KAPITAŁ LUDZKI
NARODOWA STRATEGIA SPÓJNOŚCI

UNIWERSYTET JAGIELLOŃSKI W KRAKOWIE

UNIA EUROPEJSKA
EUROPEJSKI
FUNDUSZ SPOŁECZNY

SOCIETY – ENVIRONMENT – TECHNOLOGY

Course description form

2012/2013

1. **Course title:** **Research Methods** .....

4. Course language: ENGLISH

6. Course type:

Obligatory to complete study

7. Year of study, semester: **Year 2 and 3, Semester 4, 5 and 6** .....

8. Name of co-ordinator(s): **dr hab. Małgorzata Barańska** .....

10. Collective point (involve point 10,12,17 - 10. Type of course, 12. Number of hours, 17. Assessment methods and pass requirements) **(look instruction)**

Type of course :

Lecture – tutor: **Prof. dr hab. Czesław Mesjasz** .....

Number of hours: **4** semester: **2**.....

Method of evaluation:.....

Condition of credits: **Active participation in lectures/seminars**.....

Lecture – tutor: Prof. dr hab. Paweł Koteja .....

Number of hours: **20** semester: **2**.....

Method of evaluation:.....

Condition of credits: **Active participation in lectures/seminars**.....

Lecture – tutor: Prof. dr hab. J. Nezleck

Number of hours: **20** semester: **2**

Method of evaluation:

Condition of credits: **Active participation in lectures/seminars**

Lecture – tutor: Prof. dr hab. R. Konarski

Number of hours: **20** semester: **3**

Method of evaluation:

Condition of credits: **Active participation in lectures/seminars**

Classes – tutor: dr Bartosz Such

Number of hours: **18** semester: **3**

Method of evaluation:

Condition of credits: **Active participation in lectures/seminars**

Lecture – tutor: dr hab. Małgorzata Barańska, dr hab. Rafał Barański, dr Małgorzata Czernicka

Number of hours: **10** semester: **3**

Method of evaluation:

Condition of credits: **Active participation in lectures/seminars**

Lecture – tutor: Prof. Garry Robson

Number of hours: **20** semester: **4**

Method of evaluation:

Condition of credits: **Active participation in lectures/seminars**

Lecture – tutor: Prof. dr hab. Czesław Mesjasz

Number of hours: **8** semester: **4**

Method of evaluation:

Condition of credits: **Active participation in lectures/seminars**

Additional information about method and condition of credits: .....

Students are obliged to participate in lectures/seminars and their participation will be recorded.

The course is through three semesters and at the end of each semester an exam is planned.

11. Prerequisites: (look instruction) None.....

15. Objective of the course / expected learning outcomes: (look instruction) .....

Knowledge:

After the course the student is able to understand:

1. Inter- and multidisciplinary approaches in scientific projects, the role of analogies and metaphors in scientific progress with avoiding cross-scientific superficial analogies and metaphors in development of research design. Aspects of specificity and commonness of research design in natural and social sciences

2. The concept of causality in natural and social sciences in non-experimental, quasi-experimental and experimental context and its differences in natural and social sciences.

3. Statistical methods and tools in diagnosis of cause-effect relationship in natural and social systems

4. Contextual and hierarchical nature of data (and social and natural systems) as well as interactions among hierarchical levels of the analysis. Specificity of research designs and analytical methods in hierarchical, multilevel context and proper use of statistical models that explain the nested and hierarchical levels of physical, biological and social data.

5. The nature of multidimensionality of the data in life and social sciences (complex, large scale, sequential, relational, data). Problems of reduction, classification, ordination and scaling of life and social data and content - method analogies across the life and social phenomena

6. Concept of dimension and a latent unobserservable variable in life and social sciences. Philosophical and empirical context of latent variable modeling. Measurement models with latent variables in natural and social sciences. Causality in non-experimental design and causal models with latent variables in multigroup comparisons.

