



University of Idaho

College of Engineering

BALANCING LEARNING & GROWTH FOR BETTER EDUCATIONAL OUTCOMES

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MECHANICAL ENGINEERING
CETL FACULTY SPOTLIGHT
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OUTCOMES FOR TODAY

- I** Generate interest in and valuation of both learning and growth within course design/delivery
- I** Stimulate critical thinking about the role of learning skills in converting teachable moments into growable moments
- I** Seed the idea that crafting growable experiences, with appropriate mentoring, are a prudent method for neutralizing collegiate risk factors
- I** Explore a number of teaching/learning resources (session handouts)
 - Learning Process Methodology (w/engineering customization)
 - Classification of Learning Skills (URL for Online Identifier)
 - Disciplinary & General Education Risk Factors
 - Profiles of an Engineering Professional & Quality Collegiate Learner
 - Growth Skills Inventory (special subset of learning skills)



MY JOURNEY

- I Joined UI as applied thermodynamics faculty member in Fall 1987**
=> formation of a content expert and academic researcher
- I Taught Engineering Science, Freshman/Sophomore Design in 1990's**
=> formation as a facilitator for learning to learn
- I Capstone Design instructor, 1996-present**
=> formation as a facilitator of project learning and performance development
- I Immersion in 2nd Discipline of the Scholarship of Teaching/Learning**
=> Co-Director of Faculty Guidebook Project 2001-2007
=> Co-PI of NSF Enriched Learning Environment Project 2003-2007
=> Co-PI in NSF TIDEE and IDEALS Consortia 2000-2013
- I ME Department Chair, 2015-present**
=> advocate for learning infrastructure, community building, and mentoring



MY WAY OF BEING

As a process-oriented educator/scholar...

I want to see growth myself and in others

I trust and respect students (also faculty/staff/administrators)

I enjoy assessment and I embrace feedback

I can handle and adapt to change

I am willing to take risks (esp to advance performance capability)

I use self-assessment to continually improve (esp with the SII model)

I enjoy working with others strive to use time efficiently/effectively

I am willing to shift control to students/others to maximize their growth

SOME WORKING DEFINITIONS...

- I LEARNING** - The process of developing skills, acquiring existing knowledge, or discovering new knowledge through instruction or study
- I LEARNING SKILLS** - Skills employed in the process of learning, embedded in a learner's behavioral repertoire, and transferable across disciplines and contexts, which enable him or her to improve mastery of subject matter. They are essential for constructing knowledge because they “modulate” what learners can achieve at any level. These skills, once identified, can be consciously improved and refined, increasing the rate and effectiveness of learning.
- I GROWTH** - The result of achieving positive changes in characteristics of a quality life producing increased capability through broadening values, expanding goals and strengthening key identities in realizing one's life vision.
- I MENTORING** - A subset of learning skills that increase the personal growth rate of self and others.

LEARNING PROCESS METHODOLOGY (LPM)



When we stop treating learning as a mysterious process that somehow happens to a student when someone else teaches them and instead show them what learning is and what is involved in the process of learning, they **learn how to learn**.

