

“Accomplishing Innovation in Higher Education to Answer the Problems of Tomorrow”

Ron Ulseth

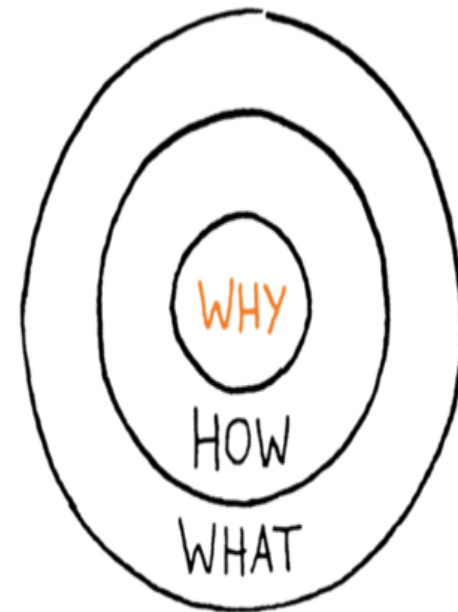
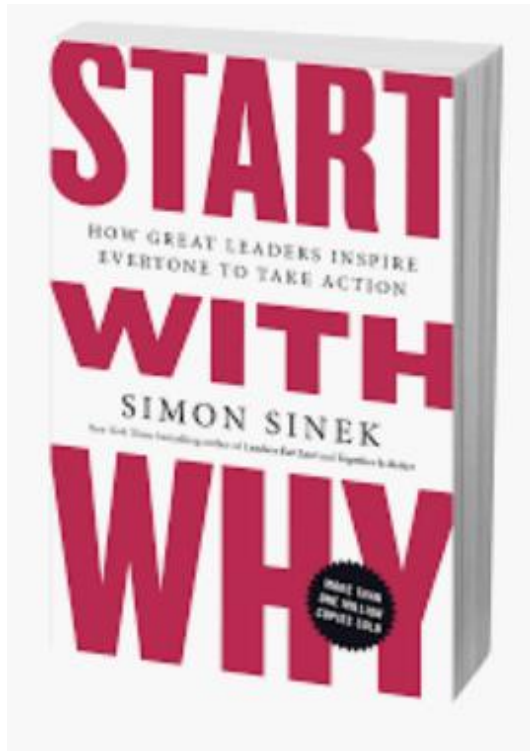
November 3, 2019

Acknowledgements

All learning starts with...

All learning starts with...
“Why?”

All learning starts with...
“Why?”



Why are you here?

60 second exercise – write down your answer

Why are we here?

Why are we here?

We have a problem to solve

Why are we here?

We have a problem to solve.

Unsatisfactory Situation

**There is a world-wide need
to change the way we
teach engineering.**

**There is a world-wide need
to change the way we
teach engineering.**

**There is a world-wide need
to change the way we
~~teach~~ engineering.**

**We need to stop teaching and start
FACILITATING
our students' learning of engineering**

**Over 100 years of research in
psychology points in the same direction...**

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psychology points in the same direction...

**We need to stop lecturing and
start guiding our students
construction of knowledge
through authentic experiences.**

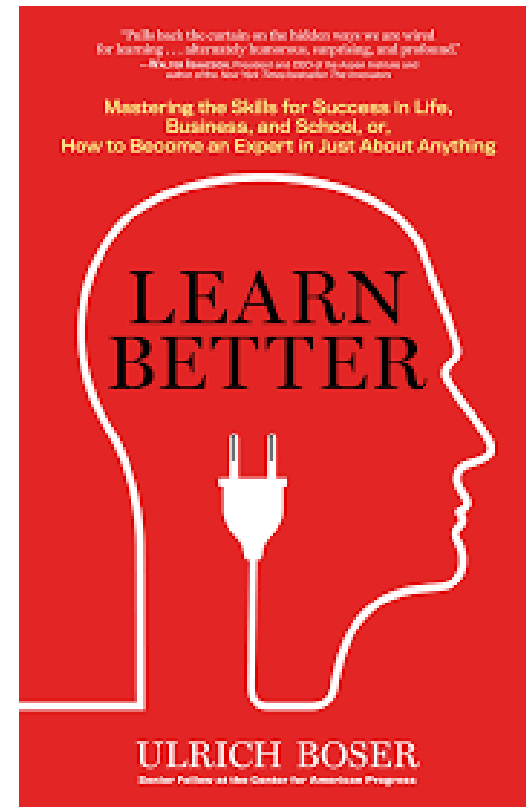
**Write one goal for your learning
in this conference.**

