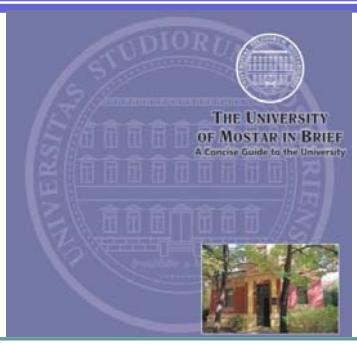
Prof.dr.sc. Brano Markić
Prof.dr.sc. Dražena Tomić
University of Mostar - West

Informatics Education at the University of Mostar

Content:

1. Introduction – about University of Mostar - West
2. Realized activities at the University of Mostar – West according to requirements of Bologna process
3. Informatics at the University of Mostar – West
4. Business Informatics at the Faculty of Economics
5. Business Informatics and project oriented teaching
6. Example of project oriented teaching
7. Conclusion



A Concise Guide to the University

FACULTIES

1. Faculty of Agriculture
2. Faculty of Economics
3. Faculty of Law
4. Faculty of Natural Sciences and Mathematics
5. Faculty of Philosophy
6. Faculty of Mechanical Engineering-Computing
7. Faculty of Medicine
8. Faculty of Civil Engineering
9. Academy of Fine Arts
10. Health College

A Concise Guide to the University

INSTITUTES

- Agronomy,
- Mechanical Engineering,
- Civil Engineering,
- Economics,
- Croatian Language and Literature, History and
- Law.

A Concise Guide to the University

OTHER FACILITIES AND SERVICES

- University Library,
- Students Hostel (Hall of Residence)
- Student Union and Student Associations,
- Student Services,
- University Sports Facilities.

A Concise Guide to the University

- Over 50 study groups in graduate and post-graduate programmes,
- More than 950 employees,
- 825 professors and associates,
- 12.500 students,
- 1.838 students enrolled in first year (2006/2007),

631 graduated students year 2004./2005.

A Concise Guide to the University

MANAGEMENT

- UNIVERSITY LEVEL

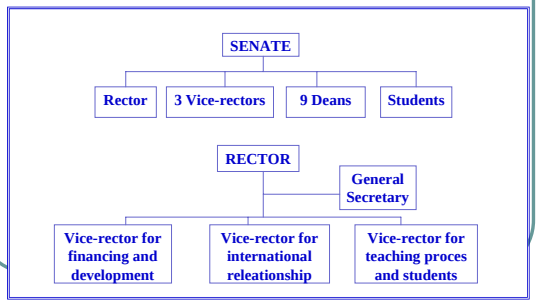
- Governing Council
- Senate
- Rector and vice-rectors
- General Secretary

- FACULTY LEVEL

- Academic Council
- Dean and vice-deans
- Secretary

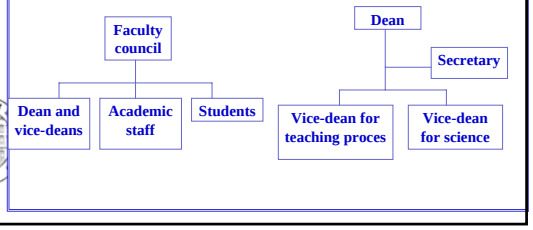
A Concise Guide to the University

MANAGEMENT – UNIVERSITY LEVEL



A Concise Guide to the University

MANAGEMENT – FACULTY LEVEL



Realised activities at the University of Mostar – West

CURRICULA AND ECTS

- All the Faculties have finished the process of analysis of their existing teaching plan and programme, made them uniform with the referential surrounding Faculties and defined ECTS scores
- Each Faculty has prepared a new curricula, defined ECTS scores and made the Information package (ECTS guide-book)
- The Information package (ECTS guide-book) has been made at the level of the University
- The following committees were formed by the Senate's decision:

1.Committee for the implementation of the Bologna Declaration, curricula and ECTS

2. Committee for improving the quality of teaching process at the University

Realised activities at the University of Mostar – West

CURRICULA AND ECTS

- It should be pointed out that starting with the academic year 2005/2006 teaching process is organised according to the Bologna Declaration as follows:
  - -(3+2) Faculty of Agronomy, Faculty of Civil Engineering, Faculty of Natural Sciences and Mathematics, Faculty of Philosophy, Faculty of Mechanical Engineering and Computing (Study Computing)
  - (3,5 + 1,5) Faculty of Mechanical Engineering and Computing (Study Mechanical Engeneering),
  - (5+0) Academy of Fine Arts, Faculty of Law
  - (4+1) Faculty of Economy
  - (6) Faculty of Medicine
  - (3) Medical college

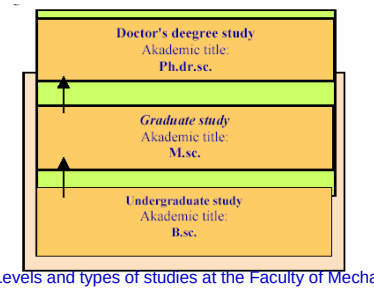
Introduction of ECTS – case studies

For Informatics and computing education at the University of Mostar most important are Faculty of Mechanical Engineering and Computing, Faculty of Natural Science and Mathematics and Faculty of Economics.