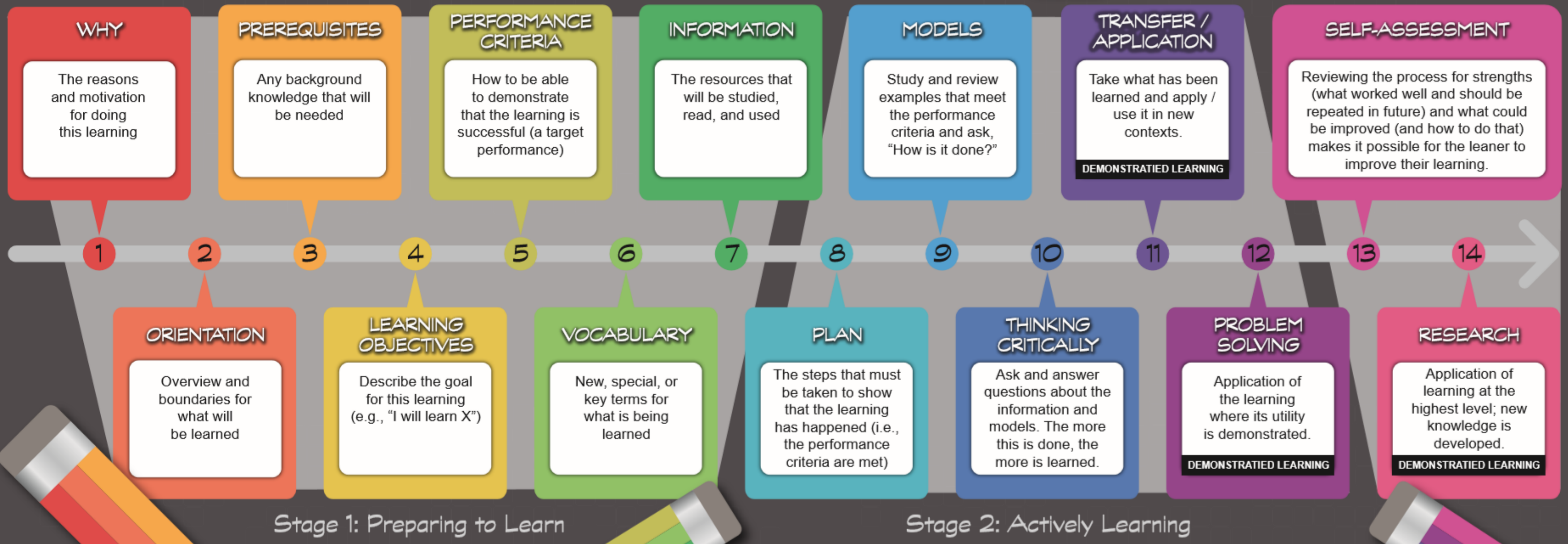
Instead of being a passive and often frustrating process that is done **to** them, their learning becomes something they can control, focus, improve, and use, all to their own benefit. The process of learning isn't anything new, but opening it up to students **IS**. To teach this process to students is to give them the knowledge and tools they need to help educate themselves.

This is the Process Education™ version of the learning process: a formal step-wise methodology that when understood in general, allows individuals to learn how to learn and when applied to a specific area, supports individuals in learning that content.



Stage 3: Improving the Process and Taking it Further

A learner self-assesses to improve their learning performance. As a self-learner, they conduct research (applying knowledge in new contexts and interpreting or understandings things in a new way) to extend their learning performance.



ENGINEERING APPLICATION OF LPM

- I Purpose/Why
- I Context/Background
- I Performance Expectations
- I Prerequisites/Preassessment
- I Terminology/Information/Resources
- I Activity Plan
- I Critical Thinking Questions
- I Generalization Exercises
- I Problem Solving Challenges
- I Validation of Learning
- I Reflection/Assessment

Utschig et al, “Learning to Learn Engineering – A Learning Sciences Approach to Engineering Curriculum Design and Implementation”, Proceedings of 2018 Frontiers in Education Conference



- Mindworks
- References
- Machine Design
- Machine Shop
- Math Modeling
- Instrumentation
- ENGR/ECE VAST
- ME201/401 Comp
- ME301 Solidworks
- ME322 Thermo
- ME421 CATIA
- ME433 Engines
- ME490 Adv Sldwks
- Capstone Design

Mindworks is one of the largest and most widely used academic websites at UI. It is a legacy of the NSF Enriched Learning Environment Project and contains many examples of active learning activities and assessment tools (especially ME 322, ME 433, and Capstone Design)

MOVING FROM KNOWERS TO LEARNERS



I TEACHABLE MOMENTS

“I realized I just discovered the principle behind the knowledge I was struggling to learn. At first I heard only I was wrong, then I got the gist of the idea. With practice I saw easier ways of making this work.”

Making the ‘why for learning’ explicit helps to emphasize on the personal value/added benefits of new knowledge.

I GROWABLE MOMENTS

“I just figured out a new way of using my learning capabilities (e.g. problem solving) to help me in similar learning challenges (problem situations). At first I did not see why the knowledge I produced wasn’t strong enough. Then I realized I was working on a key learning skill.”

Scaffolded by relevant learning skills, knowledge can be transferred more efficiently to new situations (through effective generalization).