60 second exercise – write down your answer

APA Learner Centered Principles

Ulrich Boser

Ulrich Boser



Model of Learning

-Find value

Model of Learning

- Find value
- Set goals

Model of Learning

- Find value
- Set goals
- Construct knowledge

Model of Learning

- Find value
 - Set goals
 - Construct knowledge
 - Apply knowledge

Model of Learning

- Find value
 - Set goals
 - Construct knowledge
 - Apply knowledge
 - Relate knowledge to prior learning

Model of Learning

- Find value
 - Set goals
 - Construct knowledge
 - Apply knowledge
 - Relate knowledge to prior learning
 - Reflect and plan future

These are all actions taken by students.

- Find value
 - Set goals
 - Construct knowledge
 - Apply knowledge
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These are all actions taken by students.

- Find value
- Set goals
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We cannot deliver these actions in a lecture.

How can I apply this knowledge in my teaching or program?

60 second exercise – write down your answer

How can I apply this knowledge in my teaching or program?

60 second exercise – write down your answer

- Find value
 - Set goals
 - Construct knowledge
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How do we change?

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PBL

**Through PBL,
we can guide our students as they:**

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we can guide our students as they:**

- Find value**
- Set goals**
- Construct knowledge**
- Apply knowledge**
- Relate knowledge to prior learning**
- Reflect and plan future**

Through PBL,
we can guide our students as they:

- Find value
- Set goals
- Construct knowledge
- Apply knowledge
- Relate knowledge to prior learning
- Reflect and plan future

while taking part in authentic experiences.

Here's the good news:

Here's the good news:

**The research tells us that these
models of learning are not
only more effective for all learners...**

They are especially effective for learners in marginalized groups



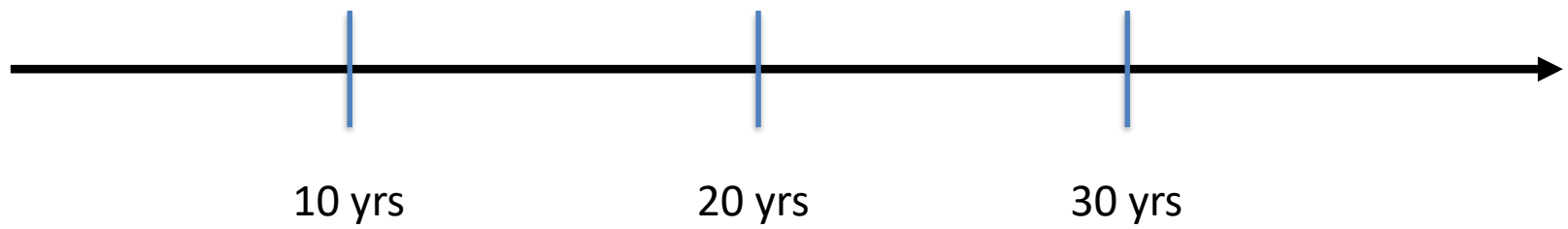
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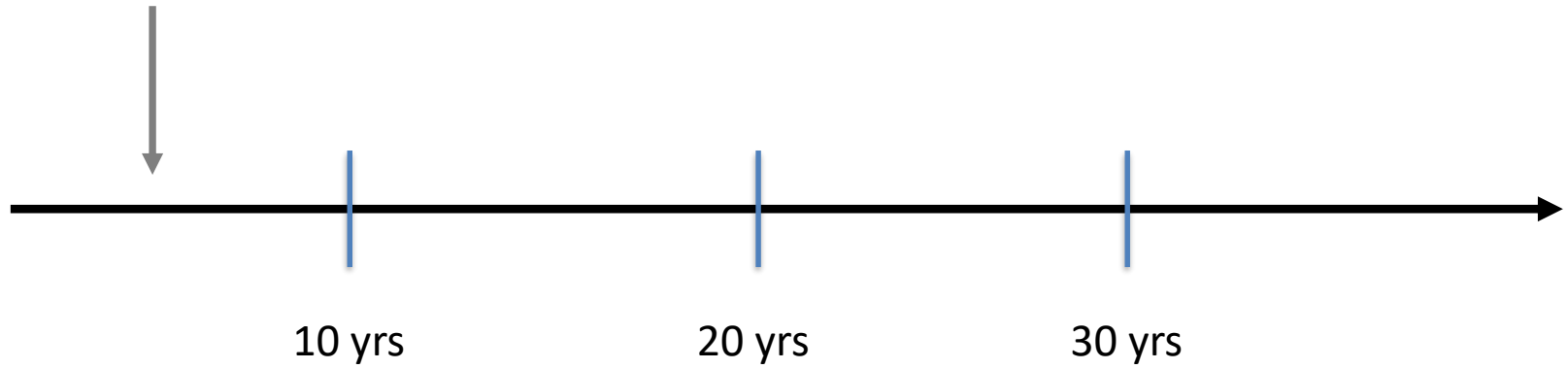
How does this knowledge relate to what I already know?