FACULTY OF MECHANICAL ENGINEERING AND COMPUTING

COMPUTING STUDY

Introduction of ECTS – case studies



Levels and types of studies at the Faculty of Mechanical Engineering and Computing

Introduction of ECTS – case studies

COMPUTING STUDY

Undergraduate study

Duration:3 years, full time study

Degree: Bachelor

Entry requirements: General college entrance requirements with additional qualifications in Physics and Mathematics

Graduate study

Duration:2 years, full time study

Degree: Master

Entry requirements: successfully finish undergraduate study - 180 ECTS

Introduction of ECTS – case studies

Aims and objectives of undergraduate studies:

- To provide a good theoretical and practical education for students who plan to work as computer engineers and a solid foundation for graduate studies.
- To develop the ability to collaborate and communicate with colleagues as well as people who are not computer specialists. On completion of the programme it is expected that students will be able to work together with a wide range of computer users, including specialists from other fields.
- To develop relevant understanding of etical considerations in relation to information and communication technology, and stimulate critical reflection on development and application.
- To be able to meet the need for maintenance and user services, by emphasizing computer communication/computer networks as well as the operation and maintenance of computer systems in the study programme.

Introduction of ECTS – case studies

Teaching methods:

Teaching is in the form of lectures, labs and practical projects, with and without supervision.

Methodology and project oriented approach are particularly emphasized in this programme.

Many of the subjects also require the completion of individual projects and group projects.

The faculty makes extensive use of lab work, internet and web technology in creating an active and challenging learning environment for the students.

Introduction of ECTS – case studies

Structure and activities:

Each year of study is divided into two semesters, with the following main structure:

Year 1:Basic courses: math, physics and electronics. Basic computer science courses: programming languages, object oriented programming and human courses: Physical education, Communication skills.

Year 2:Intermediate computer science courses, software - and hardware oriented, such as information systems design and database development, computer graphics, computer networks,Intermediate math, statistics, English language and business management for engineers

Year 3: Specialization in particular areas culminating in the completion of a main project (small thesis) (3 elective courses).

Introduction of ECTS – case studies

CURRICULA AND ECTS

The curriculum of undergraduate and graduate computing study is described in details in tables, from which timetable of performing and enrollment of courses at the Faculty is seen. All courses names are given in the Tables, and P + V (number of lectures and workshops – auditory/lab/experimental/constructive/practicum). It is supposed that all courses are performed during the whole term, that is, for fifteen weeks, so that total number of classes is determined by previously given facts.

All curriculums contain ECTS as well, which will enable student and teacher's mobility within harmonized system of university education in Europe.

Introduction of ECTS – case studies

CURRICULA AND ECTS

I SEMESTER

Code	Course	P+V	Exam	ECTS
MFO101	Mathematics I	3+3+0	1	7
MFO102	Linear algebra	2+2+0	1	6
MFO103	Physic I	3+2+0	1	6
PRO101	Introduction to computers and programming	3+1+2	1	7
DEO101	Communication skills in organization	2+2+0	1	3
DEO102	Physical Education	0+0+2	0	1
	Total	13+10+2=25	5	30

Introduction of ECTS – case studies

CURRICULA AND ECTS

II SEMESTER

Code	Course	P+V	Exam	ECTS
MFO104	Mathematics 2	3+3+0	1	7
MFO105	Physics II	3+2+0	1	6
ESO101	Electrical engineering	3+2+1	1	6
PRO102	Programming	3+0+2	1	7
GMO10	Engineering graphics and CAD	1+0+2	1	3
DEO103	Physical Education	0+0+2	0	1
	Total	13+7+5=25	5	30

Introduction of ECTS – case studies

CURRICULA AND ECTS

To develop of the curriculum computing study are used folowing documents:

"Computing Curricula 2004" - The Association for Computing - ACM, The Association for Information Systems - AIS, The Computer Society - IEEE-CS.

ASIIN-Agency for the accreditation of Engineering programmes, Natural sciences and Mathematics

Towards the Harmonisation of Electrical and Information Engineering Education in Europe

SEFI (European Society for Engineering Education) and CESAER (Conference of European Schools for Advanced Engineering Education and Research).

