THE DIMBI PROJECT – GUIDELINES FOR INNOVATIVE TEACHING CURRICULA IN THE FIELD OF BUSINESS INTELLIGENCE AND DATA WAREHOUSE

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Abstract. The article is devoted to the study of the requirements of the labor market to the qualifications of graduates in the field of business intelligence (BI) and data warehouse (DW), and ongoing educational programs. As a result of analysis are outlined the main topics to be included in the current study. This paper is written within the Erasmus plus KA2 project “Developing the innovative methodology of teaching business informatics” (DIMBI), 2015-1-PL01-KA203-0016636.

Key words: business intelligence, data warehouse, teaching curricula.

1. Query on the labor market needs in terms of knowledge, skills and social competence in relation to BI and DW

Our research started with a survey of European requirements within the area of knowledge, social competences as referred to Business Intelligence (BI) and DataWarehouses (DW).

Acording to ESCO[1] - European Skills, Competences, Qualifications and Occupations, position “Business analyst, information technologies”, sector Software Industry, requires the following knowledge and skills:

- Analysis of company's needs
- Business analysis planning and monitoring
- Decision evaluation and validation
- Ensuring strategy compliance
- Requirements analysis

The needs of the labor market within the area of knowledge, social competences as referred to BI and DW were developed. In the beginning the focus was on the ability of reporting and visualization, creation and managing of data bases, defining of procedures and standards of BI.

[1] http://en.mycompetence.bg/shortposition/332-db68-job.html

Later there were demanded knowledge and skills of OLAP business analysis and now with developing of new information technologies are necessary competence of Data Mining, Text Mining, Big Data processing.

Nowadays there are some requirements and responsibilities for Data Warehouse Specialist, available in USA[2]:

Designs, implements and supports data warehousing. Implements business rules via stored procedures, middleware, or other technologies. Defines user interfaces and functional specifications. Responsible for verifying accuracy of data, and maintaining and supporting the data warehouse.

Key Responsibilities of Data Warehouse Specialist, available in UK [3] are the following:

- Gather data and reporting requirements, assist in integration and acceptance testing, support the development of training and implementation material, participate in the implementation, and provide post-implementation support as necessary to ensure processes are effective, efficient, understood and embedded
- Select methods, techniques, or criteria for data warehousing evaluative procedures
- Design, implement, or operate comprehensive data warehouse systems to balance optimization of data access with batch loading and resource utilization factors, according to customer requirements
- Map data between source systems, data warehouses, and data marts
- Design and implement warehouse database structures
- Write new programs or modify existing programs to meet customer requirements, using appropriate programming languages and technologies
- Create or implement metadata processes and frame works
- Verify the structure, accuracy, or quality of warehouse data
- Develop and implement data extraction procedures from other systems, such as CRM, support desk, or finance
- Implement business rules via stored procedures, middleware, or other technologies
- Develop data warehouse process models, including sourcing, loading, transformation, and extraction
- Test software systems or applications for software enhancements or new products
- Review designs, codes, test plans, or documentation to ensure quality
- Provide or coordinate troubleshooting support for data warehouse and analytics
- Prepare functional or technical documentation for data warehouse and analytics
- Perform system analysis, data analysis or programming, using a variety of computer languages and procedures
- Develop or maintain standards, such as organisation, structure, or nomenclature, for the design of data warehouse elements, such as data architectures, models, tools, and databases
- Create supporting documentation, such as metadata and diagrams of entity relationships, business processes, and process flow

[2] http://swz.salary.com/SalaryWizard/Data-Warehouse-Specialist-Job-Description.aspx
[3] https://www.jisc.ac.uk/sites/default/files/role_brief_data_warehouse_specialist.pdf

• Create plans, test files, and scripts for data warehouse testing, ranging from unit to integration testing

Skills and knowledge of Data Warehouse Specialist:

•Strong analytical and problem solving capability

•Ability to work to tight deadlines, keep momentum and deal with conflicting priorities in an environment undergoing a programme of transformational change

• Strong time management, planning and organisational skills, with a flexible approach to workloads

• Proven skills in designing, documenting and delivering the architectural and data requirements of data marts, data warehouse and business intelligence solutions

•Ability to evaluate and recommend to senior colleagues on the appropriate technology for Extract, Transform and Load (ETL), business intelligence and other elements of an enterprise wide data repository and reporting solution

• Experience in data architecture, data warehousing, master data management, enterprise information integration and ETLusing a cross section of technologies and programming languages

•Experience with data analysis, modelling and design specific to a data warehouse, manipulating and modelling large amounts of data from many and diverse sources

•Experience with the design of large scale ETL solutions integrating multiple source systems

•Experience using different development methodologies including Systems Development Life Cycle, Scrum, and/or Agile, and test-driven development.

