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Предпечат: Юлиан Василев

9000, гр. Варна, бул. „Княз Борис I“ №64

email: eknigibg@gmail.com

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*Sincerely: Prof. Dr. Sc. Petko Iliev*

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

Todorka Atanasova [1]

[1] University of Economics, Varna, Bulgaria
t_atanasova@ue-varna.bg

**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.

# BUSINESS INTELLIGENCE AND DATA WAREHOUSE PROGRAMS IN HIGHER EDUCATION INSTITUTIONS: CURRENT STATUS AND RECOMMENDATIONS FOR IMPROVEMENT

**Olga MARINOVA**[1]

[1] University of Economics, Varna, Bulgaria
olga.marinova@ue-varna.bg

**Abstract.** The purpose of this article is to explore the current situation and the main challenges in existing Business Intelligence (BI) and Data Warehouse (DW) curricula. On the base of this research, certain recommendations for their improvement are made. At the same time, the paper gives concrete guidelines for the development of a clear and comprehensive graduate profile with knowledge, skills and social competence in the field of BI and DW. This is particularly beneficial for universities and other higher education institutions, that seek to offer courses with high quality content and tendencies, adequate to the latest education, in the concerned area. The 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, education content, improvements in Business Intelligence education, BI curriculum, Business Intelligence and Data Warehousing skills

## 1. Inquiry on the labor market needs in terms of knowledge, skills and social competence in relation to Business Intelligence and Data Warehouse

Before analyzing the existing situation in BI and DW education, we shall take a look at the labor market requirements concerning the job skills, educational requirements and social competence needed in relation to BI and DW. The importance of this inquiry is determined by the need to define the basic criteria which a future specialist in this highly popular and profitable field must cover. It comes as no surprise, then, that jobs for business intelligence analysts and DW specialists are becoming more attractive and they are among the top 10 best-paying science, technology, engineering and mathematics jobs (Bednarz, A., 2014).

The technical skills required for job positions in BI and DW are very similar and overlap quite often, although there are topics that are specific to only one of the two areas (figure 1). For example, skills like dimensional modeling, analytics and defining user requirements are required in both business career fields. On the other hand, skills related to

the ability to visualize and analyze data with different dashboards, scorecards and metrics are usually specific to Business Intelligence job positions.

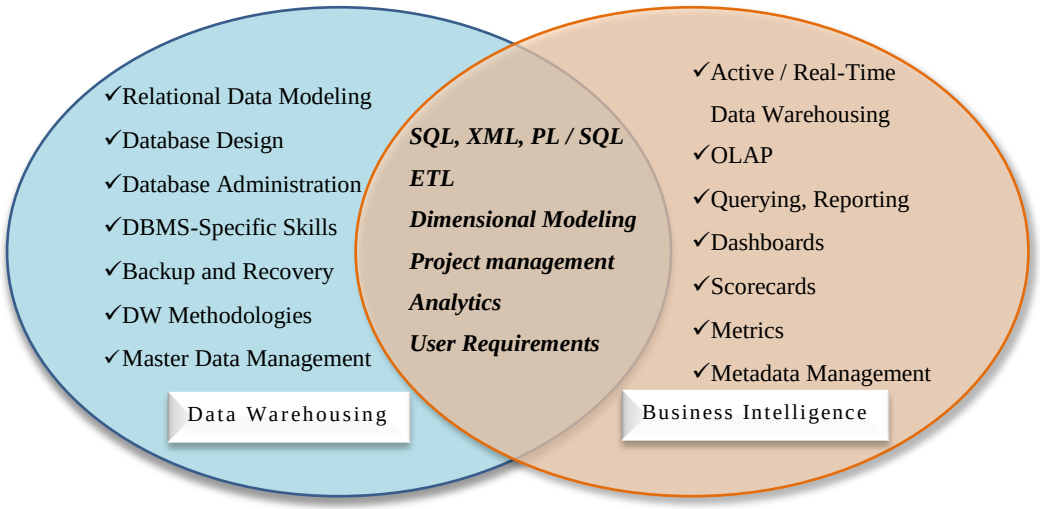


**Figure 1.** Skill overlap between Data Warehousing, and Business Intelligence
Source: Adapted from Shirani, A. and Roldan, M., 2009

The data warehousing skill set includes the foundation of relational database knowledge, though sometimes this information may not be explicitly stated in a job description. One characteristic of this group of skills is a requirement for experience with specific software products for data warehouse database design and administration. In addition, proficiency in the underlying DBMS is essential for any DW job.

Most DW job positions require specific experience with DBMS like Microsoft SQL Server, Oracle, IBM DB2, Teradata, SAP BW (Business Warehouse).

Several of the most required skills are extracting, transforming and loading data, as well as good knowledge / experience with multidimensional data modeling, such as star schemas, snowflakes, normalized and de-normalized models, handling "slow-changing" dimensions / attributes.

We can summarize the top ten DW skills and their rank according to their importance and frequency in the job listings (table 1).

**Table 1.**

Top Ten Data Warehousing Skills

| Rank | Knowledge / Skill | Percent |
|---|---|---|
| 1 | Extract, transform, and load (ETL) | 81.7 |
| 2 | Dimensional modeling; DW methodologies; DW architecture | 65.0 |
| 3 | SQL; PL/SQL; other programming languages (Perl, PHP) | 61.7 |
| 4 | Project management | 55.0 |
| 5 | Data security; backup; recovery; performance tuning | 53.3 |

| | | |
|---|---|---|
| 6 | Master data management (MDM); data quality; metadata management | 36.7 |
| 7 | UNIX; Linux | 31.7 |
| 8 | User requirements | 28.3 |
| 9 | Analytics | 26.7 |
| 10 | Reporting | 18.3 |

Source: Shirani, A. and Roldan, M., 2009.

As we mentioned earlier the required Business Intelligence skills overlap with foundational Database Management and DW skills. At the same time in this skill set there are specific requirements like experience with dashboards, scorecards metrics; querying, reporting; data mining and metadata management. One of the most important skills here is the ability to work with SQL and specific software like Oracle, Tableau, MS Power BI or IBM Cognos. In many job positions two or three of these software programs are required as a minimum.

According to the investigations conducted by some authors (Shirani, A. and Roldan, M., 2009) we can list the top ten BI skills and their rank (table 2).

**Table 2.**

Top Ten Business Intelligence Skills

| Rank | Knowledge / Skill | Percent |
|---|---|---|
| 1 | OLAP; querying; reporting | 68.3 |
| 2 | Extract, transform, and load (ETL) | 58.3 |
| 3 | User requirements; project management | 55.0 |
| 4 | Dashboards; scorecards; metrics | 43.3 |
| 5 | Dimensional modeling, DW architecture | 41.7 |
| 6 | Analytics; data mining | 38.3 |
| 7 | UNIX; Linux | 36.7 |
| 8 | SQL; P:/SQL; other programming languages | 36.7 |
| 9 | Security | 31.7 |
| 10 | Metadata management | 28.3 |

BI and DW job positions usually require a Bachelor or Master degree in Computer Science, Informatics, Computer Engineering, Business Information Systems, Accounting, Mathematics or an equivalent program. More complicated jobs may require a master's degree in Business Analytics, Machine Learning or Business administration.

Professionals in the field of BI and DW should be able to conduct interviews and gather the needs, motives and desired outcomes for the BI environment they are going to build. An important requirement is the ability to present complex ideas in a clear, concise fashion to technical and non-technical audiences. They should have very good communications skills and macro - perspective, e.g. to adopt a different perspective or mind set. BI specialists need to look at recent data trends and recommend solutions for increasing profit and reducing loss, so they should be able to solve different kinds of problems.