60 second exercise – write down your answer

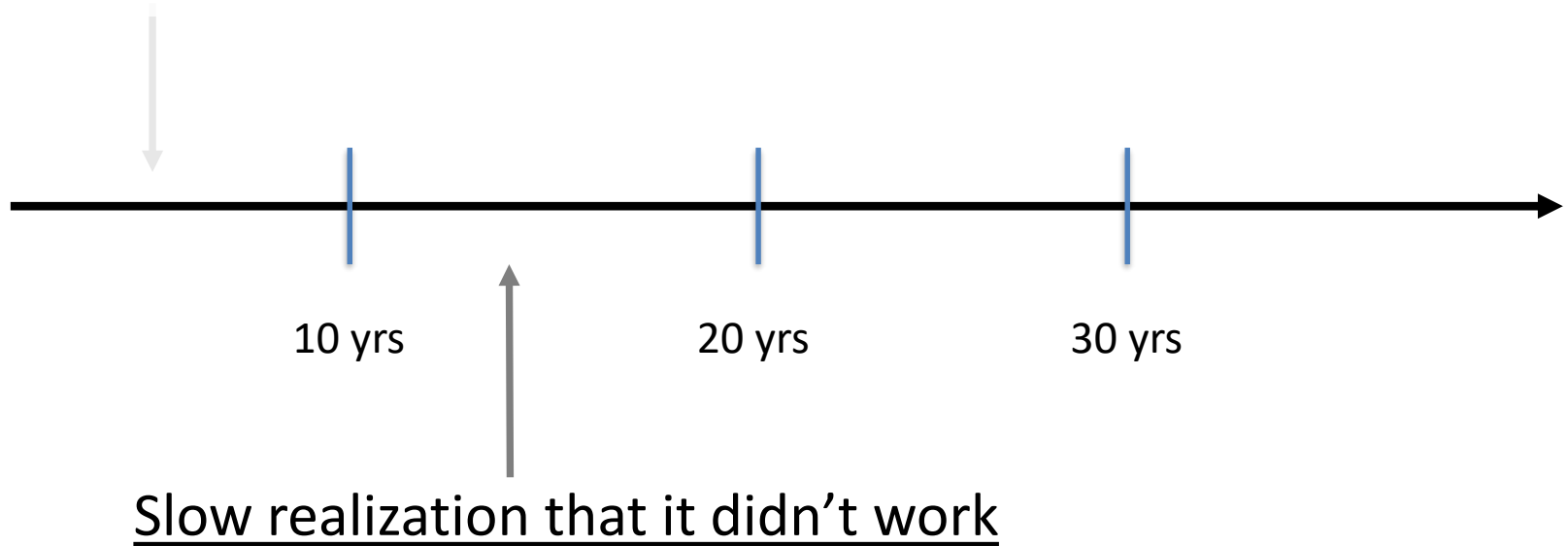
Why am I here?



