

# Design and Implementation of Educational Data Warehouse Using OLAP

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**Abstract - Educational Data Mining (EDM) is a method to support learning and teaching processes. Educational Intelligence (EI) is not wide spreading like a business Intelligence (BI). Data Warehouse (DW) technology aims to collect historical data from different kinds of Database (DB) and unifies them under single schema by using the most powerful tool as OLAP which helps the decision maker to make a right decision. Educational Intelligence system combines Educational records of students from two different sources in a single DW. The inputs of educational data warehouse can be in any format (such as reports...). Since the quantities are huge, they are almost meaningless, on the other hand the outputs mainly consist of reports and flowcharts and KPIs with meaning and effective factor for decision maker. The proposed DW is implemented based on two simulated databases of Computer Science Department in the College of Science, University of Basra for the last ten years and AL\_IRAQ University for the last 4 years implemented by SQL Server 2014 and SQL Server Data Tool (SSDT) 2012.**

**Keywords – Data Warehouse, Educational, OLAP System.**

## 1. Introduction

Information is the key element of today's business. To obtain the information, first we have to collect data - facts, numbers or text relationships among data that give us information, then converted to knowledge. So, the reason of many business organizations collect and store huge amounts of data in different formats. But, there is a problem concerning how to obtain substantial meaning in historical huge mass of data and convert it into useful information. Business Intelligence (BI) systems and Online Analytical Processing (OLAP) tools can be the solution. Business Intelligence systems approach allow

commerce institutes to separate huge and arranged information from different proveniences and transform them into useful data. [1]

Data warehousing bolster a suitable methodology in changing over operational information into significant and solid data to help the procedure of basic leadership. Furthermore, data warehousing bolster the premise for information investigation approach like data mining and multidimensional examination. Data warehousing process contains extraction of data from heterogeneous data sources, cleaning, filtering and transforming data into a common structure and storing data in a structure that is easily accessed and used for reporting and analysis purposes [2].

The goal of On-Line Logical Preparing (OLAP) instruments is systematic handling and information extraction with the end goal of basic leadership. With the guide of OLAP instruments, associations can precisely know the state inside the organization and all its parts, thinking about the states of the business. These tools can reveal hidden patterns in the collected data and, thus, help managers and analysts in making good decisions [3]

Data warehouse is a gathering of choice bolster advances, aiding and qualifying the people who involved (official, administrator, and investigator) to improve production and more secure choices. It executes a real execution of a choice bolster information model and keeps the data on which an undertaking needs to create vital choices. The data can be kept in several kinds of databases. The "data warehouse "is one database design that has lately appeared, actually it is a store of multiple heterogeneous data sources, arranged in a systematic way under a

consolidated schema at a single site appropriate to simplify administration of decision-making. Data warehouse technology comprehends data cleansing, data integration and OLAP. OLAP arises as an analytical tool with simplified like summarization, solidification and gathering, such as enabling view data in dissimilar ways [4].

## 2. Educational Data Warehouse (EDW)

The decision making of an organization needs an extensive perspective on all parts of enterprise and numerous organizations have along these lines created consolidated data warehouses that contain data drawn from various databases. Organizations have to transform their documents of data into a knowledge source. Therefore, the unified, consolidated perspective of data of the organization is introduced to the utilization of The Data Warehouse (DW) is most effective approach to achieve this purpose.

In fact Database with abilities of analyses is a set of subject-oriented, integrated, dependent on dissimilar time interims (time\_varying) and fixed (non\_volatile), that is utilized for administrative or decision support. Over a relatively long period, Management-Information-Systems (MIS) had a major effect on the management of centers of the training that are responsible for tasks in the similar method as the tool of Decision-Support-Systems (DSS), Expert-System (Expert System), Executive-Information-Systems (EIS). Arrived into reality to help managers administrative, but currently by the variation ambitious state, this approach are able to manipulate or cover the currently educational requirements [5].

## 3. Functions of (EDW)

Recently, there are some of functional requirements that can be explained as the following:

- Make rapid and effective decisions having competitive pressures exist.
- Observing the competitive environment.
- Feasibility assessment and data analysis of different sides of educational systems from various viewpoints.
- Collection and analysis of data obtained from all the resources that are available online and usage of various methods, mining and visualization of data.

According to the needs of today's conventional systems are no dissimilar and different complexes and their inability to find hidden relationships among data and

other shortcomings of today's systems. In fact, the centers and educational institutions to be able to quickly and accurately react to the changes in business areas and the right management decisions need to be taken in ways that have collected data from internal and external sources and is able to analyze them [4,5].