7. Qualitative nature of scientific research in the context of cultural reproduction and social change. Importance of perspectives and methods triangulation in scientific (qualitative) research. Ethical issues linked to research projects and setting research projects in an ethical framework.

Abilities:

After the course the student should posses the ability to:

1. Search for inter- and multidisciplinary research problems

1. Combine approaches and research methods from different fields of knowledge and scientific disciplines

2 Find applications of research methods and data analysis tools from one field of science into another one

3. Join knowledge and proper use the analogies and metaphors in interdisciplinary studies

4. Work in cross-disciplinary research teams, use of research language and conceptual networks rooted in various research traditions and types of sciences

5. Communicate the research problems, assumptions, analytical concepts and outcomes in interdisciplinary context

6. Enhance the social and group learning and the knowledge diffusion from different fields of science

7. Use of analytical methods and tools from social and natural sciences

Attitudes:

After the course the student should posses the social competencies in:

1. Developing of social skills in building and participating in the interdisciplinary research teams,

2. Improving the group communication, sharing knowledge and capabilities, mixing various contents and research methods in integrated research team.

3. Overcoming communicational barriers, misunderstandings and conflicts concerning different research traditions, scientific languages, or uneven levels of statistical and numerical proficiencies

4. Mutual interpersonal inspiration with research problems coming from own scientific fields and areas

5. Sharing content and methods' experiences from various context (social and natural) in projecting of observational, experimental and quasiexperimental research designs.

6. Learning the unified view of hierarchical nature of phenomena in various natural, life and social systems.

7. Developing the ethical framework in research project and holistic view of scientific problem in interdisciplinary studies.

16. Teaching methods: (look instruction)

Lecturing, multimedia teaching techniques, discussion, case studies - prepared by the lecturer as well as by the students, presentations by students, field trips

18A. Full description of the course / course contents: (look instruction)

Part I

I. **Introduction to interdisciplinary research [4 hours - prof Cz. Mesjasz]**
1.1. Social and behavioral sciences vs. natural sciences
1.2. Social and natural systems as a subjects of research
1.3. Systems thinking
1.4. Modern studies of social systems
    1.4.1. Sociology and complexity
    1.4.2. Economics and complexity – econophysics
    1.4.3. Management – complexity and learning organization

II. **Research design and experimental data analysis [20 hours - prof P. Koteja]:**
2.1. Elements of the methodology of natural science
    2.1.1. Research program and research project
    2.1.2. The scientific hypothesis and falsification,
    2.1.3. Evaluation of research project,
2.2. Causality in the life sciences
    2.2.1. Causality in non-experimental projects
    2.2.2. Experimental and quasi-experimental designs in natural and social sciences, experimental error and factor interactions
2.3. The theoretical basis of regression analysis
2.4.. Multiple regression and least squares methods
2.5. Introduction to General Linear Models

III **Introduction to multilevel modeling [20 hours - prof. J. Nezlek]**
3.1 Types of hierarchically nested data structures in natural and social sciences
    3.1.1. Rationale for multilevel modelling
    3.1.2. Nested data in social and life sciences
3.2. Individual - and group level relationships and variables
    3.2.1. Global, analytical, structural and contextual variables
    3.2.2. Cross-level interactions
3.3. Multilevel random coefficient models
3.4. Selection and modelling of predictors and determining error structures in MLM
3.5. HLM package in the estimation of multilevel models
3.6. Reporting of MLM results

Part II

IV**. Introduction to Structural Equation Models [20 hours - prof R. Konarski]**

5.1. Fundamentals of using structural equation modelling in life and social sciences
- 5.1.1. Concept of latent variables in life and social sciences
- 5.1.1. Data requirements
- 5.1.2. Introduction to the SEM notation and LISREL syntax

5.2. Specification and identification of path and confirmatory factor analysis model
- 5.2.1. Structural models with observed variables
- 5.2.2. Measurement model and measurement errors in SEM
- 5.2.3. Confirmatory factor analysis model

5.3. Specification and identification the general SEM model
- 5.3.1. General structural equation models
- 5.3.2. Multi-sample CFA and SEM models

