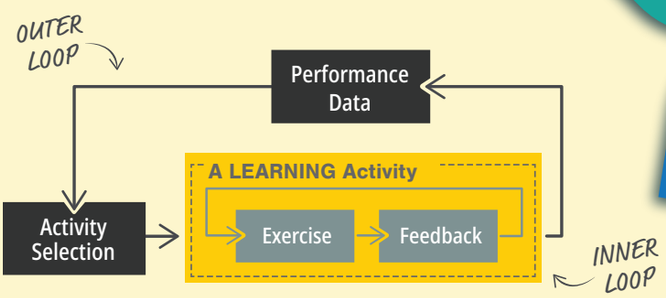
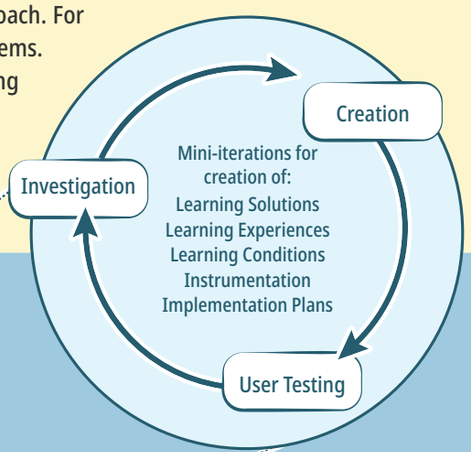
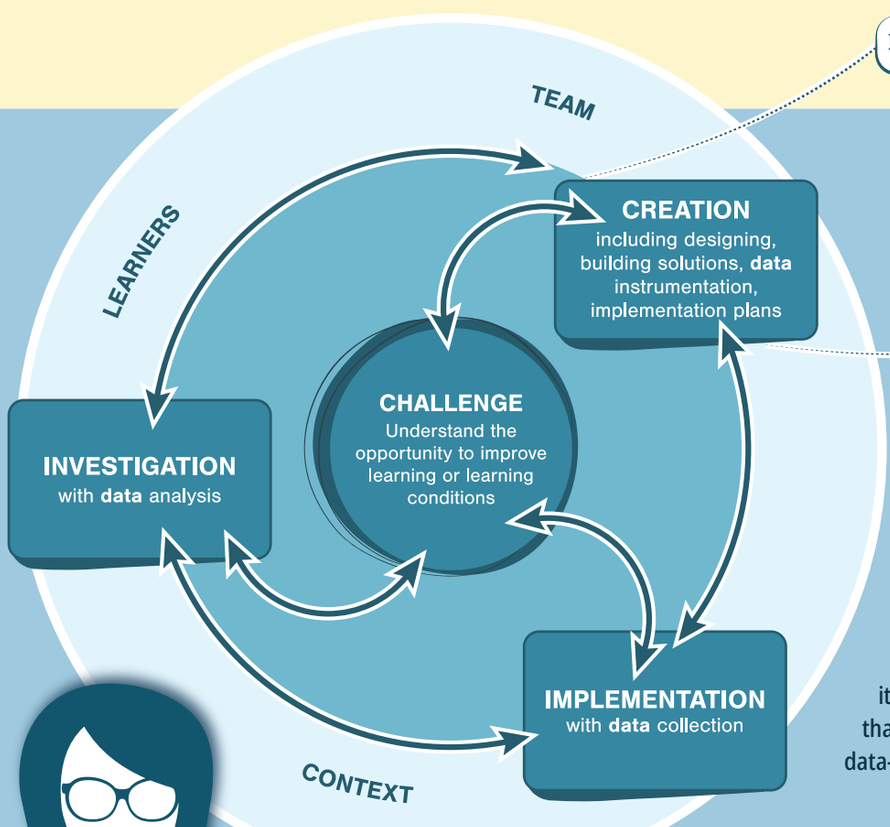
WHAT IS LEARNING ENGINEERING?

Learning engineering is a **process** and practice that applies the **learning sciences**, using **human-centered engineering design** methodologies and **data-informed** decision-making, to support learners and their development

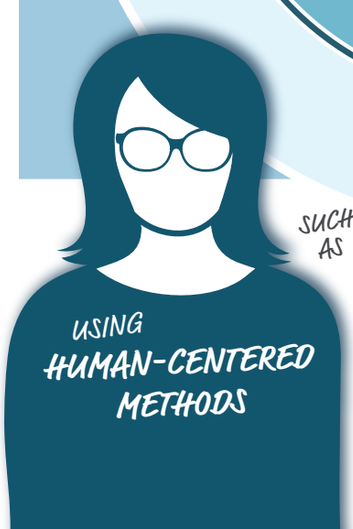


Engineering is a systematic problem-solving process that aims to create scalable solutions to problems that work within a range of conditions. Learning engineering adopts engineering mind-sets, including a systems perspective, ability to envision the future, and a scientific approach. For example, engineering control theory uses feedback loops to continuously optimize systems. Learning engineering uses these loops—across various spans of time—to enhance learning outcomes and to create opportunities to apply the science of learning at scale.





Learning engineering uses a repeatable process to iteratively design, test, adjust, and improve the conditions for learning. This process always begins with a challenge, in other words, a goal to achieve or limitation to overcome. After that, the process can follow many different paths, but those paths always involve agile, iterative, and typically concurrent methods that incorporate human-centered design and data-informed decisions.