**Based on the analysis presented, we can conclude that DW and BI specialists usually should have some of these skills**:

- technical skills – experience with specific tools and technologies like DBMS

(such as MS SQL Server, Oracle, IBM DB2, Apache Hadoop, MySQL), ETL tools (such as SSIS, Informatica, Pentaho), Reporting tools (SSRS, SSAS, IBM Cognos, Business Objects) and BI tools (such as MS Power BI, Oracle BI Enterprise Edition, IBM Cognos and Tableau).

- analytical skills – ability to break down a series of complex data and bits of information, to view and analyze different situations from a very logical perspective, to develop an overall conclusion, and to find solutions for problems of advanced complexity.
- “soft” skills – such as organization and time management skills, communication skills, active listening and active learning.

## 2. Inquiry on existing curricula in the field of Business Intelligence and Data Warehouse. Parameters of implementation of these programs

The investigation of the current state of the existing curricula in the field of Business Intelligence and Data Warehouse is necessary in order to build a fuller picture of different parameters such as the place where these programs are offered, delivery time, terms of implementation and learning outcomes. The analysis should provide a brief inquiry about universities which offer disciplines, full courses or degree programs in selected area.

As a starting point in the current paper, we used the last report of BI Congress (Wixom, B., Ariyachandra, T. and Mooney, J., 2013) – The State of Business Intelligence and Business Analytics in Academia 2012, that summarizes data for 319 universities in 43 countries. Most of the universities, included in the survey, are in the USA (206) and the rest are in Australia (11), Belgium (1), Brazil (3), Canada (7), China (6), Croatia (1), Czech Republic (1), Denmark (2), England (1), Finland (2), France (5), Germany (19), Greece (1), Hong Kong (2), Hungary (1), India (4), Ireland (1), Israel (1), Jordan (1), Korea (1), Latvia (2), Malaysia (1), Mexico (3), New Zealand (2), Norway (3), Oman (1), Peru (2), Poland (2), Portugal (2), Russia (2), Scotland (2), Serbia (2), Singapore (2), Slovenia (3), South Korea (1), Spain (1), Sweden (1), Switzerland (4), Thailand (1), The Netherlands (1), Turkey (1), UAE (1).

According to the survey, 173 universities offer Business Intelligence (BI) / Business Analytics (BA) embedded within another course at the undergraduate level and 141 at the graduate level. 153 universities offer full course in BI/BA at the undergraduate level and 165 at the graduate level. 47 universities offer concentrations/majors in BI/BA at the undergraduate level and 74 at the graduate level.

Over 41% of the surveyed universities reported an increase in the size of their BI/BA course portfolio compared with the 2010 survey.

Based on these data we can conclude that **student interest in the field of Business Intelligence and Business Analytics is growing**. **Many universities start new courses and programs in BI / BA area, including universities in Bulgaria**.

46% of the university respondents offered “Data Mining/Predictive Analytics” courses. This is the most reported course offering category. 45% offered “BI/BA – Introduction” course in their programs. Other BI/BA courses are Statistics (44%), Quantitative Analysis / Modeling (41%), Introduction to IS (41%), Data Warehousing

(39%), Data Management (37%), Decision Support (34%), IT Management / IT Strategy (29%), Data Integration / ETL (21%) and others.

As we can see, the *Data Warehousing* course is offered by 39 % of the participating universities. However, our brief survey on the Internet shows that “Data Warehouse” is covered more often as a part of the program with title *Business Intelligence* or similar and rarely occurs as a title or part of title into a separate discipline. For example, in universities like Carnegie Mellon University, Pittsburgh, which has 6 units about Data Warehousing in a course under the name *Business Intelligence & Data Analytics* and University of Westminster, London, where *Data Warehousing and OLAP* is an option module in a master degree program titled Business Intelligence and Analytics.

It is important to know what **academic disciplines and departments** are involved in delivering BI or BA courses. In this sense according to the earlier mentioned report of BI Congres 76% of the BI/BA courses are taught by the MIS/IS/IT discipline, followed by Statistics (28%), Decision Sciences (23%), Marketing (19%), Computer Science (17%), Accounting (10%), Finance (9%), QA (7%) and other university departments.

**The delivery time** of courses in BI and DW area usually takes 1 year or even shorter in case with online delivery type. The analysis is based on an inquiry on the website http://www.mastersindatascience.org/ with search about Business Intelligence Master’s Degrees.

The expected learning outcomes in selected BI and DW programs generally include skills and abilities to:

- develop skills of inquiry, analysis, interpretation and synthesis necessary for the successful design, implementation and management of Business Intelligence;
- understand the key technologies used in Business Intelligence;
- develop knowledge of data analytic tools and techniques;
- extract, cleanse, consolidate, and transform heterogeneous data into a single enterprise data warehouse;
- systematically extract relevant data from a database, integrate and process data from multiple sources ready for data analysis;
- use computing methods, tools and techniques to solve a range of practical problems;
- select and use appropriate software tools for Report/Dashboard development.

Based on our research in 5 universities (University of Westminster, Carnegie Mellon University, Saint Joseph’s University, Stevens Institute of Technology, Nova Information Management School) **we can conclude that the main modules in BI programs in most cases include similar units like**:

- Foundations for Business Intelligence
- Business Analytics / Performance Management / Economic Analysis
- Database Management Theory and Practice
- Decision Support Systems (DSS) / decision modeling
- Data Warehousing / Data Warehousing and OLAP / Data Warehousing and Business Intelligence
- Data Mining
- Statistical Learning & Analytics / Statistics and Operational Research
- Knowledge Management

- Management Issues in Business Intelligence

This conclusion is useful for further purposes, related to the development of new curricula in the field of Business Intelligence and Data Warehouse.

## 3. Develop guidelines for new and innovative teaching curricula in the field of Business Intelligence and Data Warehouse

Based on the research made concerning the education and tendencies in BI / DW sector, we can offer concrete guidelines for the new and innovative teaching curricula in the field of BI and DW. It is necessary to notice the main challenges encountered by universities offering BI / BA/ DW or similar programs and some suggestions for their complex improvement.

In the above-mentioned report of BI Congres we can find interesting replies to the question “What are the greatest challenges you face in delivering BI/BA within your curriculum?”. Almost one half of the universities have indicated “***access to data sets***” (45%) (Wixom, B., Ariyachandra, T. and Mooney, J., 2013) as the greatest challenge.

Other challenges mentioned in the report include:

- Students do not have the skills (39%);
- Finding faculty who can teach the content (35%);
- Students’ aversion to statistics (33%);
- Finding a suitable textbook (33%);
- Finding suitable cases (31%);
- Staying current with practice (29%);
- Lack of scholarships for students to study the area;
- Teaching students from multiple disciplines.

**Based on this research and our own investigation in different universities offering BI and DW courses or disciplines, we can find some basic flaws and give our suggestions**:

1. Most BI programs don’t offer curriculum online or, if they offer it, it doesn’t contain clear and detailed information about the content of the course and themes. This is especially true for Bulgarian universities.

2. BI courses require suitable textbooks and online materials, but still few universities have an education and communication platform or website with unrestricted access to educational resources. It is important to create an online platform which will include rich material base with the manuals, tutorials, interactive books and tools necessary to implement and realize the methodology of BI and DW.

3. The use of real/realistic datasets is essential. A good idea is to use the same realistic dataset with different BI software products and after that to analyse the received outcomes.