5.4. Model estimation, testing and reporting
- 5.4.1. Details of model estimation
- 5.4.2. Model testing
- 5.4.3. Reporting strategies in presentation of SEM models

V. **Practical Part:Research Teams [18 hours – dr. B. Such]**

VI. **Exploratory Multivariate Analysis in Life and Social Sciences [10 hours – dr hab. M. Barańska]**

6.1. Multivariate Analysis in life sciences
- 6.1.1. Multidimensional data, the reduction and analysis of huge amount of data
- 6.1.2. Problems of multivariate, highly correlated data

6.2. Principal Component Analysis (PCA) in data reduction
- 6.2.1. PCA in spectroscopic data
- 6.2.2. Signal processing methods

6.3. Multivariate analysis of genotype x environmental interaction
- 6.3.1. Multivatiate analysis with explanatory variables, introduction to GxE interaction (Principle Coordinate Analysis and CCA)

6.4. Classification and calibration techniques
- 6.4.1. Methods of multivariate data classification: K-Means Clustering (KMC), Linear Discriminant Analysis (LDA), PLS and PCR
- 6.4.2. Multivariate analysis – cluster analysis and PCoA for nominal, rand and continuous data, detection of redundant variables.

6.5. Multidimensional scaling (MDS) in large scale - and sequential data analysis
- 6.5.1. Computational and statistical methods applied to sequences (homology search and clustering).
- 6.5.2. Probabilistic models in analyzing the huge amount of data
- 6.5.3. Multidimensional scaling (MDS) in clustering and visualization of sequences

Part III

VII. **Qualitative research [20 hours - prof G. Robson]**

7.1. Qualitative vs quantitative research
- 7.1.1. Introduction to qualitative research, an overview of research methods,
- 7.1.2.Qualitative, quantitative and mixed methods
- 7.1.3. Culture and qualitative -theories and debates
- 7.1.4. The ethics of social research, ethical frameworks for the research

7.2. Qualitative research project

7.3. 'Action' & 'Evaluation' research

7.4. Research techniques in qualitative studies
- 7.4.1.Interviews – theory and method
- 7.4.2. Focus groups
- 7.4.3. Ethnography/Participant Observation, Pre-Fieldwork and In the Field

7.4.4 .Visual Methods, urban photo/video observation
7.5. Using 'Grounded Theory, A 'coding' and 'conceptualisation' workshop based on field trip notes
7.6. The Internet as Research Context
7.7. Computer assisted analysis of qualitative data and relevant software (NVivo)

VIII. **Interdisciplinary Research [8 hours - prof Cz. Mesjasz]**

18B. Short description of the course (max. 70 words):

The course is divided into three parts, which can be classified as: Introduction and design of experiment (1,2,3), Models and methods/measurements (4,5), and Analysis (6,7,8). Each part will be offered in one semester.

1. Introduction to interdisciplinary research
2. Research design and experimental data analysis
3. Introduction to multilevel modeling
4. Introduction to structural equation models
5. Practical part
6. Exploratory multivariate analysis in life and social sciences
7. Qualitative research
8. **Interdisciplinary studies**

19. Recommended reading: (look instruction) .....

Obligatory:

1. Introduction to interdisciplinary research

1. Beck, Ulrich, Giddens Anthony, Lash Scott, (1994). *Reflexive modernization: Politics, tradition and aesthetics in the modern social order*. Stanford: Stanford University Press.
2. Mesjasz Czesław, (2010) Complexity of Social Systems, *Acta Physica Polonica A*, vol. 117, no. 4, April, pp. 706-715, http://przyrbwn.icm.edu.pl/APP/PDF/117/a117z468.pdf
3. Senge Peter M., (1990), *The Fifth Discipline. The Art and Practice of the Learning Organization.* Doubleday: New York.
4. Sokal Alan, Bricmont Jean, (1998). *Fashionable Nonsense. Postmodern Intellectuals' Abuse of Science*. New York: New Picador.