Criteria for academic Bachelor's and Master's Curricula – 2005. ISBN:90-386-2217-1

Introduction of ECTS – case studies

What kind of knowledge provides the curriculum (curriculum structure) and what are ratio of this knowledge (relative importance):

Contents		Breakdown over 3 Years	
No.		Percent	ECTS
1.	Basic of mathematics and natural sciences	20	36
2.	Basics of electrical engineering and information technology	25	45
3.	Core subjects		
4.	Specialized subjects within a main subjects	30	54
5.	Interdisciplinary subjects (non-technical subjects)	10	18
6.	Undetermined percentage of hours ECTS points	8	15
7.	Bachelor's thesis	7	12

Introduction of ECTS – case studies

ECTS and WORKLOAD

Course	Lect.	Exer	Lab	Proj. sem.	Self-lear.	Total	ECTS
Mathematics I	45	45	0	0	90	180	7
Linear algebra	30	30	0	0	85	145	6
Physics I	45	15	15	0	70	145	6
Introduction to computers and rogramm.	45	15	30	20	70	180	7
Communications skills in organization	30	30	0	10	30	100	3
Physical Education	0	0	30	0	0	30	1
Total	195	135	75	30	345	780	30

Introduction of ECTS – case studies

ECTS LABEL

Introduction to computers and programming

	hours	ECTS
Lecture:	**45**	**1,5**
Exercises:		
auditory	**15**	**0,5**
labaratory	**30**	**1,0**
seminar	**20**	**1,0**
Self –learning	**70**	**3,0**
Total	**180**	**7,0**

Introduction of ECTS – case studies

Course title	Programming		
Course code	PRO102		
Type of course	Lecture / Seminar / Execise Course /Obligatory		
Level of course	Basic course		
Year of study	1	**Semester**	Summer
ECTS	7 (45 hours lectures, 30 hours exercises, 30 hours project, 90 hours self-learning)		
Name of lecturer	Doc.dr.sc. Mirjana Bonković		
Course objective:	Educated students to use of C and C++ programming language.		
Prerequisites	Introduction to comuters and programming		
Course contents	Types, control structures and procedures in C programming language Characteristics of structural and object-oriented programming.Styles of programming. Modelling and implementation of programme in C++ language. Classes and objects.Interfaces of classes, apstractions and implementations. Polomorphisam Programme with graphical user interfaces. Model-view-controler and document-view architectura of user interfaces. Interaction with operating systems.		
Recommended reading	Bruce Eckel, Thinking in C++, Second Edition, Prentice Hall, 2000. Hamilton, D., Programming Windows NT 4 Unleashed, Macmillan Computer Publishing, 1996		
Supplementary reading	Kernighan, Brian W. & Ritchie, Dennis M., *The C Programming Language*.Second edition, Prentice Hall. 1988.		
Teaching methods	Lectures / Seminar reports / Exercise course		
Assessment methods	Exam: writen / oral / seminar paper presentation		
Quality assurance methods	Student feedback via questionnaries and surveys Lectures responsible for the same subject area collaborate closely and monitor each other's work. Occassional class observations and appraisal by Head of Department.		

Introduction of ECTS – case studies

FACULTY OF ECONOMICS

BUSINESS STUDIES

Introduction of ECTS – case studies

- Undergraduate study
  - Duration: 4 years
  - Degree:Bachelor
  - Entry requirements:General college entrance requirements with additional qualifications in Mathematics, Informatics and Croatian language.
- Graduate study
- Duration: 1 year
- Degree:Master
- Entry requirements: successfully finish undergraduate study - 240 ECTS

USED ECTS model

Based upon nominal workload

- Student workload = time in class (lecture/tests) + time outside of class (preparation)
- 60 Credits = 1 year = 2 semesters of 30 credits each
- 1 Credit = 25-30 working hours
- 240 Credits are required for a degree
- ECTS is geared towards competencies and attaining these competencies
- Learner centered
- Credits are allocated for all portions of study (projects, essays, final work, independent study, etc)

Informatics Education at Faculty of Economics

The term Informatics is widely used in Bosnia and Herzegovina Higher Education. But in Europe besides the term Informatics there are other terms such as Computing, Computer Science and Information Science.
As you know Computing, Computer Science and Information Science are more commonly used in UK and many other variations exist.
In UK aapproximately five percent of departments concerned with the discipline actually use the word Informatics in their title, whilst UCAS, the UK organisation which centrally manages university undergraduate applications, does not include Informatics in its subject index.

What is dominant: the term Informatics or Computing in Bosnia and Herzegovina

European counterparts of UK academic departments concerned with education in computer science, use in most cases the term department or faculty of Informatics (spelt appropriately for their local languages).
In Bosnia and Herzegovina the terms Informatics and Computing are using by most institutions, faculties, departments.
At the University of Mostar exists the Faculty of Mechanical Engineering and Computing and at the Faculty of Mathematics and Natural Sciences are two departments: Mathematics and Informatics, Physic and Informatics.
At the Faculty of Economics is the department of Business Informatics.

