

### Example 1 - Indiana University<sup>1</sup>

All Indiana public higher ed institutions have common Statewide General Education Learning Outcomes. For Quantitative Reasoning, this includes:

Common statement: Apply principles of inquiry to define and analyze complex problems through reasoning and discovery.

Upon completion, students will be able to:

1. Interpret information that has been presented in mathematical form (e.g. with functions, equations, graphs, diagrams, tables, words, geometric figures).
2. Represent information/data in mathematical forms as appropriate (e.g. with functions, equations, graphs, diagrams, tables, words, geometric figures).
3. Demonstrate skill in carrying out mathematical (e.g. algebraic, geometric, logical, statistical) procedures flexibly, accurately, and efficiently to solve problems.
4. Analyze mathematical arguments, determining whether stated conclusions can be inferred.
5. Communicate which assumptions have been made in the solution process.
6. Analyze mathematical results in order to determine the reasonableness of the solution.
7. Cite the limitations of the process where applicable.
8. Clearly explain the representation, solution, and interpretation of the math problem.

### Example 2 - Miami Dade College<sup>2</sup>

Student learning outcome for mathematics: Use quantitative analytical skills to evaluate and process numerical data.

MDC Learning Outcome	Emerging 1	Developing 2	Proficient 3	Exemplary 4
<p style="text-align: center;"><b>LO2</b> <b>Quantitative Analysis</b> <small>(Revised 2/09)</small></p>	<p>Cannot identify data necessary to solve the problem.</p>	<p>Can identify data necessary to solve problem, but analyzes data incorrectly.</p>	<p>Identifies applicable data, and analyzes data correctly, but does not justify results.</p>	<p>Identifies applicable data, analyzes data correctly, and justifies results.</p>

<sup>1</sup> Indiana University East. [http://www.iue.edu/catalog/policies/documents/IU\\_East\\_General\\_Education\\_Curriculum\\_2017.pdf](http://www.iue.edu/catalog/policies/documents/IU_East_General_Education_Curriculum_2017.pdf)

<sup>2</sup> <http://www.mdc.edu/learningoutcomes/>

### Example 3 - University of Kentucky<sup>3</sup>

Overall, UK has four student learning outcome areas: Inquiry, Communication, Quantitative Reasoning, and Citizenship.

For the Quantitative Reasoning portion:

Students will demonstrate an understanding of and ability to employ methods of quantitative reasoning. [6 credit hours] Students will

- a) demonstrate how fundamental elements of mathematical, logical and statistical knowledge are applied to solve real-world problems;
- b) explain the sense in which an important source of uncertainty in many everyday decisions is addressed by statistical science, and appraise the efficacy of statistical arguments that are reported for general consumption.

Students will take one 3-hour course on the application of mathematical, logical and statistical methods, and one 3-hour course devoted to a conceptual and practical understanding of statistical inferential reasoning.

	4	3	2	1	0
<b>Demonstrate how fundamental elements of mathematical and/or logical knowledge are applied to solve real-world problems</b>	Competently translates appropriate information into fundamental elements of mathematical or logical knowledge and provides an effective interpretation for the purpose of solving real-world problems.	Adequately translates available information into fundamental elements of mathematical or logical knowledge.	Translates available information, but resulting quantitative portrayal is somewhat appropriate or accurate.	The translation of available information is incomplete or inappropriate and results in an ineffective portrayal.	Does not attempt.
<b>Appraise the efficacy of numerical/logical arguments that are reported for general consumption</b>	Uses appropriate quantitative language and/or constructs in connection with a mathematical or logical argument for the purpose of evaluating efficacy.	Adequately uses quantitative language and/or constructions in connection with an argument. It may be presented in an ineffectual format or some parts of the explication may be uneven.	Uses appropriate quantitative language and/or constructions but these are insufficient to evaluate the efficacy of the argument.	Presents an argument that is relevant, but does not provide adequate quantitative justification.	Does not attempt.

<sup>3</sup> University of Kentucky. <http://www.uky.edu/registrar/content/uk-core>

	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>
<b>Demonstrate how fundamental elements of statistical knowledge are applied to solve real-world problems</b>	Competently converts relevant information into fundamental elements of statistical knowledge and provides an effective portrayal for the purpose of solving real-world problems.	Provides an adequate conversion of information into fundamental elements of statistical knowledge.	Provides a conversion of information, but resulting statistical portrayal is only partially appropriate or accurate.	Conversion of information is incomplete or inappropriate and results in an ineffective portrayal.	Does not attempt the problem.
<b>Explain the sense in which an important source of uncertainty in many everyday decisions is addressed by statistical science</b>	Competently makes appropriate decisions and provides a thoughtful defense of the decision based on statistical science.	Makes appropriate decisions and provides a defense of the decision based on statistical science.	Makes a decision and provides a defense of the decision based on statistical science, but arguments are only partially appropriate or accurate.	Makes a decision and provides a defense of the decision, but arguments are inappropriate or inaccurate.	Does not attempt the problem.
<b>Appraise the efficacy of statistical arguments that are reported for general consumption</b>	Uses statistical language and/or constructs in connection with an argument for the purpose of evaluating efficacy.	Uses statistical language and/or constructs in connection with an argument, though it may be presented in a less than completely effective format or some parts of the explication may be uneven.	Uses statistical language and/or constructs but does not effectively connect it to evaluating the efficacy of the argument.	Presents an argument that is pertinent, but does not provide adequate explicit statistical justification.	Does not attempt the problem.

#### Example 4 - Texas Core Curriculum<sup>4</sup>

The state of Texas has a Texas Core Curriculum for Higher Education. They have 6 core objectives, including Empirical and Quantitative skills, described as:

to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions.

This objective is assessed in courses in Mathematics, Life & Physical Sciences, and Social and Behavioral Sciences

<sup>4</sup> LEAP (Liberal Education and America's Promise) Texas Initiative. <http://leaptx.org/coreobjectives/empirical-and-quantitative-skills/>

### Example 5 – Revising Student Learning Outcomes<sup>5</sup>

“The 1997 Campus Learning Objectives were written by faculty, for faculty. The two examples below illustrate high aspirational goals with no clear path for attaining them within the university:

1. Educated persons should develop the skills to understand, accept, and relate to people of different backgrounds and beliefs. In a pluralistic world one should not be provincial or ignorant of other cultures; one’s life is experienced within the context of other races, religions, languages, nationalities, and value systems.
2. Educated persons should be expected to have some understanding of and experience in thinking about moral and ethical problems. A significant quality in educated persons is the ability to question and clarify personal and cultural values and thus be able to make discriminating moral and ethical choices.

The new Campus Learning Outcomes are written purposefully in a clear and concise language, which helps students understand expectations of them:

1. Communicate clearly and effectively in written and oral forms
2. Access, use, and critically evaluate a variety of relevant information sources
3. Apply principles of inquiry to define and analyze complex problems through reasoning and discovery
4. Demonstrate the ability to relate within a multicultural and digitally connected world
5. Demonstrate a deep understanding of a field of study

Each new outcome comes with an explanatory paragraph to provide clarity, which helps faculty members, students, and stakeholders better understand the intent of each outcome. It is clear that the new outcomes are simpler, streamlined, and easier to assess compared with the old objectives.”

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<sup>5</sup> Excerpts from Alexander, R., Blakefield, M., Frank, K., & Pomper, M. (2016). State Mandates and General Education: One Campus Responds to Challenges and Opportunities. *The Journal of General Education*, 65(1), 36–47.