4. BI curriculums should pay attention to different methods and tools and have to be clearer about the business value and the importance of BI.

5. The units (modules) should provide a more detailed description of the educational content. For example, the unit about *Predictive analysis* may be described in this way:

Compare and contrast different predictive analysis methods like:

- *Classification* – Linear Discriminant Analysis (LDA), Decision Trees, Perceptron Algorithm, Back Propagation Neural Networks
- *Regression* (Function Approximation) – Multiple Linear Regression, Neural Networks

6. It is a good idea to provide step-by-step tutorials for students. Easy software installation for students, so that they can also work at home.

## 4. Development of a graduate profile with knowledge, skills and social competence in the field of Business Intelligence and Data Warehouse

There is a growing demand for specialists that can develop and implement BI solutions and DWH projects in order to improve processes and to support better strategies. The forecast is that in the next decade this trend will continue. In this regard BI and DWH course are focused on developing in-depth knowledge and skills about the essence of Business Intelligence and DW/BI system deployment, support and growth. The program also incorporates knowledge about dimensional modeling, data mining, predictive analysis methods and statistical analysis. In this regard, each BI / DW curriculum must be accompanied by a clear and comprehensive graduate profile with knowledge, skills and social competence in the field of BI and DW.

BI data can include historical information (typically stored in a data warehouse or smaller data marts), as well as current data gathered from different sources. Thereby the BI analysis can be used to support both strategic and tactical decision-making processes.

The BI / DW course **should teach students to use more effective different tools for BI analysis and to take decision on the application for specific business organizations**.

**The course purpose** /goals/ can be present in this way:

The key aims of the course are to:

- provide knowledge and skills about a wide range of topics in Business Intelligence, with a particular emphasis on DW development and use and the issues associated with mining, integrating and analyzing both unstructured and structured data;
- develop skills of analysis, critical thinking, synthesis and the ability to solve complex problems;
- make students understand the role of analytical applications and BI tools of information visualization.

**We suggest that the intended learning outcomes be described in the following categories:**

1. Knowledge and understanding
   - understand the key components, principles and concepts of BI;
   - systematic knowledge of the nature, architecture and design of the DW;
   - understand the capabilities of decision support processes enhanced by the use of BI and DWH support;
   - knowledge of open source BI tools and different data analytics techniques;

- understand how relational and dimensional data are organized, cleansed, transformed, stored, and accessed with a variety of tools including dashboards and scorecards.

2. Intellectual and practical skills
   - develop skills of inquiry, analysis, interpretation and synthesis necessary for successful design, implementation and management of Business Intelligence;
   - analytical skills to identify new business opportunities or identify inefficient business processes;
   - develop skills of dimension modeling;
   - ability to use different data mining algorithms and techniques;
   - ability to use different open source BI tools;
   - skills in Data Integration and ETL (Extract, transform and load)
   - skills in Dimensional modeling, DW methodologies and DW architecture.
3. Social competence
   - the BI/DWH course enables students to develop very good communication skills: written, verbal and presentation abilities to explain the results effectively, as well as to work as part of a team through different exercises and group activities;
   - develop detail-oriented persons with very strong analytical, number and problem solving skills;
   - students will cultivate organization and time management skills.

After successfully completing the course, students will be able to find work as:

- Business analyst / BI analyst
- Business Intelligence developer / consultant
- Data Warehouse architect / manager
- Data miner / analyst
- Data scientist / researchers or tutors in academic institutions
- Management / Marketing consultant

## 5. Conclusion

Based on the findings of this study, several conclusions can be drawn. In order to meet the growing market needs for specialists in the fields of Dimensional Modeling, Business Analytics and DW architecture, higher education institutions have to improve and periodically update their BI / DW course content.

Publishing online a clear and comprehensive information about the curriculum aims, content, learning outcomes and teaching methods used are essential to provide greater competitiveness and accessibility to the education offered.

At the same time universities should seek various opportunities for collaborative projects with businesses, in order to ensure better compliance of the material taught with the real needs of businesses.

Using a range of appropriate realistic datasets and case studies, as well as problem-based learning scenarios will help with developing solid analytical and problem solving skills. In addition to this, it is a good idea to use the same dataset with different BI software products and then analyse the outcomes.

The services offered in the Business Intelligence field are rapidly evolving, which requires universities to be more flexible and adaptable to the changing environment.

## Literature

Barquin, R., 2013. Business Intelligence Education and the Public Sector. Available at: http://www.b-eye-network.com/view/17084.

Bednarz, A., 2014. Big data, big pay: 10 data jobs with climbing salaries. Available at: http://www.networkworld.com/article/2286529/big-data-business-intelligence/144797-Big-data-big-pay-10-data-jobs-with-climbing-salaries.html#slide1.

Golfarelli, M. and Rizzi, S., 2009. Data Warehouse Design: Modern Principles and Methodologies. McGraw Hill.

Shirani, A. and Roldan, M., 2009. Data Warehousing and Business Intelligence Skills for Information Systems Graduates: Analysis Based on Marketplace Demand. *Issues in Information Systems*, pp. 333-339.

Wixom, B., Ariyachandra, T. and Mooney, J., 2013. State of Business Intelligence in Academia, BI Congress 3.

# THE DIMBI PROJECT – INNOVATIVE APPROACHES FOR TEACHING BUSINESS INFORMATICS

**Ivan KUYUMDZHIEV**[1]

[1] University of Economics, Varna, Bulgaria
Ivan_ognyanov@ue-varna.bg

**Abstract.** The purpose of this article is to collect and analyze data on existing methods of teaching business informatics in leading Bulgarian universities and suggest areas for improvements. Based on a collected data guidelines for innovative teaching methods in the field of BI and DW are developed. Proposed methods are divided in several sections – lectures, exercises (groups' size, tools used, software, hardware, teaching methods, and real life customers), students' projects, control methods. The findings of conducted feasibility study show that the business, students and universities need an innovative methodology of teaching business informatics and properly implemented this methodology has a high probability of success. 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 informatics, new teaching methods.

## 1. Query on the needs of the universities in the field of innovative teaching methods Business Informatics

The purpose of this task is to analyze the needs of Bulgarian universities in the field of innovative teaching methods for Business Informatics. To accomplish this task we conducted a study among the leading universities in Bulgaria. The study gathers information of the subjects in participating universities that include training in the field of business intelligence. Thus we accept the thesis that training in BI and DW is an important part of the training in specialties targeted at Business Informatics.

The specialties for which there is information published on the official websites of the universities are listed in the following table

**Table 1.**

BI and DW oriented specialties in leading Bulgarian universities

| N | University | Degree | Specialty name |
|---|---|---|---|
| 1 | UE-Varna | Master | IT Business Innovation |
| 2 | UNWE | Bachelor (last semester) | Business Informatics |
| 3 | Academy of Economics D.A.Tsenov | Master | Information Technology In Business |

Source: Universities websites

Analyzing the objectives set for the training programs in these fields we found many common points:

1) according to UNWE[11] the main goal of BI systems is to assist the processes of decision making in organizations by providing reliable basis for efficient management. Same source states that BI systems includes technology, software applications and practices for the collection, integration, analysis and presentation of business information necessary for decision-making and applying these techniques includes traditional forms of queries, online analytical processing and data mining and adequate visualization.

2) Curriculum of the Academy of Economics D.A.Tsenov[12] states that the BI course aims to provide students with fundamental knowledge on the application of information technologies, best practices and methodologies in the field of business intelligence for decision support in organizations and achieve their strategic goals.