What includes the term Informatics at University of Mostar

- The term Informatics includes four Informatics (similar is in Germany):
- **Technical Informatics**: focuses on hardware. How to make faster processors, how to build memories with more capacity etc.
- **Practical Informatics**: focuses on programming languages, projecting information systems, operating systems, etc.
- **Theoretical Informatics** is focused on algorithms applied in Informatics, theory of automates. Shortly, the base of theoretical Informatics is mathematics.
- **Applied Informatics** is the application of technical, practical and theoretical Informatics in certain field. So we speak about Informatics in Law (focuses on government, creating e-citizen, Medical Informatics application of corn Informatics in medicine (telemedicine), Business Informatics – application of core Informatics in business process and so on.

After analyze the content of the introductory course into Informatics at different faculties of University of Mostar the next elements are common:

1 Information as a subject of Informatics
2 Mathematical and logical elements of computer system
3 Computer systems and architectures
- Software of computer systems (operating systems, application software)
- Software development
- System design
- Algorithms
- Potentials and limitations of computing and related technologies

8 Computer-based communication
9 Social and ethical implications
10 Personal and interpersonal skills
11 Broader perspectives and context (includes links with other disciplines)

Learning and Teaching of Informatics at the Faculty of Economics University of Mostar

The Faculty of Economics University of Mostar is organized as an integral scientific educational institution.
The basic organizational units are departments, formed as scientific educational units based on the relationship between scientific and educational disciplines and the similarities and synergy of the disciplines, so as to represent a homogenous unity.
The departments perform all research and educational activities at all levels of studies, permanent education and other activities in the scope of work of the faculty that fall into the scientific and expert scope of activity of each unit.

The Faculty of Economics University of Mostar has the following departments:

Department of Accounting and Finance	Department of Mathematics and Statistics
Department of Macroeconomics and Economic Development	Department of Organization and Management
Department of Economic Theory	Department of Business Foreign Languages
Department of Informatics	Department of International Economics
Department of Marketing	

Department of Informatics

The aim of this department is to educate top experts who utilize information technology in order to enhance the competitiveness of Bosnia and Herzegovina companies.

Information technology for business strongly influences the success of a company.

The department established a major in **Managerial Informatics** (**Business Informatics**) as a result of significant demand for bachelors of business administration with solid knowledge of informatics.
Some have called informatics "technology with a human face." Informatics prepares professionals to use information technology to solve problems in a variety of settings.

What competences have students of Informatics?

Informatics students have:

- a technical understanding of how computing systems and programs operate
- an ability to adapt/assess and apply new trends in information technology (IT)
- well-developed problem-solving skills
- experience working on a team, such as those formed for the senior capstone experience
- well-developed communications skills to clearly convey solutions and observations to others
- an understanding of social and ethical principles as they relate to IT issues

Undergraduate Courses at Department of Business Informatics

Undergraduate Courses	Year	Semester	ECTS
Informatics	1	1	7
Data Management	2	4	6
Business Information Systems	3	5	6
Business applications development	3	5	6
Informatization of business processes	3	5	4
Accounting information system	3	5	4
Programming	3	6	6
Distributed systems management	3	6	4
E-Business	3	6	4
Business forecasting	3	6	4
Business decision making	3	6	4
Algorithms and data structures	4	7	6
Document management in business	4	7	6

Undergraduate Courses	Year	Semester	ECTS
Software engineering	4	7	4
Decision Support Systems	4	8	6
Information system audit	4	8	4
Artificial intelligence	4	8	4

Graduate Courses at Department of Business Informatics

Graduate Courses	Year	Semester	ECTS
Business Data Management	5	9	6
Systems for Business Process Management	5	9	6
Knowledge discovery in databases	5	9	4
Simulation Games for Managers	5	9	4
Systems for Business Process Management	5	9	4
Informatics managment	5	9	4

Informatics at the faculty of Economics

Curriculum Components

Informatics is an obligatory subject at all faculties at University of Mostar (except the Academy of Fine Arts) . It is normally that the analyze of teaching of informatics starts from the curriculum. Curriculum of each one subject includes various components. The framework has four distinct areas:

1) Course Content;
2) Course Organization
3) General and specific competences;
4) References.

Each one subject has 19 components in Curriculum

No.	Course Title:	**DECISION SUPPORT SYSTEMS**
1.	Course Co-ordinator:	Professor Brano Markić Ph.D.
2.	Instructors:	Professor Brano Markić Ph.D. Professor Dražena Tomić Ph.D.
3.	Hours of contact teaching:	60
4.	Hours of lectures/ seminars/practical work:	45
5.	Hours for written assignments:	
6.	Study hours towards examination:	75
7.	Study hours for Unspecified work:	
8.	Total hours required for preparing for the exam:	180

9. Course Content:

DECISION SUPPORT SYSTEMS
Components of decision support systems. Categories of decision support systems.
GROUP DECISION SUPPORT
Group decision making. Group work support system and groupware technologies. Decision support systems for group decision making.
DECISION SUPPORT METHODS
Simulation. Expert systems. Optimization. Multi-criteria decision making. Genetic algorithms. Neural networks. Game theory.
EXPERT SYSTEMS
Knowledge-based systems. Features and the means of using expert systems. When to use an expert system. The structure of expert systems.

