

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

**Predmet:** Izbrana poglavja znanstvene metodologije  
**Course title:** Selected topics from Scientific Methodology

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Informacijska družba, doktorski študijski program tretje stopnje	-	Prvi	Prvi
Information Society, third cycle Doctoral Study Programme	-	First	First

**Vrsta predmeta / Course type**

Obvezni/ Compulsory

**Univerzitetna koda predmeta / University course code:**

1-ID-DR-IPZM-2017-11-28

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	0	0	/	/	420	15

**Nosilec predmeta / Lecturer:**

Prof. dr. Dejan Jelovac, prof. dr. Borut Rončević, prof. dr. Matej Makarovič, izr. prof. dr. Zoran Levnajič, doc. dr. Biljana Mileva Boshkoska, izr. prof. dr. Blaž Rodič

**Jeziki / Languages:**

**Predavanja / Lectures:** Slovenski / Slovenian, Angleški / English

**Vaje / Tutorial:** Slovenski / Slovenian, Angleški / English

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Vpis v prvi letnik študija.

**Prerequisites:**

Enrolment in the first year of studies.

**Vsebina:**

Cilj predmeta je dati študentom metodološke osnove za izdelavo doktorske naloge. V sklopu predmeta bodo študentje spoznali nabor kvantitativnih in kvalitativnih raziskovalnih metod, s katerimi bodo suvereno začeli z doktorsko raziskavo. Predmet bo izvajalo šest nosilcev, vsak nosilec bo izvajal en del predmeta, kot je razloženo spodaj.

**UVOD V EPISTEMOLOGIJO (Prof. dr. Dejan Jelovac)**

- Filozofija kot sistem filozofskih ved

**Content (Syllabus outline):**

The aim of the course is to endow the students with the methodological basis for preparation of their doctoral thesis. Within the course students will learn a number of quantitative and qualitative research methods, which will enable them to confidently start their doctoral research. The course will be taught by six lecturers, each in charge for a specific part as described below.

**INTRODUCTION TO EPISTEMOLOGY (Dejan Jelovac, Professor)**

- Philosophy as a system of

- Epistemologija – ena filozofskih ved o spoznanju
- Logos vs. mythos oz. znanje nasproti mnenja
- Znanost kot resnično znanje: od klasičnega (antičnega) do modernega pojmovanja znanja
- Temeljne lastnosti moderne znanosti (racionalizem, univerzalnost znanja, duh racionalne odprtosti, začasna veljavnost resnice, logično-matematični aparat, dosledna uporaba metode, družbeni karakter, ipd.)
- Analiza nekaterih bistvenih elementov strukture moderne znanosti: Predmet; Koncept in operacionalizacija; Metoda (kvantitativna ali kvalitativna); Kontrolirano opazovanje, opisovanje, pojasnjevanje, predvidevanje; Hipoteza; Merjenje; Dejstvo; Klasifikacija (tipologija) in logična delitev; Definicija; Družbena pravilnost vs. naravni zakoni (vzročno-posledična povezanost, statistična korelacija, ipd.); Empirična posplošitev; Znanstveni zakon.
- Epilog

#### **KVALITATIVNA IN PRIMERJALNA METODOLOGIJA (prof. dr. Borut Rončević)**

- Uporaba kvalitativne in primerjalne metodologije pri proučevanju informacijske družbe in za potrebe računalniških znanosti (konkretni primeri in pogovor s študenti)
- Pregled izbranih kvalitativnih metod: terensko raziskovanje, kvalitativni intervjuji, fokusne skupine, analiza dokumentov
- Primerjalno raziskovanje: študije primerov, primerjalne študije primerov, analiza mehkih množic (fuzzy-set analiza), metodološki problemi v mednarodnem primerjalnem raziskovanju
- Metode triangulacije: interpretativna in pozitivistična paradigma, post-pozitivizem kot nova epistemološka sinteza, kombiniranje kvalitativnih in

- philosophical disciplines
- Epistemology as a philosophical discipline of knowledge
  - Logos vs. Mythos: knowledge opposite opinion
  - Science as true knowledge: from classical (ancient) to modern conceptions of knowledge
  - Basic characteristics of modern science (rationalism, the universality of knowledge, spirit of rational openness, temporal validity of truth, logical-mathematical apparatus, use of method, social character, etc.).
  - Analysis of some of the essential elements of the structure of modern science: Object; Concept and operationalization; Method (quantitative or qualitative); Controlled observation, describing, explaining, predicting; Hypothesis; Measurement; Fact; Classification (typology) and logical division; Definition; Social regularity vs. natural laws (cause and effect, a statistical correlation, etc.); Empirical generalization, and Scientific law.
  - Epilogue