3) UE-Varna[13] extends these paradigms by adding capabilities of neural networks, as evidenced by the following snippet from the syllabus for state exam:

*26. Business Intelligence Systems (BIS) - functional modules and basic functions.*

*27. Intelligent technologies in the BIS (for logical processing, neural networks).*

*28. Data mining - characteristics and stages. Main tasks.*

*29. Extracting knowledge from Internet sources (Web Mining - WM) - nature, process stages and types.*

*30. Fields of application of extracting knowledge from Internet sources. Software tools for Web Mining.*

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| Conclusion 1.1 | Leading universities in Bulgaria includes in their training programs business informatics and consider BI education a essential part of the process. |

This finding allows DIMBI project to develop a program that is BI oriented and applied at training of specialists in business informatics at leading universities in Bulgaria

To define the scope and content of the program we have to define what kind of specialists is it targeted at. UNWE defines BI as a set of architectures, tools, databases, applications and methodologies by which **business managers** and **analysts** in an organization to receive quick and easy access to all available information about the company, preferably in real time, and to implement appropriate treatment and analyzing these data to

[11] https://www.google.bg/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8&ved=0ahUKEwjetZ73_YbOAhWkB5oKHRxnCD0QFggqMAM&url=http%3A%2F%2Fwww.unwe.bg%2Fuploads%2Fmain%2F35407_20.doc&usg=AFQjCNFPoKQH7nNcArNPZfEraY-IIeouag&bvm=bv.127521224,d.bGs

[12] https://www.uni-svishtov.bg/?page=mag_prog&p=24

[13] http://www.ue-varna.bg/Uploads/kat_inf@ue-varna.bg/%D0%98%D0%BD%D1%84%D0%BE%D1%80%D0%BC%D0%B0%D1%82%D0%B8%D0%BA%D0%B0/%D0%98%D0%A2%D0%98%D0%91%202016%20%D0%9C%D0%B0%D0%B3.pdf

support decision making process. This leads us to a conclusion that BI curriculum is useful not only for IT specialist but for employees in strategic management.

Analyzing degree of preparation of candidates to study this discipline we came to the conclusion that they have advanced level of knowledge - UNWE students are studying their last semester and in the other two cases the students are graduated bachelors and studying for masters.

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| Conclusion 1.2 | The curriculums are aimed at professionals (not necessarily in IT field) that are finishing their bachelors education or studying for master. |

This conclusion gives grounds to assume that DIMBI will be able to reach a wide range of students and applications.

We’ve seen dramatic advancements in the tools and methods used to develop data warehouses. 10 year ago BI was considered as a technique using dashboards and scorecards developed for specific uses but now it’s about integrated analytics within applications. Wide rage of commercial products were created and even wider rage of free and open source projects are available now.

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| Conclusion 1.3 | Rapid change of products in use creates necessity to often revise curricula, revaluate of available software and hardware assets, and update professors knowledge. |

To accomplish the task of complying with trending BI technologies DIMBI should be created as innovative and agile methodology.

Changing the capabilities of products leads to expanding their applicability. This defines the usage of BI in wider range of organizations and business activities which leads to increasing requirements to the employees concerned with using BI.

These specialists should understand the whole decision making process and know how to gather information despite the wide variety of data sources and business activities in the scope of the organization. This knowledge should be extended with the ability to present the information in a manner that is understandable for the management. Acquiring these skills can be split in several parts:

- Future BI specialist should actively collaborate by working together on project deliverables.
- They must jointly define scope projects and set priorities that deliver business value and are achievable
- Students should have the ability to gather information and take in consideration of the main business goals and objectives, obstacles for meeting them and evaluate what is the impact for the business if they do or don’t reach these goals.
- Create understanding of how the business performance is measured.

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| Conclusion 1.4 | Growing needs of businesses leads to changes in software solutions, but also to increase the requirements to employees associated not only with IT skills. |

## 2. Query on existing teaching methods in the field of BI and DW. Parameters of the implementation of these teaching methods (university, faculty, specialization, methods, tools used)

One of the most important components of the educational process are the teaching methods. They define overall activity of professors and students and give shape of the whole educational process. The good teaching methodology could be defined as such order of the curriculum, choice of methods and tools to allow maximum range of students to gain maximum amount of knowledge valuable for their future development.

Application of different methods in the learning process in UE-Varna is determined mostly by preference of the tutors and their previous experience as well as the discipline taking place and level of students' knowledge. Despite this observation the learning process goes through three main stages - lectures, exercises and conducting various forms of control.

Lectures most often take the form of a story before large groups of students. Rarely there are held demonstrations, discussions and brainstorming although these methods help to involve students in the process and therefore lead to better understanding of the material.

Three methods with positive effect on students' knowledge applicable are debates, brainstorming and demonstration. In real-life situations BI specialists need to successfully communicate with managers (debate/discussion) while having the necessary knowledge for obtaining the information needed for decision-making (demonstration) under conditions requiring adaptability and responsiveness (brainstorming).

Brainstorming is used to stimulate the creative activity of students on a given topic or issue, discussion is aimed to develop communication and language skills, and demonstration is an essential part of every practical training.

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| Conclusion 2.1 | Conducting lectures in the form of dictation is not a good practice in BI training. |

Conducting lectures in the form of monologue limits the use of tools used to presentation software (in most cases - PowerPoint).

Conducting exercises is a process performed chronologically after presenting a certain learning material in lectures. Presumably students should be familiar with this material and so they could have exercises almost independently which gives the teacher role of a moderator. In most cases, however, the majority of students is not familiar with and/or have not understood the material from the lectures and there is a need for **demonstration** and **discussion**. This requires more personal attention to each student by the tutor. With increasing size of the group of students, this approach leads to a high degree of inefficiency – professors doesn't have enough time to help all students having problems with carrying out experiments which leads to limiting exercises complexity and number.

The tools used to conduct exercises include presentation software, and software for screen sharing of students' workstation and/or remote control by the professor. This reduces time for assisting students having problems with their exercises which gives the possibility for conducting more and more complex tasks.

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| Conclusion 2.2 | Exercises with large groups are ineffective. Screen sharing/remote control software should be used to assist professors tasks. |

Teaching methods in UE-Varna include assigning home tasks to individuals or groups. With this method students work alone or in a small group on a specific topic, with the teacher taking role of a consultant and assessor of the finished project. Such activity develops teamwork abilities and helps for the good understanding of the curriculum.

The preparation of BI project requires access to large amounts of data. This could cause inconvenience when students present their finished projects – they should have personal mobile computers or storage devices with large capacity. Therefore there should be tool that allows:

1. Students to remotely access services they need for the project. This will remove the need for installing all needed software tools on their own computers.

2. Using shared space for storing students finished tasks thus allowing easier and faster assessment and consulting.

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| Conclusion 2.3 | Group projects are good practice for BI teaching process but it should be used with software tools for remote access and sharing. |

Students must have measurable evaluation of their knowledge so they could correct it if needed. For this reason there are several test methods implemented - oral, written and practical exams

Oral and practical exams could be very time consuming leading to extending the whole assessment process. Here’s why we suggest that the written exam should be implemented as computerized multiple choice tests which could significantly decrease time needed for assessment of the exams. Tutors in UE-Varna are using web-based software solution, developed by it’s own research group, that allows fast examination of large groups of students.

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| Conclusion 2.4 | Teaching methods for BI should include all three types of examination. Oral – testing communication skills, practical – testing students abilities to use BI tools, written exam to assess their theoretical knowledge. |

DIMBI should outline as a good practice conducting computer-based multiple choice tests.

