of premier forums in this field.

ICENTRISA is hosted by Department of Informatics, Universitas Islam Indonesia (UII) in Yogyakarta, Indonesia. The conference is in line with university vision to become a mercy to the worlds, aspiring to become an internationally recognized university. It has been our primary commitment in developing and disseminating science, technology, culture, literature, and art by promoting community development toward a just and prosperous of Nation's life.

Yogyakarta is renowned as a centre of classical Javanese fine art and culture such as batik, ballet, drama, music, poetry, and puppet shows. It became a major tourist destination in Indonesia thanks to the temple of Borobudur and Prambanan. Several other places of interests are Sultan (King) palace, Water Castle, Batik Center (Java traditionally made cloth) and Mount Merapi (one of the world's most active and dangerous volcanoes).

We wish to acknowledge all conference participants and thank them for their contributions. The collaboration between practitioners and researchers continues with each extending the boundaries of quality research and practice. We thank you all for your contribution in establishing Enterprise information systems (EIS) as a multidisciplinary field and pushing research to be even more useful and practice oriented.

We thank all the members of the program committee who worked diligently reviewing papers and providing valuable feedback to the authors. Their rigorous and timely reviews contributed greatly to this exciting program. Finally, we wish to thank all the authors for their high quality submissions and patience with delays and system glitches.

We hope you enjoy ICENTRISA 2013 conference and your visit to Yogyakarta.

ICENTRISA 2013 Yogyakarta, 13-14 June 2013

Keynote Abstract **RDF:** a language for EIS

Vilas Wuwongse

Department of Electrical and Computer Engineering Faculty of Engineering, Thammasat University

Abstract. ICENTRISA 2013 defines Enterprise Information Systems (EIS) as a study of seamless integration of business processes and information flows within an enterprise and inter-enterprises. The study includes technical, organizational and social aspects of the integration, as defined by The International Federation for Information Processing (IFIP) TC 8 WG 8.9 Enterprise Information Systems. EIS may also refer to information technology (IT) artifacts that enable and support the integration. This talk will demonstrate that the Resource Description Framework (RDF) could be used as language for the design and implementation of EIS. RDF could represent business processes as well as information and its flows within an enterprise and between enterprises. It could also model IT artifacts needed for the integration of business processes and information flows. In addition, RDF is a formal language and hence is equipped with some computational mechanisms. These mechanisms would facilitate the integration and its validation and maintenance. RDF database engines and its query language, SPARQL, have already been developed. Therefore, RDF could also be employed to implement EIS.

The Development of Academic Data warehouse as a Basis For Decision Making

A Case Study at XYZ University

Paulina H.Prima Rosa, Ridowati Gunawan, Sri H. Wijono

Informatics Engineering Department Sanata Dharma University Yogyakarta, Indonesia

rosa@usd.ac.id, rido@usd.ac.id, tatik@usd.ac.id

Abstract. In this paper, the authors report the development of academic data warehouse which consist of students' performance in high school, their university entrance test scores, and their grade point average (GPA) in university. The data warehouse was developed based on Student Admission Information System (SAIS) and Academic Information System (AIS) of XYZ university. To validate the usefullness of the data warehouse as a basis for decision making, the warehouse has been analyzed using OLAP technique and tested to several users. In addition, the data resulted from the warehouse has been mined using Weka data mining tools to test whether the data can be utilized as a basis for decision making.

Keywords: academic data warehouse; decision making

1 Introduction

The result of National Examination (NE) for Indonesian high school students in year 2010 statistically decreased. There were 267 high schools in Indonesia whose students 100% failed [1]. These failures were responded variously by students. Among of them showed destructive responds either to themself or their environment [1]. It can be easily understood that in the context of some students, fail in NE is similar to fail in life. Therefore, they perceive that committed to suicides is a solution.

On the other side, several state and private universities declared that students who passed entrance tests in those universities but failed in NE are eligible to follow the lecturer after submitting credentials in a certain period [2]. The fact implicitly showed that these universities believe that students who were failed in NE potentially capable to continue their studies in higher educations.

The previous mentioned facts rise a question about the relation between high school students' performance and their academic performance in higher educations. Driana [3] proposed a study of policy in NE through several mechanisms, for example

by organizing researchers from universities to study the implication of NE towards the readiness of students in pursuing higher educations.