SUCH AS

DISCOVER: Learn about your stakeholders and their context, for instance observe and do research
IDEATE: Brainstorm about the challenge using what you discovered; make personas and use cases
FEEDBACK: Rapidly prototype and get feedback from learners and other stakeholders
TESTING: Test the prototype with people in realistic contexts, including outcomes and usability
ITERATE: Redesign and test the prototype again based on the feedback and prior testing outcomes
MATURE: Iteratively advance the prototype into more sophisticated forms and repeat

What can you **accommodate** or **modify** to optimize learning?

EXAMPLES (NOT EXHAUSTIVE LIST, OBVIOUSLY)

CAPABILITIES
Knowledge + Skills
Experiences
Mental Models

TRAITS
Culture
Identity
Interests

ABILITIES
Sensory Abilities
Cognitive Abilities
Psychomotor Abilities

STATES
Fatigue
Motivation
Emotional State

INSTRUCTION
Individual or Group
Task Complexity
Subject Matter
Competing Tasks
Instructional Tactics
Instructional Strategies
Cognitive Requirements
Delivery Modality
Time Pressure
Degree of Interactivity

INTERFACES
Classroom Tools
IT Access
Internet Access
EdTech Options
User Interfaces
Accessibility Features

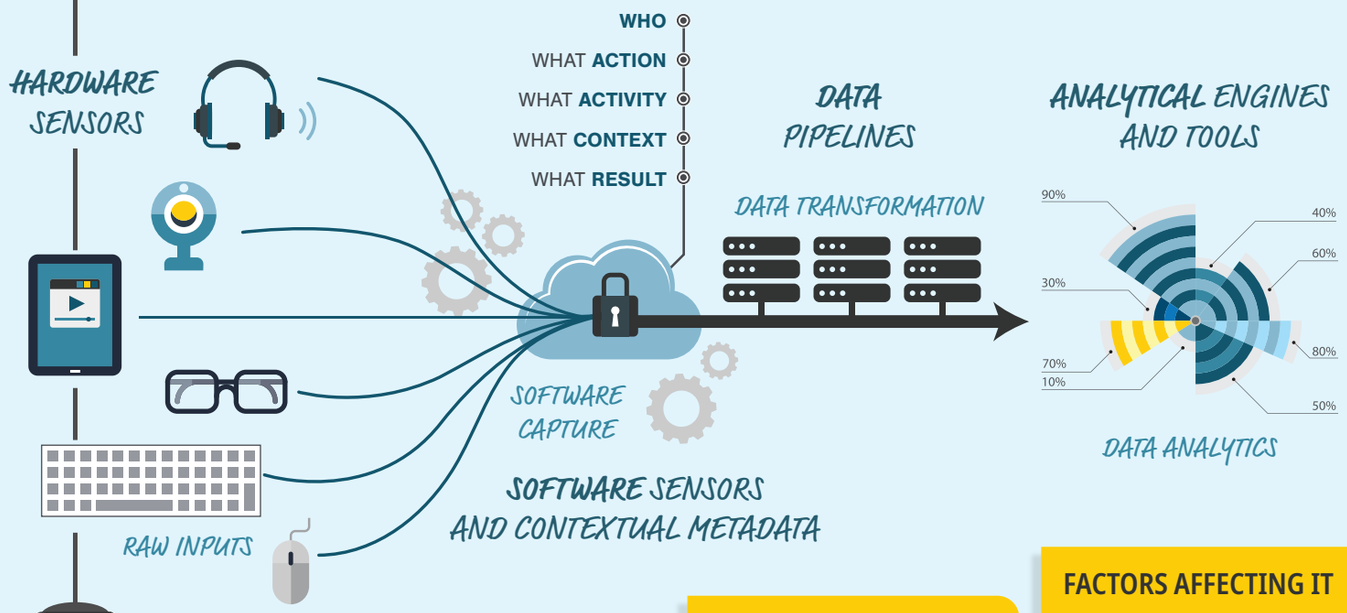
PHYSICAL CONTEXT
Noise
Lighting
Temperature
Layout
Distractions
Accessibility

SOCIAL CONTEXT
Authority gradients
Social climate
Psychological climate
Safety and wellbeing
Available mentors
Peer interactions

BROADER CONTEXT
Faculty Workload
Organizational Processes
Organizational Leadership
Resource Availability
Government Initiatives
Economic Pressures
Job Market
Public Health Conditions
Educational Policies

+ OBSERVED PERFORMANCE AND BEHAVIORS

This data may be collected digitally



Use the Learning Sciences

...collective body of knowledge derived from scientific research about how people learn and how to enhance learning. The learning sciences are drawn from many fields including education, cognitive psychology, neuroscience, social sciences, computer science, and data science.

HOW PEOPLE LEARN
Human development stages
Cognitive Info Processing
Perception/sensemaking
Transfer of learning
Forgetting and retention
System 1 and System 2
Expertise and mastery

FACTORS AFFECTING IT
Prior experiences
Mental models
Cognitive biases
Motivation
Locus of control
Cognitive load
Metacognitive processes

LEARNING TECHNOLOGIES
Traditional tools like chalkboards
Distributed/blended learning
Adaptive and intelligent tutors
Games and gamification for learning
Microlearning
Simulations; scenario-based learning
Live, virtual, and constructive

INSTRUCTIONAL METHODS
Pedagogy, andragogy, and heutagogy
Instructional strategies and tactics
Reflection and practice
Zone of proximal development
Scaffolding
Instructional design processes
Learning taxonomies (e.g., Bloom's)

EVALUATION METHODS
Summative and formative assessments
Adaptive assessments
Stealth assessments
Physical and behavioral sensors
Neurophysiological measures
Credentials and micro-credentials
Competency-based and mastery learning