## 4. Educational Systems

Recently, educational systems are on the one side to increase the efficiency and quality are encountering the new difficulties and the requirements of the dynamic economy and other native or local existing businesses. This poses the need to establish and institutionalize a comprehensive systems for supporting decision making and distributed training [6].

## 5. Design and Implement System

The operations of building and implementing the proposed system are accomplished as in the following:

- 1) Design and implement databases (In our system it contains SQL and flat files)
- 2) Design and implement Data Warehouse
- 3) Design and implement OLAP Console
- 4) Design and implement Report Console
- 5) Design and implement User Interface

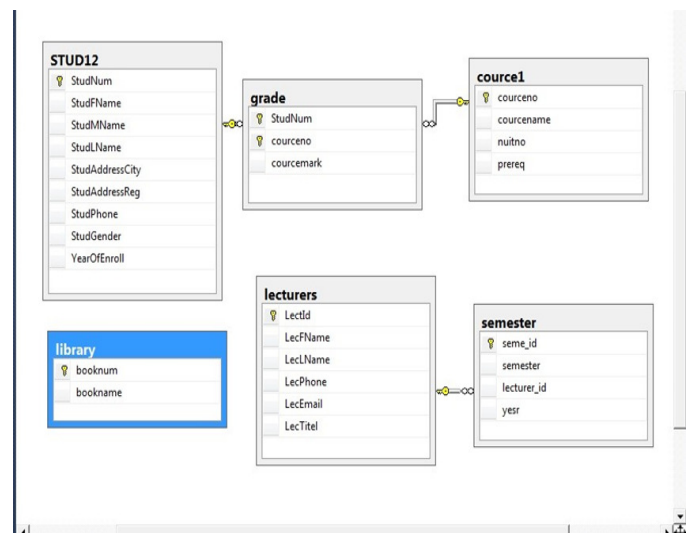


Figure (1) Student Database Schema

The structure of student database is relational where the personal information of students stored in STUD12 Table as shown in the figure (1), the personal information of lecturers stored in lecturer table, and so on.

## 6. Schema's Design

The shape that we utilize to put the tables is called "Schema". Star schema is suitable for our DW students system for the accompanying reasons:

- 1) Outcomes from information profiling process prompted pick this design.
- 2) Its trouble free to design, set up and execute.
- 3) Many other dimensions may be adapted later.
- 4) It can be understood by the analyst.

The schema configured by using SQL Server Management studio (SSMS) 2014 is presented in figure (2).

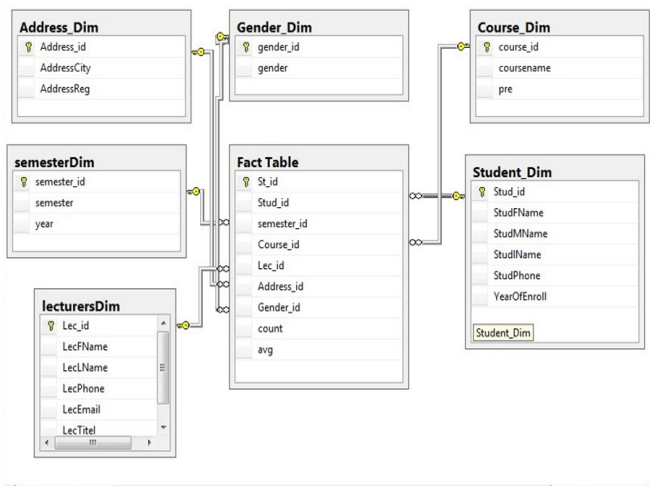


Figure (2) Proposed star schema

## 7. Results

In Design OLAP Consoles different platforms of OLAP used. Some of these platforms is designed by using Microsoft Excel 2013 power pivot table which provide wonderful interfaces to view results immediately. First group of OLAP consoles designed by using SQL Server Reporting Service (SSRS) 2013. The designed consoles provide some chosen dimensions with multiple choices which permit the user to choose the values easily.

Results will be shown as charts. The type of chart will give deep understanding about the results, see Figure (3). This figure shown number of students from each city, as we see the students of Basra city are indicate to the highest bar.

