

THE DIMBI PROJECT – INNOVATIVE APPROACHES FOR TEACHING BUSINESS INFORMATICS

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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 UNWE¹¹ 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.Tsenov¹² 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-Varna¹³ 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.*

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

Conclusion 1.2	The curriculums are aimed at professionals (not necessarily in IT field) that are finishing their bachelors education or studying for master.
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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 range of commercial products were created and even wider range of free and open source projects are available now.

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

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.
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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.

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

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

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.
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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.

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.
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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 relationships¹⁴.

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.

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.
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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.

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

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