As a major drawback in teaching methods used in UE-Varna could be outlined the lack of classes for communication with real customers. This would give a proper basis for implementing the method called “sociodrama”. A sociodrama is a dramatic play developed by social scientist Jacob L. Moreno, in which several individuals act out assigned roles for the purpose of studying and remedying problems in group or collective relationships[14].

Students play a role and try to imagine what they would do in a given situation. Depending on the task they have to imagine they are in a particular situation and fulfill a role

[14] Garcia, A. & Sternberg, P., 2000. Sociodrama: Who's in Your Shoes?. ISBN-13: 978-0275962999 . Praeger, pp.8.

with certain characteristics. Main objective of this method is for students to comprehend the problem through their own experience.

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| Conclusion 2.5 | It’s essential for BI education students to be able to communicate with their possible future employers so they could get closer idea of decision making process. |

Master's programs are aimed at students graduated from different disciplines. Training in BI is also used in various disciplines due to the growing demand for specialists in this field. This leads to the conclusion that the program and the requirements are the same for students with different backgrounds, which creates difficulties in teaching and learning material.

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| Conclusion 2.6 | Methodology of teaching BI should be agile and dependent of students knowledge level. |

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

The following is a set of guidelines of what we consider best practices for new and innovative teaching methods in the field of BI and DW. Proposed methods are divided in sections:

1. Lectures.
2. Exercises
    - 2.1 Groups size
    - 2.2 Tools used
        - 2.2.1. Software
        - 2.2.2. Hardware
        - 2.2.3. Teaching methods
    - 2.3 Meet real life customers
3. Students projects
4. Control methods

**1. Lectures**

Tutor should not read lectures to the students in the form of monologue. There should be included different teaching methods like brainstorming, discussions and demonstrations.

Brainstorming is used to stimulate the creative activity of students on a given topic or issue, discussion is aimed to develop communication and language skills, and demonstration is an essential part of every practical training

In real-life situations BI specialists need to successfully communicate with managers (debate/discussion) while having the necessary knowledge for obtaining the information needed for decision-making (demonstration) under conditions requiring adaptability and responsiveness (brainstorming).

**2. Exercises –** practical exercises should be conducted in rooms equipped with computers and follow next basic rules:

**2.1 Groups size**

With increasing size of the group of students the professor has not enough time to assist all students having problems with carrying out experiments which leads to limiting considered material. Therefore the good practice should be constraining groups size between 10 and 14 students who can access individual computers.

**2.2 Tools used –** the goal of used tools is to facilitate the learning process by focusing the attention of students and teacher on the exercises.

**2.2.1. Software**

The tools used to conduct exercises include presentation software, software for screen sharing of tutor`s workstation and remote control of students workstations. This allows for faster spreading the information to more students simultaneously which lead to better and faster understanding the examples.

**2.2.2. Hardware**

Creating and assessing students projects should be done using central computer server which allows:

1) students to use it remotely which cancels the obligation to install all of the software products on their own workstations

2) using central data storage for students projects.

**2.2.3. Teaching methods**

2.2.3.1. Course projects are considered a good practice in BI education. Students work alone or in a small group on a specific topic. Professors are in the role of a consultant and assessor of the result.

2.2.3.2. Students should be able to fulfill same business requirements using different software tools. Doing so will give them the ability to analyze and choose the best suited tool for the task.

Learning process should not be concentrated on only one software tool. Instead of product driven approach, tutors should use a requirements-driven approach. Students should be able to

1) Plan to go through multiple iterations of requirements gathering and define business goals and objectives?

2) Gain understanding what could prevent them from meeting those objectives?

3) Choose the best tools for every stage of the process.

**2.3 Meet real life customers**

Communication with business representatives will help students to understand exactly what kind of information is most useful to them. Working on projects assigned by a real life customers in a team with other students will help them to develop abilities to:

- Actively collaborate by working together on project deliverables.
- Jointly scope projects and set priorities that deliver business value and are achievable.
- Hiding complexity for end users: end users should be able to directly select indicators and dimensions for use in reports or interactive analysis – no further knowledge on database sources and structure is needed

**3. Students projects**

Providing access to lectures data and software tools isn't enough to ensure that the students understand how this process leads to the situation where decisions in the company are actually improved. It's hard for anyone to understand the value and possibilities of BI and DW without implementation of a specific practical task concerning improving decision making.

The idea of project-based learning is not new - it originates in the early 20 century and it's populated by W. Kilpatrick and J. Dewey. Students work in groups on a certain task performing different roles. Professors help students understand the tasks, assess the results and moderate the process if necessary.

Implementing this method in BI education leads to situation where university not only prepares students for a certain job, but be job itself. Some of the projects should include methods of role-playing games or sociodrama. Students play role and try to simulate what they would do if situation close to the assigned project task happen in practice. Introducing real customers to the process helps students accommodate to their perspective and build better understanding of the whole process. The purpose of this method is students to percept the problems of decision making through their own experience.

**4. Control methods**

Students must have measurable evaluation of their knowledge so they could correct it if needed. For this reason there are several test methods implemented - oral, written and practical exams.

Oral and practical exams could be time consuming leading to extending the whole assessment process. Here's why we suggest that the written exam should be implemented as a computerized multiple choice tests which could significantly decrease time needed for assessment of the exams.

To evaluate students communication skills should be conducted and oral examination, which may include various case studies for discussion. Communication skills would not be useful in the absence of practical knowledge to properly use the right software tools. For this reason, must be conducted and practical exam using computers

## 4. The feasibility study of the proposed innovative solutions. Any modification of assumptions

Feasibility study of the proposed innovative solutions should provide assessment of the requirements for all the sides in this process – students, tutors, universities, and the organizations defining the characteristics of the labor market. Theses sides are listed in several categories and subcategories to achieve precise feasibility study for each one of them. Course duration, software and hardware requirements are responsibilities of the universities applying DIMBI.

**1. Hardware requirements**

To properly follow the suggested guidelines there should be implemented central server. It should be used for remote creation of projects, publication of tasks and results and installing software system for conducting test examination.

Except the central server all classroom exercises should be done with enough computer stations for every student of the group.

**2. Software requirements**

Implementing DIMBI requires installing software of the following categories:

- BI software – except most popular commercial tools there should be installed and some of the most perspective free and open source BI solutions.
- Presentation software – used by tutors in both lectures and exercise classes these tools can make the theory more understandable and compelling. There are completely free tools, tools free for teaching purpose (prezi.com) or tools part of previously bought service (PowerPoint).
- Software for test assessment – installing such product on the central server could facilitate the process of students examination.
- Software for remote access for the student to the central server.
- Software for remote access in the exercise classrooms – these tools can reduce significantly the time needed for the tutor to understand students questions and provide the assistance needed.

**3. Course duration**

The duration of the course should be consistent with the volume of the theory included, the knowledge students already have and the capacity of the universities to spend time and resources for its implementation

**4. Tutors preparation**

All tutors should be aware of DIMBI guidelines and have sufficient knowledge of:

1) software used – tools for BI, presentation, remote access, automated test examination

2) teaching methods used – discussion, project-based learning, brainstorming, sociodrama etc.

**5. Requirements of the students knowledge**

To be able to understand the basics of BI and its part of decision making process students should have sufficient knowledge of:

(mandatory)

-Basic computer literacy – teaching BI doesn’t require knowledge of any programming languages or algorithmization methods.