Course Content:

KNOWLEDGE REPRESENTATION AND METHODS OF INFERENCE
Knowledge. Production rules. Decision trees. Semantic nets. The process and rules of inference. Basic techniques of inference. Forward and backward chaining. Inexact reasoning. Probability theory. Certainty factors. Fuzzy logic.
KNOWLEDGE ENGINEERING
The expert systems' life cycle. Knowledge acquisition and evaluation. Developing expert systems.
IMPLEMENTATION OF EXPERT SYSTEMS IN DECISION MAKING
Expert system for credit allocation. Expert system for marketing campaign. Expert system for choosing a candidate for workplace. Expert system for choosing tourist destination.
SIMULATION
Basic terms of discrete-event simulation. Simulation in decision making.
SIMULATION MODELS
Developing simulation models. Activity flow diagram. Strategy of running simulation model. Three-phase strategy.
CREDIBILITY IN SIMULATION MODELS
Validation of simulation models. Basic assumptions of increasing credibility of simulation models. Verification of computer simulation model. Validating the conceptual model.
STATISTICS ASPECT OF SIMULATION
Planning of simulation experiments. Generating random numbers and variables. Input data analysis. Output data analysis. Confidence intervals for simulation. Comparison to alternative systems.
THE APPLICATION OF SIMULATION MODELS IN DECISION MAKING
Simulation model of a bank office. Simulation of supply and warehousing. Simulation of company's logistics. Simulation of manufacturing process. Call centre simulation. Simulation of business scenarios.

10. Description of general and specific competences (knowledge and skills) to be developed by this course:

The course provides students with the knowledge on methods, techniques and software tools for decision support as well as decision support systems in general.
The course also offers the skills for creating business system simulation models, simulation experiments and for evaluating business system performances.
Furthermore, it gives insight into expert systems, methods of knowledge representation and knowledge-based inference.
The course also provides students with the ability to recognize the decision-making problems to be solved by these methods and to gain the experience in team project work associated with modeling, simulation and performance analysis of the business systems.

11.	Teaching methods:	Lectures, seminars, practical work, essays, individual assignments, team work.
12.	Additional requirements for students:	Active involvement and participation in all the teaching methods. Reading the proposed literature. Writing essays on current topics. Participating in team projects.
13.	Assessment/ examination method:	Examination will be conducted in the course of contact teaching (lectures, seminars, practice work, tutorials, individual assignments). Final grade will be based on continuous assessment and on written and oral exams. Various methods of examination mentioned above account for 40% of the final exam grade, final written exam for 40% and oral exam for 20% of the final exam grade.
14.	Required reading:	G. M. Marakas (2002), **Decision Support Systems in the 21st Century**. 2nd edition, Prentice Hall. V. Čerić (1993), **Simulacijsko modeliranje**, Udžbenik Sveučilišta u Zagrebu, Školska knjiga, Zagreb.

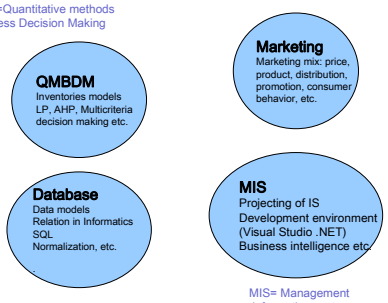
15.	Recommended reading:	D. J. Power (2002), **Decision Support Systems: Concepts and Resources for Managers**, Quorum Books. Seila, V . Čerić and P. Tadikamalla (2003), **Applied Simulation Modeling**, Thomson - Brooks/Cole.
16.	ECTS	6
17.	Basis for credit Allocation (reasons for the allocated number of ECTS):	180 hours required for preparing the exam.
18.	Course and teaching quality assurance method (method of monitoring the quality of the course and its teaching):	Internal evaluation by anonymous student survey at the end of the course.
19.	Conditions for enrolment	No specific conditions.

Informatics in supporting project and cross-subject teaching in education of economists

I will present an experience and new teaching approach at Faculty of Economics University of Mostar at department of business informatics by integrating knowledge from various subjects: Quantitative Methods for Business Decision Making, Databases, Marketing and Management Information Systems.
In the traditional teaching the acquisition of knowledge and the application of the knowledge are more separate.