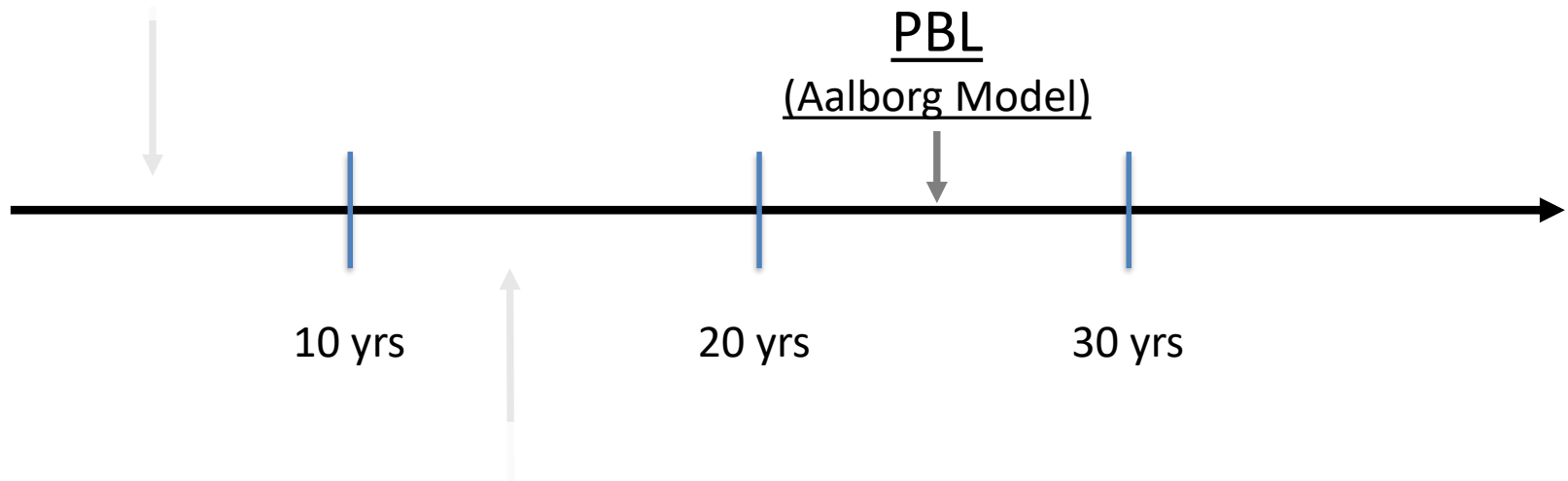
Blindly taught how I'd been taught



Blindly taught how I'd been taught



Blindly taught how I'd been taught



10 yrs