(recommended)

-communication skills, understanding of relational, non relational and distributed databases. BI specialists should understand the process of decision making and to be able to gather information from the databases in use despite of wide variety of tools used and business activities included. These could help to:

1. Actively collaborate by working together on project deliverables.
2. Jointly scope projects and set priorities that deliver business value and are achievable.

Experience in the field of database systems should be at use for the BI students because it would make it easier for them to understand the process of gathering and processing data to information for decision making.

**6. Marketing feasibility**

Increasing BI capabilities leads to the broader application of this technology. Therefore more organizations are requesting BI skills from their employees.

It has been found that the leading universities in Bulgaria are preparing students in specialties including BI and DW. Here is why developing of agile and innovative methodology should be beneficially for both universities and businesses.

**7. Findings and recommendations**

The findings of this feasibility study show that the business, students and universities need an innovative methodology of teaching business informatics and properly implemented this methodology has a high probability of success. Key findings are as follows:

**Technology:**

- Based on tools already in use in the universities
- Recommends including free and open source software to reduce total cost
- Once in place this methodology is simple to operate and maintain for a relatively low cost

**Marketing:**

- The marketplace for teaching courses for preparing BI specialists is in a steady state of growth
- Universities implementing DIMBI will be able to differentiate itself from its competitors and will utilize incentive programs to target new students

**Organizational:**

- DIMBI doesn't require increases to staffing or changes to organizational structure
- DIMBI recommends installation of central server and installation of software for remote access in computer laboratories.

## 5. Conclusion

As a result of this research several conclusion may be made.

Leading universities in Bulgaria includes in their training programs business informatics and consider BI education a essential part of the process. The curriculums are aimed at professionals (not necessarily in IT field) that are finishing their bachelors education or studying for master.

Rapid change of products in use creates necessity to often revise curricula, revaluate of available software and hardware assets, and update professors knowledge. Furthermore program and the requirements are the same for students with different backgrounds, which creates difficulties in teaching and learning material. To accomplish the task of complying with trending BI technologies DIMBI should be created as innovative and agile methodology.

Group projects are good practice for BI teaching process but it should be used with software tools for remote access and sharing. Exercises with large groups are ineffective and to mitigate the negative effect screen sharing/remote control software should be used to assist professors tasks.

It’s essential for BI education students to be able to communicate with their possible future employers so they could get closer idea of decision making process.

Teaching methods for BI should include all three types of examination. Oral – testing communication skills, practical – testing students abilities to use BI tools, written exam to assess their theoretical knowledge. To minimize time for students assessment DIMBI should outline as a good practice conducting computer-based multiple choice tests.

Proposed guidelines could give DIMBI characteristics of agile and dependent of students knowledge level methodology. Conducted feasibility study shows that the business, students and universities could apply DIMBI for teaching business informatics and properly implemented it has a high probability of success

## Literature

Garcia, A. & Sternberg, P., 2000. Sociodrama: Who's in Your Shoes?. ISBN-13: 978-0275962999 . *Praeger*, pp.8.

Sharma, V. (2011) Principles and Methods of Teaching. Pinnacle Technology.

Westwood, P. (2008) What Teachers Need to Know about Teaching Methods. Aust Council for Ed Research.

# THE DIMBI PROJECT – ADAPTING NEW METHODS OF TEACHING BUSINESS INFORMATICS

**Julian VASILEV**[1]

[1] University of Economics, Varna, Bulgaria
vasilev@ue-varna.bg

**Abstract.** The purpose of this article is to find and analyze the existing methods of teaching business informatics. This research is limited to universities in Bulgaria teaching data warehouse (DW) and business intelligence (BI). The main approach for collecting data and analyzing it is content analysis. As the result of the analysis several new teaching methods are proposed. Their practical implications concern academic staff teaching business informatics. 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 informatics, new teaching methods.

## 1. Query about tutor's awareness of DW/BI usability through DW/BI questionnaires

The purpose of this task is to find the awareness of teachers of DW/BI usability. There are two groups of tutor – one of them who are teaching Business informatics and the other group – who are not teaching Business informatics but need the use of DW/BI instruments. The awareness of DW/BI usability is studied through a face-to-face interview with a prepared questionnaire. The purpose of the applied method is to gather rather qualitative than quantitative information about tutor's awareness of DW/BI usability.

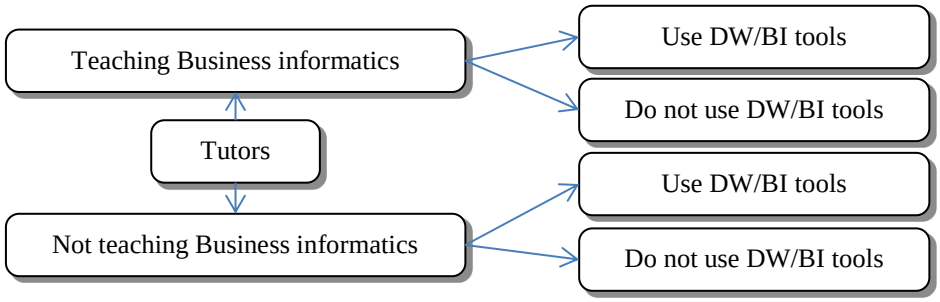


**Figure 1.** Tutors and business informatics
Source: Own contribution

People who teach DWH and BI are usually aware of theoretical concepts and they know very good examples of case studies. Most of the used software products come with ready-made examples which may be used for educational purposes. A significant problem is with licenses. Most tutors prefer to use open source software or trial versions of software products.

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| Conclusion 1.1 | Good examples of the application of DWH and BI instruments are found in some software products. |

This conclusion may be used as a starting point for further research and for providing DWH and BI courses to students not studying Business informatics and practitioners.

Tutors who teach DWH and BI courses sometimes focus too much on theoretical aspects and the use of one software products.

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| Conclusion 1.2 | Some tutors who teach DWH and BI instruments usually use one software product for illustrating the taught courses. |

This conclusion gives an opportunity to the DIMBI project to extend some case studies with the parallel testing of research questions in different software products.

The face-to-face talks with tutors who do not teach DWH or BI showed that they know about some software instruments but they do not know how to use them.

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| Conclusion 1.3 | Some tutors know about the existence of DWH and BI instruments but they do not know how to use them. |

This conclusion may be another opportunity for the DIMBI project. Providing e-books with well documented examples with sample datasets may provide fast getting of knowledge of the application of DWH and BI instruments.

Difficult and complex software products need a lot of time to be installed. New software products (such as Talend and HPCC) usually lack of documentations. So some tutors, who have experience with other software products, need a lot of time to learn new software products.

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| Conclusion 1.4 | New software products (also open source ones) who come without documentation take too much of the tutors’ time to be studied. |

This conclusion is a very good opportunity of the DIMBI team. Researchers from UJW, WUE and VUE may study different new open source software projects and offer a wide variety of case studies and real business examples.

## 2. Query on the needs of the universities in the field of innovative teaching methods Business Informatics

The need of new and innovative teaching methods is proved by the disadvantages of current teaching methods.

Business informatics is a fast growing and developing sphere of knowledge during the recent years. New software products, new technologies, new hardware devices appear. This fast growing industry requires specialists in business with high quality skills. Getting these skills may be done at universities. Using old-fashioned methods of teaching does not attract students.

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| Conclusion 2.1 | University should offer innovative methods of teaching to attract more students. |

The competitiveness of universities for first-year students, allow universities to apply new methods of teaching. This conclusion may be a good opportunity for the DIMBI project. Applying innovative teaching methods may give the chance to university to attract more students.