Traditinal teaching - reproducing information from: QMBDM, DB, MARKETING, MIS

QMBDM=Quantitative methods for Business Decision Making



MIS= Management information system

Databases course goals are:

1. Understand tables of a relational database as well as the SQL language that enables to extract pieces of information.
2. Know how to design a database and how to model it using entity-relationship diagrams and UML class diagrams.
3. Know the meaning of a normalized database design and know how to analyze dependencies between relational tables in order to build a normalized database.
4. Understand the underlying basic theory and logic of SQL, i.e., relational algebra.
5. Acquiring ease of use with some database editors and design tools.
6. Possibly understand some advanced concepts such as database theory and concurrency, implementation issues, performance and request optimisation, distributed systems, object databases, XML databases, etc.

QMBDM course goals are:

Recognizing the problems in business. Skills of modelling and analyzing of the problem. Results interpretation and decision making.
Financial mathematics
(a) Loans, Investment projects
Linear and integer programming
(a) Case studies
(b) Computer implementation
(c) Results interpretation
Multicriteria decision making
(a) Case studies
(b) AHP Method, Promethee method
Game theory
(a) Case studies
(b) Definition of games and strategies used in economy
(c) Determining optimal strategy

Marketing course goals are:

Developing general and specific competences (knowledge and skills) :
a) the course provides knowledge and skills related to consumers' price sensitivity,
b) assessment of costs relevant for pricing, anticipation and influencing competitors' prices,
c) creating appropriate pricing strategies,
d) Coordinating price decisions with the elements of the marketing mix and influencing consumers' perception of product value,
e) Discovering models of consumer behavior, etc.

MIS course goals are:

The course provides students with the knowledge on methods, techniques and software tools for managers support as well as decision support systems in general.
The course also offers the skills for creating business system simulation models, simulation experiments and for evaluating business system performances.
Furthermore, it gives insight into expert systems, methods of knowledge representation and knowledge-based inference.
The course also provides students with the ability to recognize the decision-making problems to be solved by these methods.
Gain the experience in team project work associated with modeling, simulation and performance analysis of
the business systems.

Improvment traditinal teaching by project oriented teaching

The goal of study is not to accumulate this seprate and disintegrated knowledge.

Students have to be:

- trained and learned how to cope with all changes and uncertainness of future
- trained for independent and life-long learning
- trained in knowledge integration from different disciplines

Why Project Oriented Studies

How we see solution for teaching process?
Solution is the project oriented teaching.

PROJECT →

"an enterprise carefully planned to achieve a particular aim"

(Packendorff, 1995).

Why Project Oriented Studies

PROJECT characteristics →

- it is a unique task
- it has a predetermined date of delivery
- it is subject to one or several performance goals (such as resource usage and quality)
- it consists of a number of complex and/or independent activities.

Why Project Oriented Studies

The aim of project oriented studies is to enable students to acquire knowledge and at the same time to understand its application

Why Project Oriented Studies

Process of project realizing distinguishes two kinds of operations:

- *Operations with knowledge (application)
- *Operations on knowledge (critical thinking).

Why Project Oriented Studies

Operations with knowledge →

- mental processes aimed to clarifying concrete phenomena (domain of practice) with the help of theoretical concepts (domain of theory)

Why Project Oriented Studies

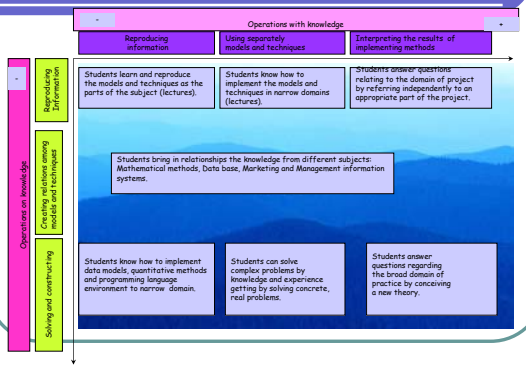
Operations on knowledge →

- mental processes that focus on the domain of theory itself (how to integrate knowledge and put it to broader contents).

Why Project Oriented Studies

Operations with and operations on knowledge occur simultaneously during the project realization. A two-dimensional field (operations on knowledge and operations with knowledge as dimensions) represents the students knowledge improvements (of course their cognitive skills) in lecturing and building projects.
Two axes are subdivided in accordance with the projects realization. In the upper left cell, it is only a matter of reproducing knowledge - students learn and reproduce the models and techniques as the parts of the subject (lectures), with hardly any form of mental operations involved.
Moving to the right (operations with knowledge), students are requested more and more to select and combine concepts and theories from their memory, in order to illuminate phenomena in reality or to analyse and solve realistic problems.
Our teaching process tends to realize the goals found in the last bottom right cells.

Operations with knowledge and operations on knowledge



Pilot Project BUMM based on project oriented teaching

Modern education of economists has to deal with:

- - Teaching the fundamental and expert knowledge of different economic disciplines (macro&microeconomics, accounting, finance, management etc.)

- - Teaching the fundamental knowledge of IT disciplines (Informatics, Accounting Information Systems, Management Information Systems, Marketing Information Systems, Databases etc.)