In Bulgaria, only some large companies [4] require skills to work as Data Base Administrators. Candidates have to possess:

• experience in SQL programming and database development (mandatory)

• experience in at least one of the following RDBMS is required - Oracle, Microsoft SQL Server or Teradata

• strong analytical skills

• relevant university degree

• fluency in English language – both written and spoken

• communicative, hard-working, responsible personality

Following skills are considered as advantage:

• experience in ETL tools e.g. IBM DataStage, Microsoft SSIS, Informatica, Ab initio

• experience in SAP Business Objects, Microsoft SSRS & SSAS

• experience with large database and data warehouse background

The companies that are looking for Data Base Administrators in Bulgaria have the following requirements[5] for experience:

•deep understanding of relational database concepts;

•very good knowledge of Transact-SQL

•experience with MS SQL Server 2014

[4] http://www.rabota.bg/it-telekomunikacii/2016/07/26/data-warehouse-developer.293657

[5] http://www.rabota.bg/it-telekomunikacii/2016/06/22/data-base-administrator.292577?utm_source=imoti&utm_medium=banner&utm_campaign=RSS

•communication, teamwork, problem-solving and good analytical skills;

• familiarity with the main data manipulation languages and the principles of database design;

•flexibility and adaptability; good organizational skills;

•the skill to work to tight deadlines under pressure;

• a willingness to keep up to date with developments in new technology.

We have to consider also that business knowledge is as important as technical skills for working successfully on BI and DW initiatives.

2. Query on existing curricula in the field of BI and DW. Parameters of implementation of these programs (where, faculty, specialization, delivery time, terms of implementation, learning outcomes)

Parameters of existing curricula in the field of BI and DW are presented in the following table.

Table 1.

Teaching methods of DW and BI in Bulgarian universities

Where	Faculty	Specialization	Delivery time	Terms of implementation	Learning outcomes
D.A.Tsenov Academy of Econo mics-Svishtov	Management and Marketing	Business Information Technologies, Master	1 semester	Students are offered a detailed knowledge of the components of business intelligence: extracting, transforming and loading data; nature, architecture and design of the data warehouse; nature, structure and organization of the process data retrieval; using online analytical processing businesses. Practice with the relevant software	Knowledge of the methodologies in the field of BI
UNWE-Sofia	Applied Informatics	Business informati	1 semeste	Description of Business	

	and Statistics	cs and communications-bachelor's degree	r	Intelligent Systems. Architecture for business intelligence systems. Business models and information flows. Planning project for building business intelligent system. Data analysis. Analysis metadata. Design of databases. ETL. Developing applications. BI and data visualization. Knowledge discovery and Data Mining. Managing business performance.	
University of Economics Varna	Informatics	Business Information System-Bachelor, IT business inovation-Master	1 semester	Business Intelligence- key concepts. Business Intelligence Systems Architecture, basic functions. Data Bases and Data Warehouses. Intelligent Technologies in Business Intelligence Systems- Neural Networks,Data Mining. Business Intelligence Systems development tools.	Students receive theoretical knowledge for opportunities of BIS, as and practical skills for DM and business analyses.

Sofia University “ST.Kl.Ohridski”	Mathematics and Informatics	Master's program: Technology Knowledge and Innovation	1 semester	Nature and architecture of business intelligent systems. Data warehouse and extracts of data. ETL processes and tools. OLAP tools. Data Mining. Approaches to development BIS. Managing business performance.	Effectively use the knowledge in the organization and realize competitive opportunities associated. Analyze and evaluate the characteristics of the international and domestic environment related market requirements, opportunities and rapid growth and competition. Quickly make decisions in conditions of uncertainty and time and resource deficit
Carnegie Melon University[6]		Business Intelligence		Foundation for Business Intelligence. Business Analytics for BI. Concepts and Practice of DSS Modelling. DataBase Management Theory and Practice. Enterprise Data. Business Process Modelling and Analysis. Introduction of Data Mining. Critical Performance	

[6] online.sju.edu/programs/business-intelligence-curriculum.asp

				Management. Predictive Analytics. Management Issues in BI.	
Technische Universitat Darmstadt[7]		Business Intelligence and DW	1 semester	Motivation, BI Architectures, BI Modeling, Star Schema, Multi-Dimensional Models, Special DW/BI Operators, Optimization of DWs: partitioning, aggregates, histograms and other query optimization techniques, Special index methods, Smart implementation of operators, Back room operations, ETL processes: data extraction, data cleansing, data loading, Column-Oriented Databases in Business Intelligence, Data Warehousing Appliances, Cloud Data Analytics	

Some common issues in these topics are:
- Fundamentals of Business Intelligence. Business Analytics for BI.
- Business Intelligence Systems - architecture, basic functions.
- Data Warehouse and extracts of data.
- ETL processes and tools.
-Technologies OLAP, OLTP.
-Business Process Modelling and Analysis.