This idea can be initiatied by studying the relationship between high school students performance and their academic performance in higher educations by using data warehousing and data mining techniques. Previous studies in data warehousing and data mining showed that data warehousing and data mining techniques have been used to understand students and their academic environments better. Baranovic et.al. [4] reported an implementation of data warehouse for the Higher Education Information System in Croatia. Ramaswami and Bhaskaran [5] studied the usefullness of data mining to predict result of elementary and high school students in India using CHAID Prediction Model. Bravo and Ortigosa [6] elaborated their research on student activities in e-leaning media to detect symptoms of low performance using production rules. Vialardi et al. [7] presented a recommendation in higher education using data mining techniques. Azimah and Sucahyo [8] have developed a data warehouse and performed data mining of academic data in "Nasional" University. Ernawati [9] performed data mining to find quantitative association rules of students' academic performance and their genders as well as their entrance tests in higher education. Haryanto and Rosa [10] performed a prediction towards admitted students who are not enrolled. Wirati and Rosa [11] presented the classification of students' performance based on their university entrance test scores.

Eventhough several researches in students' performance have been carried out, none of it discusses about the relationship between high school students' performance and their success rate in higher educations due to the facts that the data are not available electronically.

XYZ University is a private University in Indonesia that has developed its own information system since 1996. Among of its systems are Student Admission Information System (SAIS) and Academic Information System (AIS). SAIS was developed to handle student admission from application process up to the process of deciding which applicants will be admitted. On the other hand, AIS was developed to handle academic process after students have been officially registered. Although the two systems were operated in the platform of university's local area network, they are not integrated. Due to this fact, authors' preliminary survey in XYZ University showed that Head of Study Programs had difficulties in finding comprehensive view of students' performance in high school and their academic records during study in higher educations, which is needed in making decisions related to students. For example, during admission process, rate based on high school study area of students from a particular high school.

Therefore, this paper elaborates the development of data warehouse to handle high volume of data that were extracted from the Student Admission Information System and the Academic Information System of XYZ University. The result of the study is an integrated data warehouse which is usefull for users and ready to be utilized as a basis for decision making.

2 SUBJECT AND DATA

2.1 Subject

The subjects used in this research are the students batch 2007 and 2008 of four study programs in XYZ University who are registered in the second semester of 2010/2011. The students admitted through two types of admission namely: (1) outstanding student admission, and (2) regular admission. The outstanding student admission will select eligible students by using students' grades in high school, while regular admission will select students based on entrance test scores.

2.2 Data

The data were extracted from two sources of XYZ University: (1) the Student Admission Information System (SAIS) and (2) the Academic Information System (AIS). All data are gathered from the system in the form of database format. The two systems were not integrated as a single system. It causes difficulties for novice users to access comprehensive knowledge from the two systems. Table 1 describes the data used in this research.

Data Name	Period	Source
The entire database table of	Student Admis-	SAIS
Student Admission System	sion in 2007-	
from all admission types,	2008	
which contains all fields		
Complete data of all active	Active student	AIS
students in 4 Study Pro-	in second se-	
grams, which contains all	mester	
fields	2009/2010	
Course taken by all students	Course taken by	SAIS
	all students from	
	academic year	
	2007/2008 up to	
	2009/2010	
Data dictionary containing	Lifetime of	SAIS and
the meaning of all data in	SAIS and AIS.	AIS
SAIS and AIS		

Table 1. Data Source

3 Data warehouse Development

The data warehouse design was performed based on nine-step methodology as proposed by Kimball [11]. Following are the step of the data warehouse development:

1. Choosing the process.

Data warehouse to be constructed is intended to conduct an analysis of students' performance. The subject of data warehouse is student. From the whole system of XYZ University, two processes are selected to develop the warehouse, namely student admission process and student assessment process.

2. Choosing the grain.

The selected grains in this case are: (1) student admission report which consists of students' performance in high school and university entrance test score report; (2) result of study in university which consist of students' Grade Point Average (GPA) for each semester.

3. Identifying and conforming the dimensions.

Following are possible dimensions that are chosen: gender, admission type, study program, high school name, high school district, and students' study area in high school.

4. Choosing the facts.

Following are the facts that are incorporated in the warehouse: (1) identity of admitted students, (2) students' score in high school, (3) students' entrance test score, (4) study program, (5) subjects taken by students, (6) students' grade for each subject.

5. Storing pre-calculations in the fact table.

In this case, a pre-calculation to find GPA of each student for each semester were required. The GPA will then be stored in the fact table together with other facts elaborated in step 4.