The technology change requires tutors with innovative think and applying new methods. Mega classes were popular 20 years ago but nowadays new approaches should be found.

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| Conclusion 2.2 | University should close teaching methods using mega classes. Small groups of students should be taught. |

This conclusion gives another opportunity for the DIMBI project. The change from mega classes to small groups of people allows branding in education. Small groups of people can benefit from the face-to-face contact with the tutor.

Giving knowledge to other people is a difficult task. Different kinds of pedagogical methods are well known. Since Business informatics is a complex field of study innovative approaches should be applied. One of them concerns studying in small groups of people, the other one – using only laboratories for teaching

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| Conclusion 2.3 | Tutors should teach business informatics only in computer rooms. |

This conclusion gives many opportunities to the DIMBI project. Since all researchers in the project have solid backgrounds of teaching, they may exchange their teaching experience.

In some cases students complain from too much theoretical knowledge and lot information that is not understandable.

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| Conclusion 2.4 | Tutors should teach business informatics using case studies from real practice. |

This conclusion is an opportunity for the DIMBI project. Sample datasets may be uses. Research questions may be defined. Several software tools (from the class of DWH and BI) may be used to accept or reject the research questions.

## 3. Query on existing teaching methods in the field of BI and DW in Bulgarian universities. Parameters of the implementation of these teaching methods

The query on the existing teaching methods of BI and DWH is done using the method “cabinet study”. Publicly available information is used. Information about teaching methods of Business informatics from Bulgarian universities is aggregated in the following table (table 1).

**Table 1.**

Teaching methods of DW and BI in Bulgarian universities

| University | Specific methods | Tools |
|---|---|---|
| University of Economics Varna, Bulgaria | Small groups of people;<br>Providing online courses;<br>Using different software products; | Rapid Miner, PSPP, Ornage Canvas, Talend, HCPP, Alyuda Neurointelligence, Easy NN |
| Academy of economics Svishtov, Bulgaria | Including economical courses for students studying Business informatics | N/A |
| University of national and world economy, Sofia, Bulgaria | Studying not only disciplines concerning Business informatics, but also other disciplines aimed at business communications | N/A |

Applying different teaching methods result in the drop-out of students.

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| Conclusion 3.1 | Some students drop-out from universities because of the application of inappropriate teaching methods. |

This conclusion may be used as an opportunity for the DIMBI project. Providing new methodologies of teaching Business informatics may lead to keeping the attraction of students and getting lower levels of drop-out students during the course of study.

Theoretical concepts are discussed during lectures with mega classes.

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| Conclusion 3.2 | Theoretical concepts are discussed during lectures with mega classes. |

This is a usual practice for many universities but the current situation may be changed using the aim of the DIMBI project. Decreasing the time in mega classes and teaching in small groups of people will benefit to better understanding of complex theoretical knowledge.

Sometimes students say that it is difficult to get practical skills. Getting practical skills depends mainly on the tutor and the methods of teaching.

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| Conclusion 3.3 | Applying the appropriate methods of teaching results in getting specific skills in Business informatics. |

The DIMBI project may benefit from this conclusion. The theoretical knowledge may be explained using real case studies.

Sometimes students say that they do not see the link between theory and practice. Lectures do not include examples. If there are examples during lectures, different examples are given during exercises (laboratories)

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| Conclusion 3.4 | In some cases the practical examples in lectures and laboratories are different. |

This conclusion gives an opportunity to the DIMBI project to provide new knowledge in the sphere of Business informatics by showing cases studies in computer rooms and not using old-fashioned lectures with mega classes.

## 4. Planning for new teaching methods taking into account the learning outcomes in terms of knowledge, skills and social competence

The new teaching methods consist of several approaches for the methodology of teaching.

Firstly, case studies with real examples from practice should be used. These examples will give confidence to students when solving real business situations. Case studies make the bridge between theory and practice.

Secondly, these case studies are accompanied by sample datasets. The datasets have several columns (describing attributes of data) and rows (for each case).

Thirdly, these datasets are provided as CSV files. Students will get specific knowledge for importing CSV files in different software products.

Fourthly, research questions are defined. This is a creative process and managers in practice sometimes find difficulty in defining sensible research questions. These questions should be answered by using the sample datasets (figure 2).

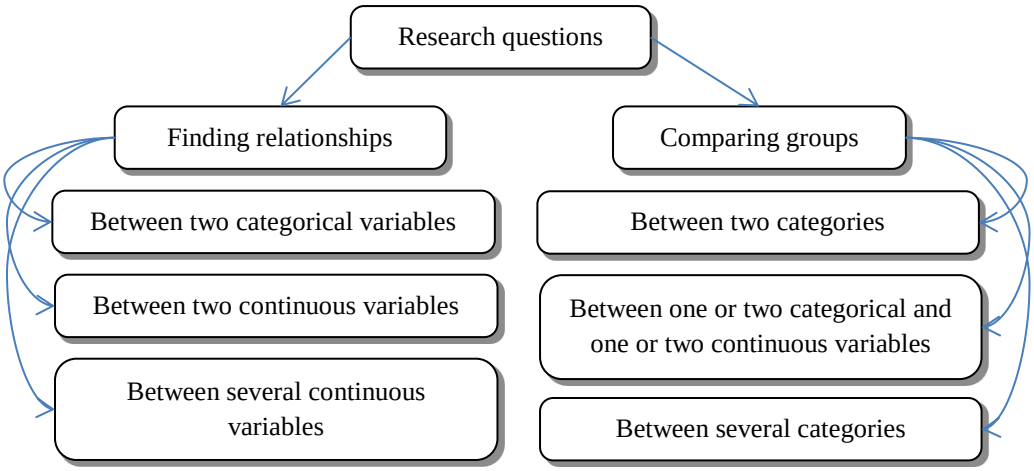


**Figure 2.** Methods for solving research questions
Source: Own contribution

Fifthly, students from three universities (IJW, WUE and VUE) will join two ISP. Students will get skills to work in teams and to work with colleagues from abroad. These soft skills will help them in future work in European projects.

Sixthly, students will get new knowledge and skills in the fields of DWH and BI having lectures and exercises from teachers from three different universities. Each tutor has his/her own approach for the methodology of teaching. Getting one and the same skills from different tutors will bring non-monetary benefits. Students who have background in EU projects are more willing to continue working on further EU projects. These students may generate proposals for the calls “New and emerging technologies” in H2020.

## 5. The preparation of the description of the methods taking into account the innovative elements that distinguish it from the existing

The description of the methods is the following:

- Providing real examples with case studies;
- Providing the description of these case studies in electronic format before having classes;
- Notifying students for the electronic version of the case studies;
- Starting the exercises;
- Discussion on questions before starting;
- Defining research questions;
- Using several software products by several tutors;
- Discussing the output of the software;
- Commenting on outliers, limitations, practical implications, interpretations of the output;

- Preparing the full description of the case study for the e-books (Intellectual outputs O3);
- Discussing on including new case studies with a short description, a dataset, research questions and not giving step-by-step information for solving them.

Since the project consists of several researchers, they should work in teams, e.g. by university. Each team should choose a sample dataset. For instance each team may choose one of the datasets provided by IBM:

https://www.ibm.com/communities/analytics/watson-analytics-blog/guide-to-sample-datasets/

The team will discuss on research questions. Each team member should use a different software product to prove or reject the research questions. As a result new case studies should be available for the e-books. These examples may be extended to research papers for online peer-reviewed journals.