-- Training in the problem solving, know-how management and the capability of life-long learning

- - Improvement of the key competencies (methodical and social competencies and the competency of personage, the most important in team work).

Pilot Project BUMM

- START in 2004/2005 acdemic year
- 4 subjects:
- Databases, (**B**aze podataka)
- Management information systems (**U**IS)
- Quantitative methods for business decision making and (**M**atematske metode)
- Marketing (**M**arketing)

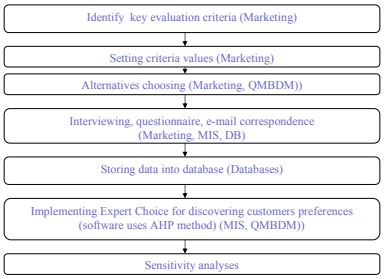
Pilot Project BUMM

Structure of project :

1. Choosing the problem/task from the predefined set of problems/tasks
2. System analysis (problem description, practical research of problem/task, analysis)
3. Development of data model
4. Transforming of data model into data base design
5. Choosing quantitative model for real problem solving
6. Development of user interface (software) for that method
7. Preparation of the final report
8. Preparation of the project presentation
9. Presentation of the results to professors ant other groups.

Example of project oriented teaching: Discovering customers preferences by purchasing of paper

Research may be divided into following sequential steps :



Data – criteria and alternatives selection

The first step in research process is finding out which criteria and factors customer transforms in memory during the product selecting process. For long time is known that no matter how desirable a product appears in heads of product developers, consumer acceptance determines its success.
Research is conducted on the market in Herzegovina (BiH) to five producers of papers: Fabriano (Copy 1, Copy 2, Copy 3, DeLux), Neusiedler (IQ premium, IQ premium triotec, IQ pastel), Logic (Logic 300, Logic 500, Logic ECO), Soporcel (Navigator), SCP Ružonberok (Gutenberg) .
As result of a series of interviews are chosen three dominant criteria:

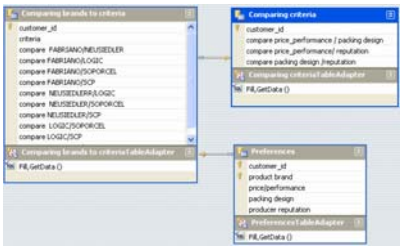
1. price/performance,
2. producer reputation (on market in Herzegovina)
3. product quality.

In this project student have used Analytic Hierarchy Process.

Alternatives

The set of alternatives (Fabriano , Neusiedler, Logic, Soporcel, SCP Ružonberok) is determined unique. That are the products producers and the goal is to investigate customers preferences to this market brands. It was shaped the questionnaire and the answers of 3000 customers are stored in database:

The logical data model except table Preferences includes two tables: Comparing criteria and Comparing brands to criteria.



BUILDING UP THE MODEL OF CUSTOMERS PREFERENCES

In logical model of database all comparisons among criteria and comparisons alternatives with each one criteria are stored in tables Comparing criteria and Comparing brands to criteria. For each column in tables Comparing criteria and Comparing brands to criteria is calculated average value and is rounding on integer. This value is interpreted using Saaty scale.

One SQL statement is enough:

SELECT Avg([Numerical Comparison criteria]![compare price-performance with /design]) AS ["price-performance i design"], Avg([Numerical Comparison criteria].[compare price-performance with / reputation]) AS ["price-performance and reputation"], Avg([Numerical Comparison criteria].[compare design /reputation]) AS ["Design and reputation"]
FROM [Numerical Comparison criteria];

The results of SQL are average values relatively relationship criteria: price_performance and design, price_performance and reputation, design and reputation:

"Price-performance and packing design"	"Price-performance and reputation"	"Packing design and reputation"
7,15	4,47	0,26

Average values of subjective customer judgment on relative criteria importance

The Customers subjective judgment

The result of SQL statement is shown as criteria matrix. This matrix reflects subjective judgments of customers about relationship among criteria. The results are presented as two dimensional Pivot table in Expert Choice:

	price/performance	packing design	reputation
price/performance		7,15	4,48
packing design			3,99
reputation	Incon: 0,09		

The weights of criteria:

The relationship between criteria price/performance and packing design for customers has average value 7,15 and on Saaty scale that means very strong preferred price/performance criteria. The relationship between criteria packing design and produce reputation is 1:4 (at Fig.3. value 0,26). That means that on Saaty scale customers prefer producer reputation to design of paper package. If we implement the procedure for calculating the criteria weights (using Expert Choice) the results are priorities with respect to:

1 price/performance 0,711
2 packing design 0,073
3 producer reputation 0,215
Inconsistency = 0,09.

The inconsistency factor is 0,09 and doesn't overcome the threshold value 0,1. Customers give the highest importance to price/performance criteria (w1=0,711), then to producer reputation (w3=0,215), and finally to design of paper package (w2=0,073).