20 yrs

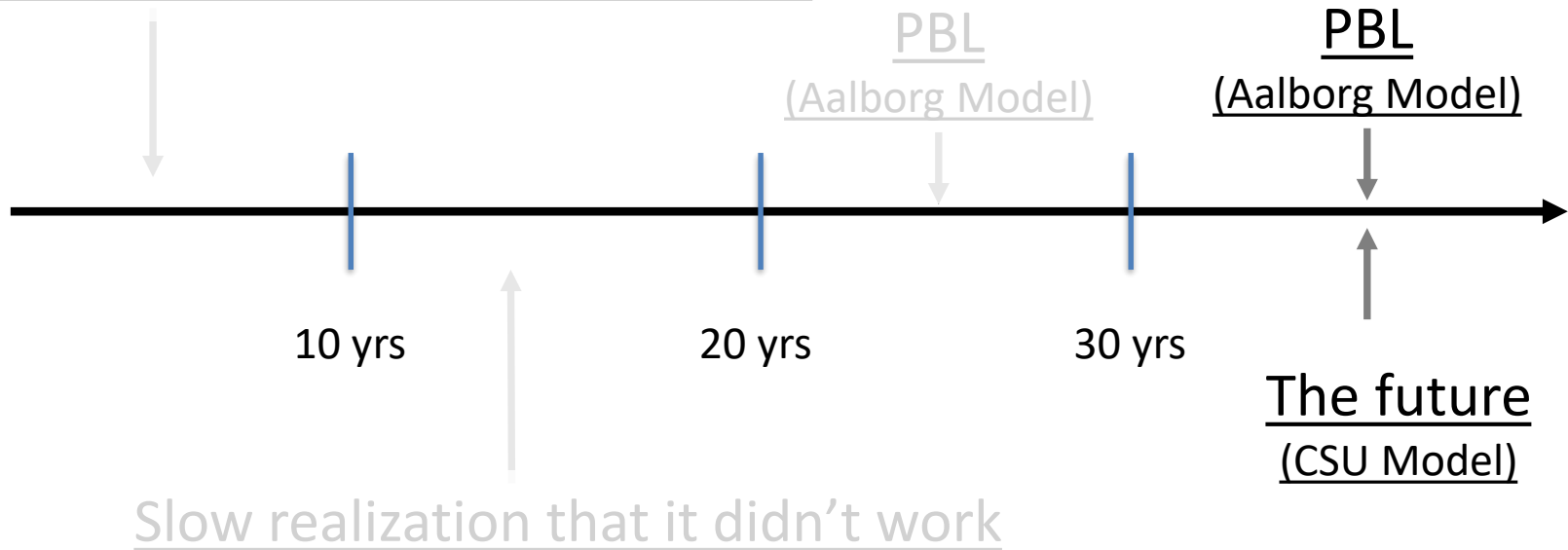
30 yrs

Slow realization that it didn't work

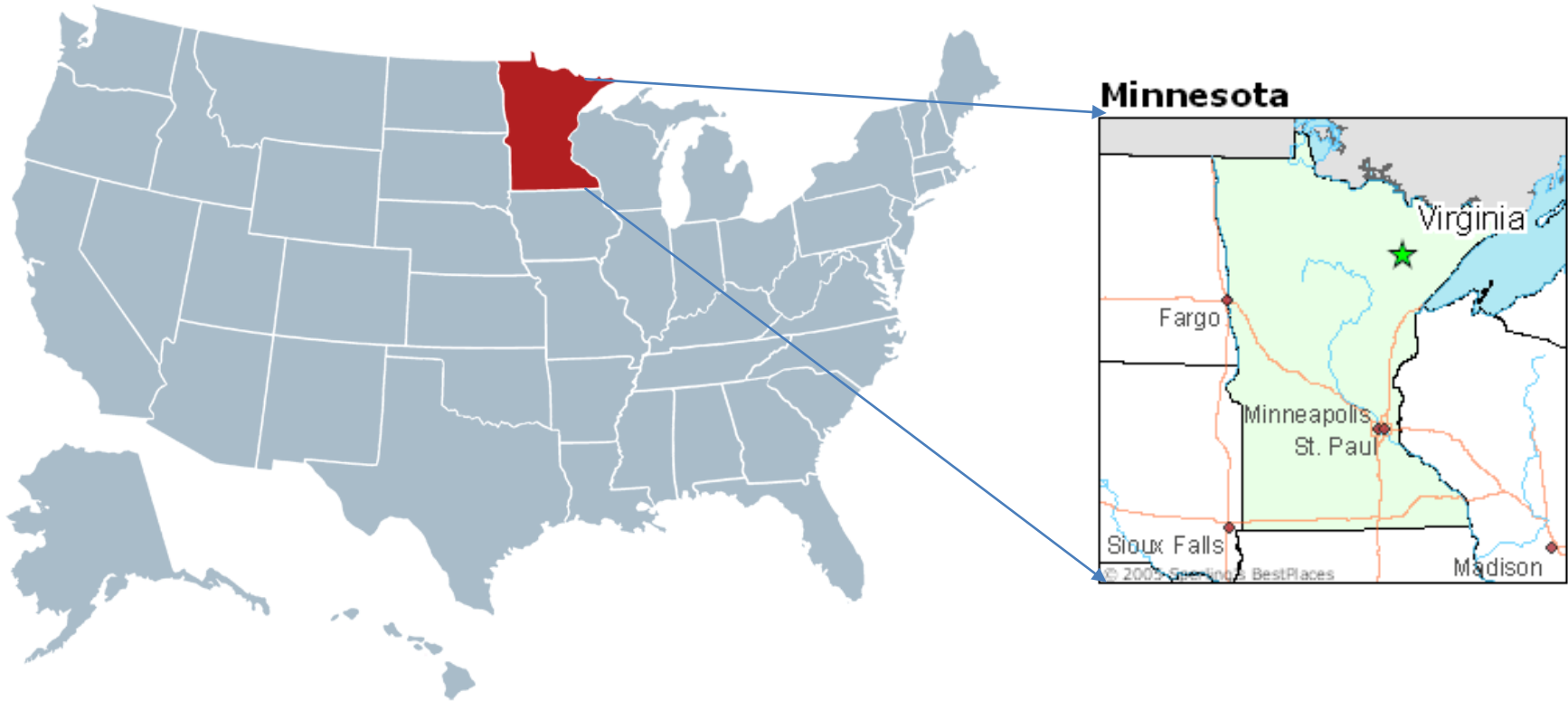
PBL

(Aalborg Model)