The members of the DIMBI team have background in testing research questions (hypotheses) in different software products (Vasilev & Atanasova 2015).

## 6. Analysis developed drafts teaching methods in relation to the teaching

The analysis of the developed drafts of teaching methods is done by using quantitative methods. Several experts are interviewed about the new methods of teaching. For each teaching methods they provide strong aspects and threats (figure 3).

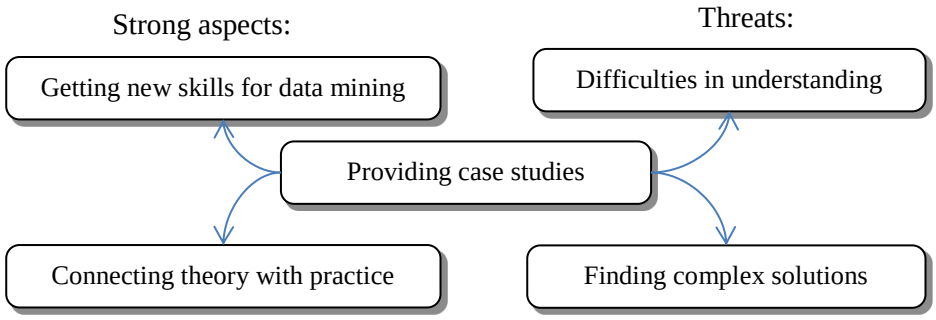


**Figure 3.** Teaching method 1 “Providing case studies”
Source: Own contribution

The marked threats of teaching method 1 give some opportunities for the DIMBI project. Further explanations and further reading sections within the e-books may help students in better understanding. Tutors should seek for fast and simple solutions to research questions. They should not focus too much time on complex solutions (figure 4).

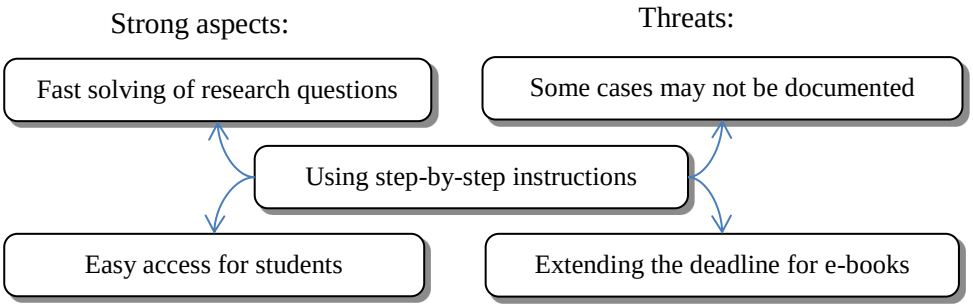


**Figure 4.** Teaching method 2 “Using step-by-step instructions”
Source: Own contribution

The marked threats of teaching method 2 give some opportunities for the DIMBI project. The scientific managers have to organize the work of researchers so that they will cope with preparing the description and explanations of case studied on time.

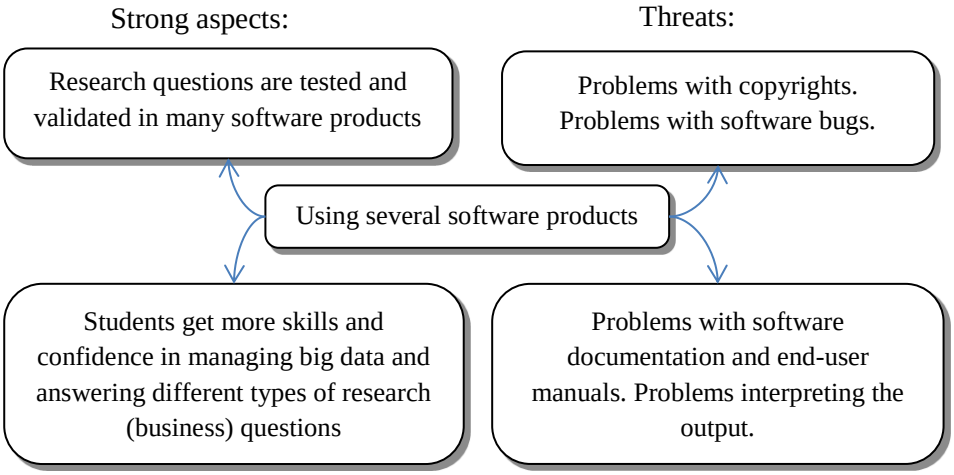


**Figure 5.** Teaching method 3 “Using several software products”
Source: Own contribution

The marked threats of teaching method 3 give some opportunities for the DIMBI project. The members of the DIMBI team may create better documentation and manuals for certain software products through the e-books (Intellectual output of the DIMBI project O3). The members of the DIMBI team should use open source software products and publicly available datasets.

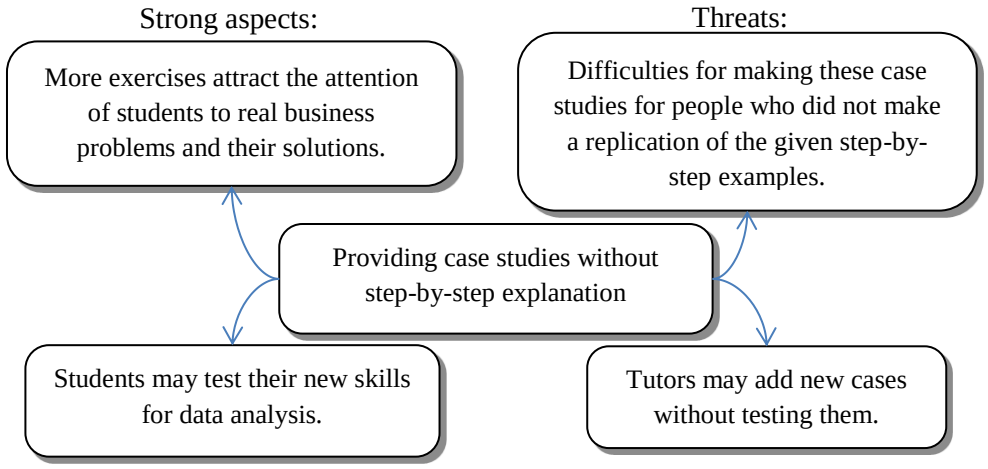


**Figure 6.** Teaching method 4 “Providing case studies without step-by-step explanations”
Source: Own contribution

The marked threats of teaching method 4 give some opportunities for the DIMBI project. Tutors should test the case studies without step-by-step explanations before adding them to the e-books. Each case should end with literature for further reading and links to other web sites solving similar problems.

## 7. Conclusion

As a result of this research several conclusion may be made.

Good examples of the application of DWH and BI instruments are found in some software products. Some tutors who teach DWH and BI instruments usually use one software product for illustrating the taught courses. Some tutors know about the existence of DWH and BI instruments but they do not know how to use them. New software products (also open source ones) who come without documentation take too much of the tutors’ time to be studied.

University should offer innovative methods of teaching to attract more students. University should close teaching methods using mega classes. Small groups of students should be taught. Tutors should teach business informatics only in computer rooms. Tutors should teach business informatics using case studies from real practice.

Some students drop-out from universities because of the application of inappropriate teaching methods. Theoretical concepts are discussed during lectures with mega classes. Applying the appropriate methods of teaching results in getting specific skills in Business informatics. In some cases the practical examples in lectures and laboratories are different.

Future work may focus on other novelties in teaching business informatics.

## 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.