6. Rounding out the dimension tables .

The information in dimension table were completed if needed.

7. Choosing the duration of the database.

Data to be loaded and analyzed are students of academic year 2007/2008 up to 2009/2010.

8. Tracking slowly changing dimensions .

There is no changing dimensions in this case.

9. Deciding the query priorities and the query modes.

After the fact table was defined, the following OLAP queries were designed to present data from the data warehouse:

- (a) Examining the average of students' high school grades and GPA based on the study program and school dimensions for all students from outstanding track.
- (b) Examining the average of entrance test score and GPA based on the study program and school dimensions for all students from regular admission track.
- (c) Examining the average of students' high school grades and GPA based on the school dimension for all students from outstanding track.
- (d) Examining the average of entrance test score and GPA based on school dimensions for all students from regular admission track.
- (e) Examining the average of students' high school grades and GPA based on the study area dimension for all students from outstanding track.
- (f) Examining the a average of entrance test score and GPA based on study area dimensions for all students from regular admission track.

4 Results and Analysis

4.1 Online Analytical Processing (OLAP)

Once the data warehouse is constructed, the author carried out an analysis using OLAP techniques. The atributes used as the analysis is the students' high school grades, NE grades, university entrance test score, GPA1, GPA2, GPA3, and GPA4, which will be viewed from the following dimensions: high school, admission type, study program, gender, study area, and high school district. Fig. 1 shows the star schema which is designed for OLAP.



Fig. 1. Star Schema Design

ICENTRISA 2013 Yogyakarta, 13-14 June 2013 Analytical results obtained by using OLAP techniques which generate XML documents. Users could select the focus of their attention. The possible measures to be analyzed are the average GPA, the average university entrance test scores, the average students' high school grades on several subjects (Indonesian Language, History, English, Mathematics, Physics, Chemistry, Biology, and Economy). The analysis might based on high school, admission type, study program, gender, study area, and high school district. The following are examples of the interesting possibilities of multidimensional analysis:

- (a) Examining the average of students' high school grades and GPA based on the study program and school dimensions for all students from outstanding track.
- (b) Examining the average of entrance test score and GPA based on the study program and school dimensions for all students from regular admission track.
- (c) Examining the average of students' high school grades and GPA based on the school dimension for all students from outstanding track.
- (d) Examining the average of entrance test score and GPA based on school dimensions for all students from regular admission track.
- (e) Examining the average of students' high school grades and GPA based on the study area dimension for all students from outstanding track.
- (f) Examining the average of entrance test score and GPA based on study area dimensions for all students from regular admission track.

Fig. 2 shows a sample report of multidimensional analysis example point a aboved. Several parts of the report are blocked due to the confidentiality of the information.

To generate the report in Fig. 2, average of students' high school grades were calculated from the fields of fact table by using average (AVG) aggregate function. For example, the average of MathScore field in Fig. 1 was stored as Mathematic field in Fig. 2. While the average of each GPA was calculated by using average (AVG) aggregate function to be stored as the following fields: AVG_GPA1, AVG_GPA2, AVG_GPA3, and AVG_GPA4. Data aggregate were calculated based on six dimensions namely high school, admission type, study program, gender, study area, and high school district.

Mahasiswa	ent en pos														
		Measures													
Study Pregnm	High Shool	7 AVG_Final	AVO_OPA1	AVO_OPA2	AVO_OPAS	AVO_OPA4	 Indonesian 		* History	*English	•Mathematic	• Physical	+ the legy	o@hem	albaenerriss
-All Study Program	4Semua Daftar SMU	72,575	2,883	2,84	2,932	2,969	7	2,894	54.099	70,401	67,683	34,006	32,194	30.612	39,567
*PSIKOLOGI	+Semua Daftar SHU	72.883	2.943	2,905	3.031	3.043	7	2,402	56.023	70,47	67.25	31.773	27,682	26.848	42.629
-SAINS DAN TEKNOLOGI	+Semua Daftar SHU	72,339	2,786	2,737	2,86	2,975	7	3,925	47,125	70,875	69,275	54,55	58,25	54,25	19,475
	-Semua Daftar SMU	72.339	2.786	2,737	2.86	2.975	7	3.925	47,125	70.875	69.275	54.55	58.25	54.25	19,475
	Sector Control	03.33	3,3	3.92	3,762	3,783									
		80,5	3,1	2,8	3,684	3,565									
		80.5	3,55	3.318	3,188	3,15									
	Stort Growning Korring	79.83	3,2	3,52	3,368	3,524									
		78.67	3,722	3.56	3,435	3.667		78	0	80	81	78.5	75	79,5	0
		77.85	3,35	3.091	3,421	3.25									
	Statingerse are another	77,1	2	2	2,206	3		72,5	82	80	71	0	0	0	80
		77	3,889	3,75	3	3,619		72,5	78,5	75	79,5	0	0	0	79,5
		76.91	2,05	1,727	2,562	2.762		_							
		76,5	3,45	3,24	3,476	3,565									
		76,33	3,45	3,364	2,952	2,818		_							
	Martine Contraction	74.83	3.009	3.625	3,565	3.619		01.5	36.5	78	72	75.5	75,5	66.5	0

