Core Concept: System Analytics

Engineering Literacy Dimension: Engineering Practices
Practice: Quantitative Analysis
Overview: *System Analytics* is the process of investigating systems and calculating the way in which a system's components interact with each other, how they function over time, and the way in which they operate within the context of larger technological and natural systems. A system can be described as any entity or object that consists of parts, each of which has a relationship with all other parts and to the entity as a whole. These parts work together in a predictable or planned way to achieve a specific goal. System Analytics requires knowledge related to (a) *system inputs (i.e. people, materials, tools/machines, energy, information, finances, and time),* (b) *system processes (i.e. design, production, management),* (c) *system outputs (including desirable, undesirable, intended, unintended, immediate, and delayed outputs),* (d) *system feedback and control (including both internal and external controls),* and (e) *system optimization.* This core concept is important to the practice of Quantitative Analysis as every physical and digital system is intertwined with a variety of natural, social, and technological systems, and is a system itself as well as developed through a system. The ability to analyze the design, function, and interaction of systems enables the development of dynamic controls that use data-comparing devices and sensors to optimize and automate system operations.

Performance Goal for High School Learners
I can successfully analyze an engineering system through identifying its inputs, outputs, processes, and feedback loops to implement controls to predict and optimize system performance.
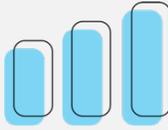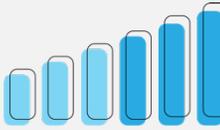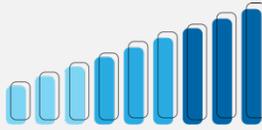
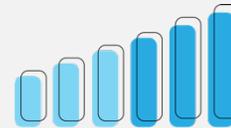|	Basic	Proficient	Advanced
SYSTEM INPUTS	I can identify inputs and outputs of a given engineering system.	I can identify and explain the relationships between inputs and outputs of a given engineering system.	I can analyze what inputs and conditions are needed for a desired output in a given engineering system.
SYSTEM PROCESSES	I can classify the technological processes of a given engineering system.	I can identify and explain the major steps involved in the processes of a given engineering system through the use of diagrams.	I can identify and analyze the major steps involved, as well as recognize the inputs, processes, and outputs of a given engineering system.
SYSTEM OUTPUTS	I can identify a feedback loop in a given engineering system.	I can explain a certain feedback loop through the use of a block diagram.	I can derive a feedback loop to control a certain engineering system, and then describe how it impacts the system as a whole.

Core Concept: System Analytics Cont.

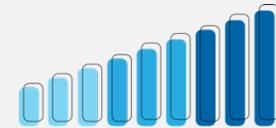**Performance Goal for High School Learners**
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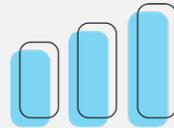
	Basic	Proficient	Advanced
SYSTEM FEEDBACK & CONTROL	I can identify a feedback loop that is being used to control a given engineering system.	I can identify a feedback loop and articulate how it is being used to control the inputs of a given engineering system.	I can analyze a given engineering system and identify and explain a feedback loop that is being used to control the system.
SYSTEM OPTIMIZATION	I can identify which internal sub-systems are needed to be optimized in order to refine a given engineering system.	I can analyze and discuss multiple constraints for optimization of a certain internal sub-system.	I can predict how the optimization of a certain sub-system impacts the system as a whole.