#### **QUALITATIVE AND COMPARATIVE RESEARCH METHODS (Borut Rončević, Professor)**

- Using qualitative and comparative methodology in research on information society and in the computer science (specific examples and discussion with students)
- Overview of selected qualitative methods: field research, qualitative interviews, focus groups, documentary analysis
- Comparative research: case studies, comparative case studies, fuzzy-set analysis, methodological problems in international comparative research
- Triangulation: interpretive and positivist paradigm, post-positivism as a new epistemological synthesis, combining qualitative and quantitative methods
- Software for qualitative analysis

kvantitativnih metod

- Programska oprema za kvalitativno analizo

### **OSNOVNI STATISTIČNI KONCEPTI IN DESKRIPTIVNE STATISTIKE (prof. dr. Matej Makarovič)**

- Izbrane teme iz inferenčne in bivariatne statistike (t test, bivariatna analiza variance, hi-kvadrat, Kenallov tao-b in gamma, korelacija intervalnih spremenljivk)
- Uvod v izbrane multivariatne metode (faktorska analiza, hierarhična klaster analiza, regresija)

### **UVOD V ANALIZO OMREŽIJ (izr. prof. dr. Zoran Levnajić)**

- Omrežja in zakaj in preučujemo, prednosti omrežne predstavitve podatkov
- Družbena, informacijska, tehnološka in biološka omrežja
- Osnovni koncepti teorije grafov, pojem analize omrežij, standardna orodje analize omrežij
- Modeliranje realnih omrežij, osnovni modeli omrežij
- Skrajna struktura skupnosti, dinamični procesi
- Odprti problemi v sodobni znanosti omrežij

### **SODOBNE METODE ANALIZE PODATKOV (doc. dr. Biljana Mileva Boshkoska)**

- Podatkovno rudarjenje in druge metode za analizo podatkov
- Standardiziran proces podatkovnega rudarjenja
- Vrste problemov in nalog primernih za reševanje s podatkovnim rudarjenjem
- Pregled najpomembnejših metod za podatkovno rudarjenje: odločitvena in regresijska drevesa, metoda podpornih vektorjev, Bayesovske metode, nevronske mreže
- Odločanje in modeli

### **BASIC STATISTICAL CONCEPTS AND DESCRIPTIVE STATISTICS (Matej Makarovič, Professor)**

- Selected topics from inferential and bivariate statistics (t test, bivariate analysis of variance, chi-square test, Kendall tao-b and gamma, correlation of interval variables)
- Introduction to selected multivariate methods (factor analysis, hierarchical cluster analysis, regression)

### **INTRODUCTION TO NETWORK ANALYSIS (Zoran Levnajić, Associate Professor)**

- Networks and why we study them, benefits of representing data as networks
- Social, information, technological and biological networks
- Basic graph theory concepts, idea of analyzing a network, standard tools for network analysis
- Modeling real networks, fundamental network models
- Community structure, dynamical processes
- Open problems in modern network science

### **MODERN METHODS OF DATA ANALYSIS (Biljana Mileva Boshkoska, Assistant Professor)**

- Data mining and other methods for data analysis
- A standardized data mining procedure
- Tasks of data mining
- An overview of data mining methods: decision and regression trees, support vector machines, Bayesian methods, neural networks
- Decision making and decision support methods and modeling

**OSNOVE AGENTNEGA MODELIRANJA (izr. prof. dr. Blaž Rodič)**

- Uvod v modeliranje z agenti (MA), kdaj in zakaj uporabljati MA
- Pregled MA orodij, izbira teme MA projekta, Arhitekture agentnih modelov, izbira arhitekture za izbrani MA projekt
- Delavnica z izbranimi MA orodji, implementacija enostavnega modela
- Verifikacija in validacija modela
- Analiza in predstavitev rezultatov, izvajanje simulacije in analiza modela in rezultatov simulacije

**BASICS OF AGENT BASED MODELLING (Blaž Rodič, Associate Professor)**

- Introduction to agent based modelling (ABM), when and why to use ABM
- Overview of ABM tools, Choosing the ABM project theme, Architectures of agent-based models, selection of architecture for the selected ABM project
- Workshop with selected tools, implementation of a simple model
- Verification and validation of the model
- Analysis and presentation of results, implementation of simulation and analysis of the model and simulation results