[7] https://www.dvs.tu-darmstadt.de/teaching/bidw/

-Data Mining.
- Business Intelligence Systems development tools.

3. Develop guidelines for new and innovative teaching curricula in the field of BI and DW

Some guidelines for new and innovative teaching curricula in the field of BI and DW include:

- Information technologies for direct, almost instant access to data. Mobile access. Cloud solutions.
- Web based solutions for BI.

One of the Ideas[8]: better understand the customers using BI.

Customers do not appear “physically” in a store and their behaviors cannot be observed by traditional methods.

A website log is used to capture the behavior of each customer, e.g., sequence of pages seen by a customer, the products viewed

Utilize website logs, analyze customer behavior in more detail than before (e.g., what was not bought)

Combine web data with traditional customer data

- Application of Intelligence technologies for Data Mining (especially Neural Networks), Web Mining, Logical Conclusions and Knowledge Bases.

Some of the main reasons for the need to implement Intelligence technology in BIS are:

o The problem Big Data. this data in addition to the volume characterized by a wide variety requiring integration techniques and specific treatments. Artificial Intelligence Technologies realize the transformation of data into easy to understand dependencies.

o Need for logical processing knowledge base to draw conclusions.

o Output forecasts on non-numerical data of different types. Neural Networks can help to find the trends.

- “in-memory” solutions

Software:

QlikView is distributed multiuser environment one of the most flexible platforms for Business Intelligence and Data Mining. It offers a new level of analysis and adding value to repositories of data. The product is a pioneer in the so-called. BI "in-memory" (memory) that provides dynamic calculations of new views of information.

Microsoft SQL Server

Alyuda NeuroIntelligence- software for neural networks

Rapid Miner- open software for Data Mining

[8] http://cs.ulb.ac.be/public/_media/teaching/infoh415/dwnotes.pdf

4. Development of graduate profile with knowledge, skills and social competence in the field of BI and DW

Here is presented some motivation[9] for Business Intelligence:

- The challenge of turbulent business environments: overview, major issues and needs for business intelligence and analytics.
- The impact of technology and the internet in the global business environment
- The need for analytics and data mining technologies in competitive business environments
- The strategic value of information and business intelligence in key enterprise systems

The financial crisis has increased the focus on BI also. We cannot afford not to use the “gold” in our data.

The main aim of competence in the field of BI and DW is combination the present **information and analytic technology practices** with applied **business methods**.

So we can divide 2 groups of skills: business and technical.

It is very important to understand how business work and how they can use BI solution. Business skills include[10]:

- **Analytic Problem-Solving:** Employing best practices to analyze large amounts of data while maintaining intense attention to detail.
- **Effective Communication:** Using reports and presentations to explain complex technical ideas and methods to an audience of laymen.
- **Creative Thinking:** Questioning established business practices and brainstorming new approaches to data analysis.
- **Industry Knowledge.**

Technical Skills include:

- Statistical methods and packages (e.g. SPSS), but even more critical is having the desire to find better explanations for whatever phenomena that is studied.
- R and/or SAS languages
- Data warehousing and business intelligence platforms
- SQL databases and database querying languages, metadata management
- Programming (e.g. XML, Javascript or ETL frameworks)
- Database design, cleaning
- Data mining
- Data security
- Data visualization and reporting techniques
- Machine learning techniques

[9] http://programs.unisa.edu.au/public/pcms/course.aspx?pageid=156901

[10] http://www.mastersindatascience.org/careers/data-analyst/

5. Development of draft curricula in BI and DW

The basic challenge in teaching a BI course is the need to create specialists who can determine what needs of the company have to be measured/reported and who can build the solution.

Main Topics of drafts curricula BI and DW:

1.Introduction to BI.

2.Data Base Management System- data, modeling, OLTP.

3.Business Intelligence Information Access, Analysis and Presentation.

4.Data Warehouse. Extraction, Transfer and Loading (ETL). Creating an InfoCube. Loading Data into InfoCube.

5.Enduser tools- OLAP, dashboards, scorecards. Analysis of economic indicators. Prediction.

6.Data visualization.

7.Data Mining,Text Mining,Web Mining. Methods and software tools.

8.Software for BIS developing.

9.BI management.

10.Data security.

11.Web based BI. Mobility access.

12. Future trends.

Conclusion

The Training in the field of Business Intelligence is necessary for managers at all levels of the Management. In our research we investigated curricula from different universities. On the basis of labor market requirements and qualification characteristics of the profession we chose and proposed educational disciplines. We believe that they are suitable for the construction of modern specialists in BI.

Literature

Vasilev, J. & Atanasova, T., 2015. Parallel Testing of Hypotheses with Statistical and Artificial Intelligence Methods : A Study on Measuring the Complacency from Education. *Computer Science and Applications*, 2(5), pp.206–211.