	Adam Mickiewicz University in Poznań
	Doctoral School of Exact Sciences AMU
	Systems thinking as a modern approach to understanding reality
	prof. dr hab. Marzena Dzida

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: fixes that backfire; limits to growth; shifting the burden; tragedy of the commons; eroding goals; escalation; success to the successful; growth and underinvestment. 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-and-workshop format will provide each doctoral student with the opportunity to: go through a specific process, allowing them to understand and apply systems thinking individually; work in groups; exchange views and engage in forum discussions. Doctoral students will be able to verify their understanding of the issues discussed using specific examples.
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.	Continuous evaluation
E_W08 Knows and understands fundamental dilemmas of contemporary civilization and the role of science, especially in the field of education, in solving them.	Continuous evaluation
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.	Continuous evaluation Evaluation of the multimedia presentation
E_U06 Present the results of his/her research and to initiate and conduct scientific and popular science discussions in Polish and foreign languages.	Continuous evaluation Evaluation of the multimedia presentation
E-U08 Plan his/her own development, both in terms of scientific, academic and other professional activities, and inspire and stimulate development of other people.	Continuous evaluation Evaluation of the multimedia presentation
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.	Continuous evaluation
E_K02 Acting in accordance with the ethical principles of scientific work and interpersonal relations; moreover, he/she is ready to build the ethos of the scientific and professional environment.	Continuous evaluation
E_K04 Thinking and acting in an entrepreneurial way, creating new ideas and searching - in cooperation with people from other disciplines - for innovative solutions, as well as taking up challenges and intellectual risk in the scientific and public spheres and taking responsibility for the consequences of their decisions.	Continuous evaluation
E_K05 Continuous improvement of professional competence and personal development, in particular by tracking and analyzing the latest developments in the represented scientific discipline.	Continuous evaluation

Literature	<u>Basic literature:</u>

	[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	A 10-minute multimedia presentation analyzing a selected problem using one of the systems analysis methods. **Multimedia presentation evaluation criteria:** The PhD student prepares a multimedia presentation based on substantive criteria (coverage of the topic) and form of communication (image composition, language and style, use of time). The presentation is evaluated based on its substantive content, graphic design, and skillful delivery of the lecture and discussion. Passed – The PhD student demonstrates extensive knowledge of the topic, understanding of all related issues, proper selection of material, and insightful interpretation. The PhD student formulates their own conclusions, utilizes supporting material appropriately, uses appropriate terminology and concepts, the presentation is well planned and organized (logical and discursive structure), maintains a good balance between the introduction, body, and conclusion, time is perfectly planned and utilized, the answers are substantively accurate, active participation in the discussion, and the multimedia presentation is perfectly prepared in terms of form, employing a variety of means of expression (charts, drawings, texts, comments, animations, etc.). Failed – The PhD student discusses the topic in an incomplete and repetitive manner, makes essential errors in the talk, including a lack of communicative language. The PhD student has limited vocabulary and terminology, fails to understand the questions, and answers are off-topic. The multimedia presentation is poorly prepared both in terms of content and form. **Criteria for continuous evaluation during lecture:** Passed - PhD student actively participates in lectures; expresses correct statements using the acquired terminology; independently solves problem issues. Failed - PhD student does not understand the presented content, does not participate in the discussion.