**Temeljni literatura in viri / Readings:**

- RAJARAMAN, ANAND in ULLMAN, JEFFREY DAVID (2012) *Mining of massive datasets*. New York: Cambridge university press.
- HÄRDLE, WOLFGANG KARL in SIMAR, LÉOPOLD (2015) *Applied Multivariate Statistical Analysis. Fourth Edition*. Heidelberg: Springer.
- HASTIE TREVOR, TIBSHIRANI ROBERT IN FRIEDMAN JEROME (2009) *The elements of statistical learning: Data Mining, Inference, and Prediction*. New York: Springer.
- PATTON MICHAEL QUINN (2015) *Qualitative Research & Evaluation Methods: Integrating Theory and Practice*. London: SAGE.
- RAGIN C. CHARLES (2008): *Redesigning Social Inquiry: Fuzzy-sets and Beyond*. Chicago: Chicago University Press.
- TASHAKKORI ABBAS IN TEDDLIE CHARLES (1998) *Mixed Methodology, Combining Qualitative and Quantitative Approaches*. Sage Publications, 1998.
- CRESWELL JOHN W. (2014) *A Concise Introduction to Mixed Methods Research*. SAGE, 2014.
- Railsback, S.F., Grimm V. (2011) *Agent-Based and Individual-Based Modeling: A Practical Introduction*, Princeton University Press.
- Gilbert, N. (2007), *Agent-Based Models (Quantitative Applications in the Social Sciences)*, SAGE Publications.
- Grigoryev, I. (2014) *AnyLogic 7 in Three Days: A Quick Course in Simulation Modeling*, AnyLogic North America.
- Newman, M. (2010) *Networks: An Introduction*, Oxford University Press

**Cilji in kompetence:**

*Učna enota prispeva k razvoju naslednjih splošnih in predmetno-specifičnih kompetenc:*

- sposobnost identificiranja danega raziskovalnega problema, njegove analize ter možnih rešitev
- ustvarjanje novega znanja in prispevek k razvoju znanosti
- sposobnost obvladavanja standardnih metod, postopkov in procesov raziskovalnega dela na različnih znanstvenih področjih
- sposobnost samostojnega raziskovalno-razvojnega dela in vodenje raziskovalne skupine
- sposobnost za reševanje konkretnih raziskovalnih problemov na posameznih področjih družbenih in ostalih ved
- razvoj veščin in spretnosti v uporabi znanja na raziskovalnem področju doktorske disertacije
- sposobnost inovativne uporabe in kombiniranja raznih raziskovalnih metod

**Objectives and competences:**

*Learning unit contributes to the development of the following general and subject-specific competences:*

- the ability to identify, analyze and construct solution a given research problem
- creation of new knowledge and contribution to the development of science
- mastery of standard methods and approaches in the process of scientific research in various scientific fields
- ability of independent research and development work and management of research group
- skills and abilities for solving concrete research problems in various fields of social and other sciences
- development of skills and abilities in usage of knowledge in doctoral research
- ability of innovative combined usage of various research methodologies

**Predvideni študijski rezultati:**

Znanje in razumevanje:

*Študent/študentka:*

- obvlada ključne raziskovalne metode, ki so potrebne za izdelavo doktorske naloge,
- pozna naravo velikih količin podatkov in je sposoben uporabiti visokozmogljive računalniške sisteme za analizo velikih količin podatkov,
- je sposoben kombinirati metode kvalitativne in kvantitativne analize,
- je sposoben samostojnega raziskovalnega dela z uporabo kvalitativnih in kvantitativnih metod,
- je sposoben kombinirati različne pristope družboslovnega in naravoslovnega raziskovanja,

**Intended learning outcomes:**

Knowledge and understanding:

*The student:*

- masters key research methods that are necessary to conduct the doctoral research work,
- knows the nature of big data and is able to use high-performance computers for simple analysis of big data,
- is able to combine the methods of qualitative and quantitative analysis,
- is capable of independent research using qualitative and quantitative methods,
- is able to combine different approaches from social and natural sciences,

- je sposoben predstaviti svojih raziskovalnih rezultatov v znanstvenih publikacijah.
- poznavanje metod modeliranja in simulacije z agenti.

- is able to present his/her research results in scientific publications.
- knowledge of modelling and simulation methods using agents.

#### **Metode poučevanja in učenja:**

- *Predavanja* z aktivno udeležbo študentov; kratka razlaga, diskusija, razprava na primerih, reševanje problematike.
- *Seminarsko delo* v obliki priprave in zagovora projektne naloge.
- *Individualno delo* študentov: samostojni študij znanstvene in strokovne literature in rezultatov raziskav. Izdelava domačih nalog in projektne naloge.

#### **Learning and teaching methods:**

- *Lectures* with active participation of students; a brief explanation, discussion, debate on cases dealing with the problems.
- *Seminar* in the form of preparation and presentation of project assignment.
- *Individual work* of students; independent study of scientific and professional literature and research results. Work on home and project assignments.

Delež (v %) /  
Weight (in %)

#### **Načini ocenjevanja:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt): Študent izbere enega nosilca, ki določi potrebne naloge.

#### **Assessment:**

Type (examination, oral, coursework, project): Student chooses one of the lecturers who sets the entire course requirements.

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