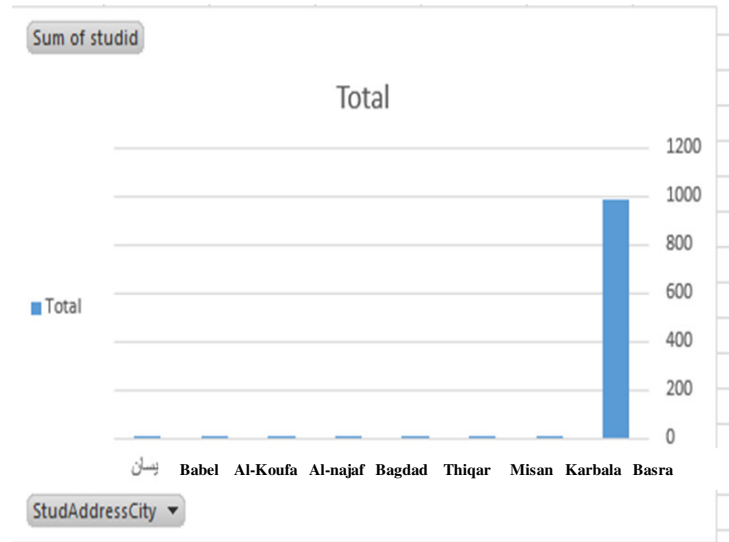


Figure (3) number of students in Iraq cities

The second one designed and clustering according to the two gender and six city of the students see the figure (4).

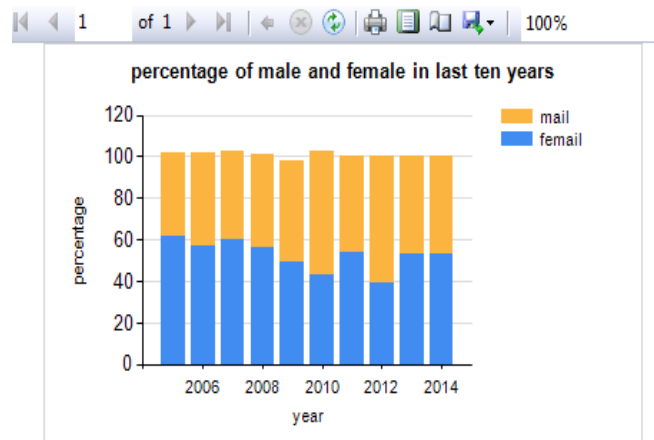


Figure (4), percentage of male and female in last ten years

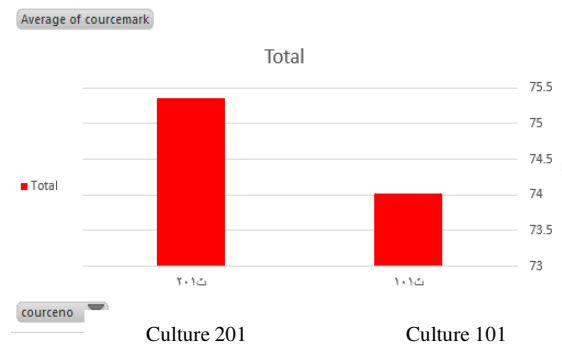


Figure (5) marks average of ca 201 and ca101  
 In this case we compare average mark of two courses culture 201 and culture 101 during ten years.

## 8. Conclusion

This paper described design and implementation of a successful educational data warehouse for higher education at the University of Basra. Data warehousing technology helps to collect historical huge data from several kinds of databases and unify them under unified schema in order to be used by on line Analytical Processing (OLAP) to help lecturer and decision makers. Extract, Transform and Load (ETL) system is the core of the DW. Each type of data base needs different constriction of ETL system according to the data types. OLAP is the storage of multidimensional, generally hierarchical, data providing near constant-time answers to queries. The OLAP techniques can be utilized to obtain students' achievements and to perform descriptive analysis. Decision Support System (DSS) technique and algorithm can be applied in order to forecast potential areas of studies for the students. The proposed designed approach might be implemented by the lecturers and heads of the departments and the decision makers.

## 9. Future Works

[1] Possible follow-up work should therefore be aiming at reviewing different parts, requirements specification, the requirements architecture itself and the verification with practitioners who can contribute a lot with deep implementation experience.

[2] The verification should be extended to include this experience. Possibilities are reviews of the document and description of the reference architecture by practitioner, interviews to focus on certain points of the reference architecture and to gather scenarios to apply the reference architecture to and test its fit.

[3] Finally, a method of predicting properties of the resultant cubes of the slice(), dice(), and rollup() operations on a cube in the data warehouse would be beneficial. If the properties of the resultant cube are known before it is created, the most efficient available storage method could be selected. For example if the result of a rollup() is expected to be small, the resultant cube should be stored in a new storage structure.

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