2. **Research design and experimental data analysis**

1. Shadish, W., R., Cook, T., D., Campbell, D. T., (2002) *Experimental and Quasiexperimental Designs for Generalized Causal Inference*, Wadsworth,
2. G. Quinn and M. Keough (2002): *Experimental design and data analysis for biologists.* Cambridge Univ.. Press

3. Introduction to multilevel models

1. Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical Linear Models: Applications and Data Analysis Methods*, New York: Sage
2. *HLM7: Student version*, shareware downloadable from http://ssicentral.com

4. **Introduction to Structural Equation Models**

1. Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling* (3rd Ed.). New York: The Guilford Press.
2. Schumacker, R. E., & Lomax, R. G. (2004). *A Beginner's Guide to Structural Equation Modeling* (2nd Edition). Mahwah, NJ: LEA.

3. Grace, J., B., (2006) *Structural Equation Modeling and Natural Systems*, Cambridge Univ Press
LISREL 8: Free student edition of LISREL for Windows downloadable from http://www.ssicentral.com

6. Multivariate method in Life Sciences

1. Hill, T. & Lewicki, P. (2007). *STATISTICS: Methods and Applications*. StatSoft, Tulsa, OK
2. Posada D. (2009). *Bioinformatics for DNA Sequence Analysis*. Humana Press,

7. Qualitative Research

1. Bogdan, R. & Taylor, S., *Introduction to Qualitative Methods*
2. Flick, U. *An Introduction to Qualitative Research*
3. Gomm, R. *Social Research Methodology*: A Critical Introduction

Supplementary:

1. **Introduction to interdisciplinary research**

Eve, Raymond, Horsfall , S. and Lee, M., (1997). *Chaos, Complexity and Sociology*: Myths, Models, and Theories. Thousand Oaks, CA: Sage Publications.
Checkland, Peter B. (1998) *Systems Thinking, Systems Practice*, John Wiley & Sons Ltd.
Glasersfeld, E. (1995). *Radical constructivism: A new way of knowing and learning*. London: The Farmer Press.
Gleick, J. (1987). *Chaos: The Making of a New Science*. New York: Viking Press. (and further editions).
Luhmann, N. (1990). *Essays on Self-Reference*. New York: Columbia University Press.
Mirowski, P. (1989). *More Heat than Light: Economics as Social Physics, Physics as Nature's Economics*. Cambridge: Cambridge University Press.
Popper, K.R., (1974). *The Poverty of Historicism*, London: Routledge and Kegan Paul.
Taleb N. N., (2007). *The Black Swan. The Impact of the Highly Improbable. New York:* Random House.
Wittgenstein, L., G. E. M. Anscombe, and E. Anscombe, (2003), *Philosophical Investigations:* The German Text, with a Revised English Translation 50th Anniversary Commemorative Edition, Blackwell Publishing Ltd,
Waldrop, M. Mitchell, *(*1992). *Complexity: The Emerging Science at the Edge of Order and Chaos*. New York: Simon & Schuster,
Wolfram, S. (2002). *A New Kind of Science*. Champaign, Illinois: Wolfram Media Inc.,

3. **Introduction to multilevel models**

Nezlek, J. B. (2011). *Multilevel Modeling for Social and Personality Psychology*. In J. B. Nezlek (Ed.) The SAGE Library in Social and Personality Psychology Methods. London: Sage Publications

4. **Introduction to Structural Equation Models**

Konarski, R. (2009). *Modele równań strukturalnych. Teoria i praktyka*. Wydawnictwo Naukowe PWN.

7. **Qualitative Research**

Bryant, A. & Charmaz K. (Eds) *The Sage Handbook of Grounded Theory*
Geertz, C. *The Interpretation of Cultures*
Jacobs, M. D. and Hanrahan, N. W. (Eds) *The Blackwelll Companion to the Sociology of Culture*
Seale, C. et al (Eds) *Qualitative Research Practice*
Wright, P. *Research Questions: A Guide for Social Scientists*
Websites, course (notes and data sets) packages and other sources will be added during the classes