Fig. 2. Sample Report from OLAP

OLAP multidimensional analysis resulted from the data warehouse has been demonstrated to four Head of Study Programs. A questionnaire to evaluate the result were also distributed to them. The results of the questionnaire are presented on table 2.

Statement	Strongly Agree	Agree
The information generated from the data warehouse facilitates Head of Study Programs to thoroughy view high school grades and GPA of the students from outstanding track, based on the school dimensions	80%	20%
The information generated from the data warehouse facilitates Head of Study Programs to thoroughy view university entrance test score and GPA of the students from regular admission track, based on the school dimensions	100%	
The information generated from the data warehouse facilitates Head of Study Program to get student profiles and to make decisions related to the student	80%	20%
The user interface of the data warehouse is easy to use	100%	

Thus in general it can be concluded that the data warehouse has been able to integrate the student academic record in high school, the university entrance test scores, and student academic performance in university.

4.2 Data Mining

Data extracted from the datawarehouse that has been saved in a spreadsheet format (. csv) were tested further using Weka data mining tools to evaluate whether it could be utilized as a basis for generating knowledge potentially usefull for decision making. Table 3 in the following are the examples of possible data mining towards the data.

Table 3.	Result	of Data	Mining
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Goal	Algo-rithm	Rules	Accuracy
Classify GPA	Id3	If $6.73 \le \text{NE}$ score < 7.63 then GPA < 2.5	53. 27%
based on NE scores		If NE score ≥ 8.54 then GPA ≥ 3.0	

		If 7.63 NE score <8.54 then GPA< 2.5 If $5.82 \le NE$ score < 6.73 then GPA< 2.5 If $4.92 \le NE$ score then GPA< 2.5	
Classify GPA based on universi- ty entrance test score	Id3	If entr_tes < 23 then GPA < 2.5 If entr_tes > 71.8 then GPA < 2.5 If 59.6≤entr_tes< 71.8 then GPA>3.0 If 47.4≤entr_tes< 59.6 then GPA<2.5 If 35.2≤entr_tes< 23.0 then GPA<2.5	55.14%
Classify universi-ty entrance test score based on NE scores	Id3	If NE score < 4.92 then $35.2 \le \text{entr_tes} < 23.0$ If NE score ≥ 8.54 then $47.4 \le \text{entr_tes} < 59.6$ If 7.63 \le NE score <8.54 then $59.6 \le \text{entr_tes} < 71.8$ If 75.82 \le NE score <7.63then entr_tes < 23.0 If NE score <4.92 then entr_tes < 23.0	32.71 %

Eventhough the accuracy is not high enough, we could find rules relating NE scores, university entrance test scores, and GPA. To improve the accuracy, further refinement of the parameters need to be investigated. However, it has been proofed that the datawarehouse is ready to be mined. In addition to the above examples of data mining, other data mining techniques such as clustering and association might be applied to the data extracted from the warehouse.

5 Conclusion

Academic data warehouse of XYZ University has been successfully designed and implemented using the star schema. Analysis of academic performance can be seen with various measure of the average GPA, average university entrance test score, average NE score, and the average students' high school grades in several subjects. Analysis can be viewed from various dimensions namely high school, admission type, study program, gender, study area, or high school district, based on the interest of the user. Users' evaluation showed that the information generated from the data warehouse facilitates Head of Study Program to get student profiles and to make decisions related to the student. Analysis results in the form of spreadsheet format can also be stored separately and subjected to data mining.

Further research to be done is performing more comprehensive data mining towards data extracted from the data warehouse to get valuable knowledge from it. In addition, the presentation of multi-dimensional analysis for novice users might be improved so that it will be more user friendly.

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