Priority of alternatives to price/performance criteria

The same algorithm is implemented to assessment of preferences between producers (alternatives) according to criteria price/performance. From table Comparing brands to criteria is for each one column calculated average value and that values are put into two dimensional Pivot table in Expert Choice:

	FABRIANO	NEUSIEDLER	LOGIC	SOPORCEL	SCP
FABRIANO		6,26	8,15	8,15	9,44
NEUSIEDLER			3,02	3,23	4,22
LOGIC				1,18	1,16
SOPORCEL					1,08
SCP	Incon: 0,03				

Synthesis with respect to: price/performance criteria.

Alternative	Priority
FABRIANO	0,643
NEUSIEDLER	0,177
LOGIC	0,059
SOPORCEL	0,064
SCP	0,058

Priority of alternatives

Synthesis with respect to: price/performance criteria.

Alternative	Priority
FABRIANO	0,643
NEUSIEDLER	0,177
LOGIC	0,059
SOPORCEL	0,064
SCP	0,058

	FABRIANO	NEUSIEDLER	LOGIC	SOPORCEL	SCP
FABRIANO		6,26	8,15	8,15	9,44
NEUSIEDLER			3,02	3,23	4,22
LOGIC				1,18	1,16
SOPORCEL					1,08
SCP	Incon: 0,03				

Priority of alternatives to packing design criteria

Synthesis with respect to: packing design criteria.

Alternative	Priority
FABRIANO	0,208
NEUSIEDLER	0,194
LOGIC	0,264
SOPORCEL	0,182
SCP	0,151

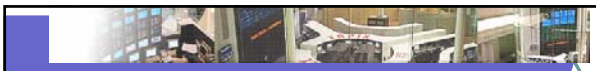
	FABRIANO	NEUSIEDLER	LOGIC	SOPORCEL	SCP
FABRIANO		3,99	5,96	6,68	8,02
NEUSIEDLER			1,47	2,55	3,58
LOGIC				1,33	1,8
SOPORCEL					1,98
SCP	Incon: 0,02				

Compare the relative preference with respect to: producer reputation

Customers' preferences to paper producer

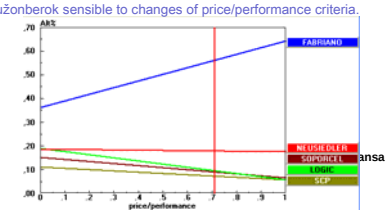
Based on customers subjective judgments of relative relationships priorities, presented in tables 2-4, are calculated local priorities of paper selection. The overall priority each one alternative relation to all criteria is calculating by multiply local priorities with weights of criteria and summarizing all products. The customers preferences are presented at next figure:

Alternative	Priority
FABRIANO	0,561
NEUSIEDLER	0,180
LOGIC	0,097
SOPORCEL	0,089
SCP	0,073



SENSITIVITY ANALYSES

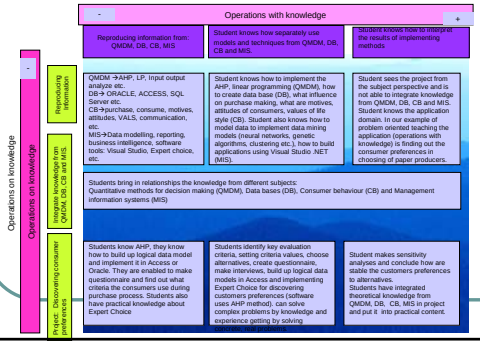
Sensitivity analyze serves to make concludes how are the customers preferences to alternatives stable or changeable in relation to changes in criteria priorities. This analyze is very sophisticated and useful because measure the value of information about customers preferences. Next figure highlights how the priorities of alternatives are: Fabriano, Neusiedler, Logic, Soporcel and SCP Ružonberok sensible to changes of price/performance criteria.



Project report consists of:

- Problem description
- System analysis
- Data base model
- Data base design
- Short description of quantitative methods that could be used in solving of particular problem (with pro and contra for the use of each of them)
- Explanation how and why project group chose one of that methods for problem solving
- Software interface (program code in Visual Basic 6.0)
- Comments of obtained results
- Conclusion.

Summarize: Project oriented teaching in project BUMM



Conlusion

- Project oriented teaching and the right implementation of IT are one of the best ways for developing teaching curriculum at the Faculties of economics,
- Students develop broad range of their understanding,
- Students develop and implement skills related to team work, answer the questions regarding to the broad domain of practice by applying their theoretical knowledge,
- At Faculty of Economics is implemented a teaching model which combines lectures and project work. The project work is exclusively problem-oriented and can be realized only by integration of the theoretical knowledge (lectures) and practice immediately connected with the nature of the solving problems.
- Department oh Business Informatics plays a key role in project oriented teaching.

Thank you for your attention.