EMPIRICAL AND DEDUCTIVE REASONING

Empirical and Deductive Reasoning (FD-EDR) is one of the six Foundational Disciplines that are part of the WCAS bachelor's degree.

We learn about the world in two main ways: empirically, from observations, and by making logical deductions from what we already know or conjecture. Courses in this discipline teach students to use these two modes of inference.

Empirical conclusions, derived from observations about the world, come with uncertainties or probabilities. Courses in empirical reasoning teach students to apply statistical reasoning to interpret evidence, to estimate the uncertainties inherent in their conclusions, and to build theoretical models based on data.

We also reason by deduction from axioms we take as certain, or from conjectural models of the real world. Courses in this discipline teach students both the power and limitations of such formal reasoning. Students will learn to create and analyze chains of mathematical or logical deductions, or computational algorithms.

Learning objectives for FD-EDR

Courses in Empirical and Deductive Reasoning are designed to achieve a combination of the following learning outcomes:

- Recognize empirical versus deductive modes of inference
- Articulate the power and the limitations of statistical reasoning, including the quantification of uncertainties in data
- Recognize the dangers of reasoning biases, including conclusions from anecdotal evidence, and the limits of when causal claims can be made from correlational data
- Learn to create and analyze formal models of real world phenomena
- Appreciate the power of abstraction in applying similar formal constructs to a range of different problems
- Learn to clearly and persuasively communicate both empirical and logical arguments, via writing, presentation, and graphical formats

FD-EDR Courses

Courses approved for the 2025-2026 academic year.

Course	Title
BIOL_SCI 337-0	Biostatistics
BIOL_SCI 338-0	Modeling Biological Dynamics
COG_SCI 202-0	Evaluating Evidence
COMP_SCI 110-0	Introduction to Computer Programming
COMP_SCI 111-0	Fundamentals of Computer Programming
COMP_SCI 150-0	Fundamentals of Computer Programming 1.5
EARTH 211-0	Data Analysis in Earth and Environmental Sciences
EARTH 361-0	Scientific Programming in Python
LING 260-0	Formal Analysis of Words & Sentences
LING 270-0	Meaning
LING 330-0	Research Methods in Linguistics
LING 334-0	Introduction to Computational Linguistics
MATH 100-0	Quantitative Reasoning
MATH 202-0	Finite Mathematics
MATH 211-0	Short Course in Calculus
MATH 218-1	Single-Variable Calculus with Precalculus
MATH 218-2	Single-Variable Calculus with Precalculus
MATH 218-3	Single-Variable Calculus with Precalculus
MATH 220-1	Single-Variable Differential Calculus
MATH 220-2	Single-Variable Integral Calculus
MATH 226-0	Sequences and Series
MATH 228-1	Multivariable Differential Calculus for Engineering
MATH 228-2	Multivariable Integral Calculus for Engineering
MATH 230-1	Multivariable Differential Calculus
MATH 230-2	Multivariable Integral Calculus
MATH 235-0	Series and Multiple Integrals
MATH 240-0	Linear Algebra
MATH 250-0	Elementary Differential Equations
MATH 281-1	Accelerated Mathematics for ISP. First Year
MATH 281-2	Accelerated Mathematics for ISP. First Year
MATH 281-3	Accelerated Mathematics for ISP. First Year
MATH 285-1	Accelerated Mathematics for MMSS
MATH 285-2	Accelerated Mathematics for MMSS
MATH 285-3	Accelerated Mathematics for MMSS
MATH 290-1	MENU: Linear Algebra and Multivariable Calculus
MATH 290-2	MENU: Linear Algebra and Multivariable Calculus
MATH 290-3	MENU: Linear Algebra and Multivariable Calculus
MATH 291-1	MENU: Intensive Linear Algebra and Multivariable Calculus
MATH 291-2	MENU: Intensive Linear Algebra and Multivariable Calculus
MATH 291-3	MENU: Intensive Linear Algebra and Multivariable Calculus
PHIL 150-0	Elementary Logic I
PHIL 250-0	Elementary Logic II
POLI_SCI 210-0	Introduction to Empirical Methods in Political Science
POLI_SCI 212-0	Evaluating Evidence
POLI_SCI 312-0	Statistical Research Methods
PSYCH 201-0	Statistical Methods in Psychology
PSYCH 301-0	Research Methods in Psychology
PSYCH 333-0	Psychology of Thinking
SOCIOL 226-0	Sociological Analysis
SOCIOL 303-0	Analysis and Interpretation of Social Data
STAT 201-0	Introduction to Programming for Data Science
STAT 202-0	Introduction to Statistics and Data Science
STAT 210-0	Introduction to Probability and Statistics
STAT 228-0	Series and Multiple Integrals