CLASSIFICATION OF LEARNING SKILLS



<http://www.processeducation.org/cls/web/>

FOUR DOMAINS OF PERFORMANCE, with supporting PROCESSES, SKILL CLUSTERS, and LEARNING SKILLS



Cognitive Domain



Social



Affective



**Evaluation and
Assessment of Quality**

Leise et al, "Classifying Learning Skills for Educational Enrichment", International Journal of Process Education, Vol 10 (1), 2019.

PROCESS AREAS WITHIN EACH DOMAIN



Cognitive – (1) Information Processing, (2) Critical Thinking, (3) Generalizing, (4) Problem Solving, (5) Discovering/Creating/Innovating

Social – (1) Communicating, (2) Relating with Others, (3) Living in Society, (4) Managing, (5) Leadership

Affective – (1) Engaging Emotionally, (2) Expanding Self-Efficacy, (3) Clarifying, Building, and Refining Values, (4) Personal Growth, (5) Facilitating Growth Beyond Oneself

Assessment/Evaluation – (1) Defining Quality, (2) Measuring Quality, (3) Assessing Quality, (4) Evaluating Quality, (5) Providing Feedback on Quality, (6) Enhancing Quality, (7) Self-Assessing, (8) Reflecting

SOCIAL DOMAIN EXAMPLE



<http://www.processeducation.org/cls/web/>

Process 1 **COMMUNICATING** (producing and receiving messages)

Receiving a Message (using techniques to process a transmission of information)

1. **Active listening:** maintaining attention on what is being said with interaction
2. **Rephrasing:** restating—illustrating what was heard by honoring and then enhancing the message
3. **Reading body language:** gathering information from non-verbal signs
4. **Gaining perspective:** adopting new points of view based on the message
5. **Being perceptive:** being attuned to what is happening during communication
6. **Identifying key ideas:** determining the important components of the message

Preparing a Message (structuring the information for a given audience)

1. **Defining thesis:** specifying central theme for a message
2. **Knowing the audience:** understanding the background and interests of receivers
3. **Articulating an idea:** distilling the essence of the message
4. **Building credibility:** generating trust that the message is true
5. **Structuring a message:** sequencing elements for the desired impact
6. **Phrasing:** using words and expressions suitable for the audience or context
7. **Choosing medium:** selecting the means or channel of communication

RISK FACTOR ANALYSIS



I Engineering Specific Risk Factors

struggles with math
difficulty transferring knowledge
isolated learner
problem solving experience
fixed mindset
misconception of the discipline

memorizes vs learning
trouble reading engineering
managing frustration/anxiety
isolated learning
concrete thinker

I At Risk Behaviors that Impact all College Students

Perseverance Issues
Academic Mindset Issues
Unproductive Learning Strategies
Underdeveloped Social Skills

Horton, "Identifying Risk Factors that Impact College Success", International Journal of Process Education, Vol 7(1), 2015.

USING PROFILES TO BUILD IDENTITY



I Profile of an Engineer – Technically Competent, Business Aligned, Socially Conscious, Customer Focused, Idea Generator, Decision Maker, Solution Integrator, Team Worker, Communicator, Results Oriented, Change Manager, Principle Centered

D. Davis, S. Beyerlein, and I. Davis, “Development and Use of an Engineering Profile”, Proceedings of the American Society for Engineering Education Annual Conference, 2005

I Profile of a Quality Collegiate Learner – Growth Mindset, Academic Mindset, Learning Processes, Learning Strategies, Affective Learning Skills, Social Learning Skills, Productive Academic Behaviors

Apple, Duncan, and Ellis, “Key Learner Characteristics for Academic Success”, International Journal of Process Education, Vol 8 (1), 2017.

MOVING FROM LEARNERS TO GROWERS



I GROWABLE MOMENTS

“I just figured out a new way of using my learning capabilities to help me in similar learning challenges (problem situations). At first I did not see why the knowledge I produced wasn’t strong enough.

Scaffolded by relevant learning skills, knowledge can be transferred to new situations through effective generalization.

I GROWABLE EXPERIENCES

“I just realized that my overall effectiveness could improved by seeing how my performance has features important for my life. My mentor seemed to expect me to do more in a situation where I performed well.”

Learning is more intense and enduring when it is aligned with personal and professional identity.



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