Adam Mickiewicz University in Poznań

Doctoral School of Exact Sciences AMU

Systems thinking as a modern approach to understanding reality

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Field of science	
Teaching method	lecture
Language	English
Numbers of hours	15
Aims of the course	The aim of this course is to develop the ability to perceive reality as a system constituting a complex whole composed of many interconnected elements, interacting with the environment in which it exists. We are going to acquire the skill of "systems thinking" as the art of viewing interrelationships and tracking their changes over time. We are going to learn the way of thinking, the language of description, and the forces and interdependencies that shape the behavior of systems. We are going to acquire the ability to apply the laws of systems thinking to identify system dysfunctions. We are going to learn Senge's methods of systems analysis (deepening one's own system history, the Five "Whys?" questions, causality loops, and archetypes). We are going to learn how to change systems more effectively and operate in greater harmony with social, organizational, and economic processes.
Course contents	Systems thinking is a modern approach to understanding reality. The course will cover topics such as the scientific origins of systems thinking (cybernetics, physical chemistry including thermodynamics, biology), and the fields in which systems thinking is applied (social sciences, psychology, sociology, philosophy, natural sciences, law, and the exact sciences; organizational and business management, etc.). We will answer questions such as: what is a system and what are its characteristics, how systems work, and how to live in a world of interconnected systems. We will explore and characterize deterministic systems, probabilistic systems, deterministic-probabilistic systems, the functional and structural aspects of systems, system dysfunctions, the laws of systems thinking that will allow us to diagnose system dysfunctions, and Senge's systems analysis methods (deepening one's own system history; The Five "Whys" Questions; the basic mechanisms of system operation – causality loops and archetypes). We will learn to recognize causality loops: reinforcing feedback loops and balancing feedback loops. We will learn to use archetypes—diagrams that facilitate cataloging the most common behaviors in a system. We will explore typical archetypes: harmful medications, limits to growth; shifting the burden. We will analyze the organization as a dynamic system, organizational archetypes, and remedies for overcoming them. Students will be able to acquire the ability to "see the big picture," because, according to Senge, systems thinking is "a framework for seeing relationships, not things, for seeing patterns of change, not static 'snapshots.'" ("it is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static 'snapshots'". p. 68) The lecture format will provide each doctoral student with the

	opportunity to: go through a specific process, allowing them to understand and apply systems thinking individually.
Prerequisites and co-requisites	None

Learning outcomes	
On completion of the course PhD candidates will be able to:	**Assessment mode**
E_W02 Knows and understands at an advanced level research methodology appropriate for the discipline of science in which education takes place, which allows for proper selection of research theories and tools and their effective application and modification within the framework of own research.	**Written work**
E_W08 Knows and understands fundamental dilemmas of contemporary civilization and the role of science, especially in the field of education, in solving them.	**Written work**
E_U01 Use knowledge from various disciplines of science to creatively identify, formulate and innovatively solve complex research problems or perform advanced research tasks. In particular, he/she is able to: - define the objectives and the subject of scientific research, - formulate research hypotheses, - develop research methods, techniques and tools and apply them creatively and effectively, - draw conclusions on the basis of scientific evidence.	**Written work**
E_K01 Critical evaluation of the work in the field of the scientific discipline within which the education is provided and its own contribution to the development of this discipline.	**Written work**
E_K05 Continuous improvement of professional competence and personal development, in particular by tracking and analyzing the latest developments in the represented scientific discipline.	**Written work**

Literature	Basic literature: [1] Peter Senge, The Fifth Discipline, Doubleday, New York 1994 [2] Donella H. Meadows, Thinking in Systems: A Primer, Earthscan Publications 2009 Additional literature: [1] Peter Senge, Art. Kleiner, Charlotte Roberts, Richard Ross, Bryan Smith, The Fifth Discipline Fieldbook, Nicholas Brealey Publishing, London 2010
Additional information	**Written work** **Subject: Analysis of a selected problem using one of the systems analysis methods** **Grading Criteria:** **Very good** - the independently prepared written work contains all the required elements. The student independently describes and analyzes the problem, correctly uses the knowledge presented in the lecture; the work contains no errors, and is very carefully edited. **Good plus** - the independently prepared written work contains all the required elements. The student independently describes and analyzes the problem, correctly uses the knowledge presented in the lecture; the work contains no substantive errors; the work contains few editing errors. **Good** - the independently prepared written work contains all the required elements. The

	student independently describes and analyzes the problem, correctly uses the knowledge presented in the lecture. The work contains few editing errors and few minor substantive errors. **Satisfactory plus** - the written work contains all the required elements. The work contains editing errors and less significant substantive errors, which are corrected after consultation with the lecturer. **Satisfactory** - the written work contains all the required elements. The work contains editing errors and substantive errors, which were corrected after consultation with the lecturer. **Unsatisfactory** - the written work is incomplete. The student does not understand and is unable to formulate and analyze the problem, even after consultation with the lecturer.