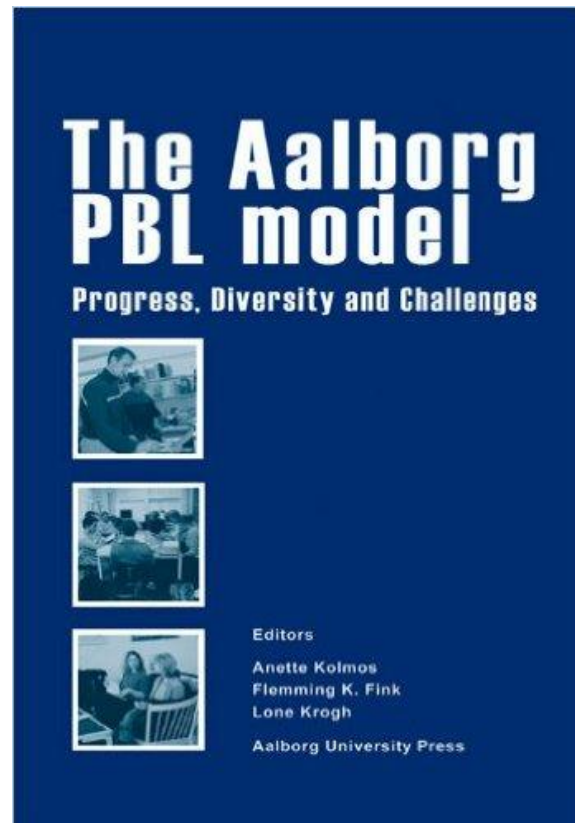
Blindly taught how I'd been taught



Iron Range Engineering (IRE) is a bachelor's of science engineering program located in northeastern Minnesota in the United States.



IRE was an adaptation of the Aalborg model of Project (problem) Based Learning - PBL.



Iron Range Engineering gets its problems as complex, ill-defined projects directly from industry.





UNITED TACONITE

Cooler Sump Pump Design



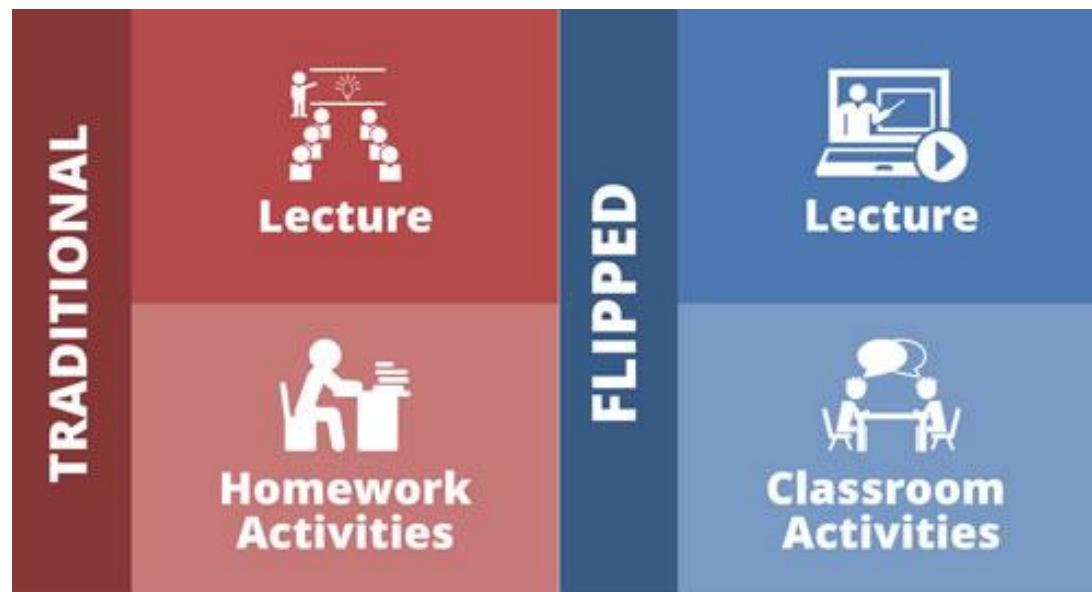
Problem Statement

The existing Cooler Sump Pumps are discharging a wash-down slurry outside the pellet plant, resulting in a loss of valuable iron units, labor requirements to dig ditches, and an increased risk of environmental non-compliance.

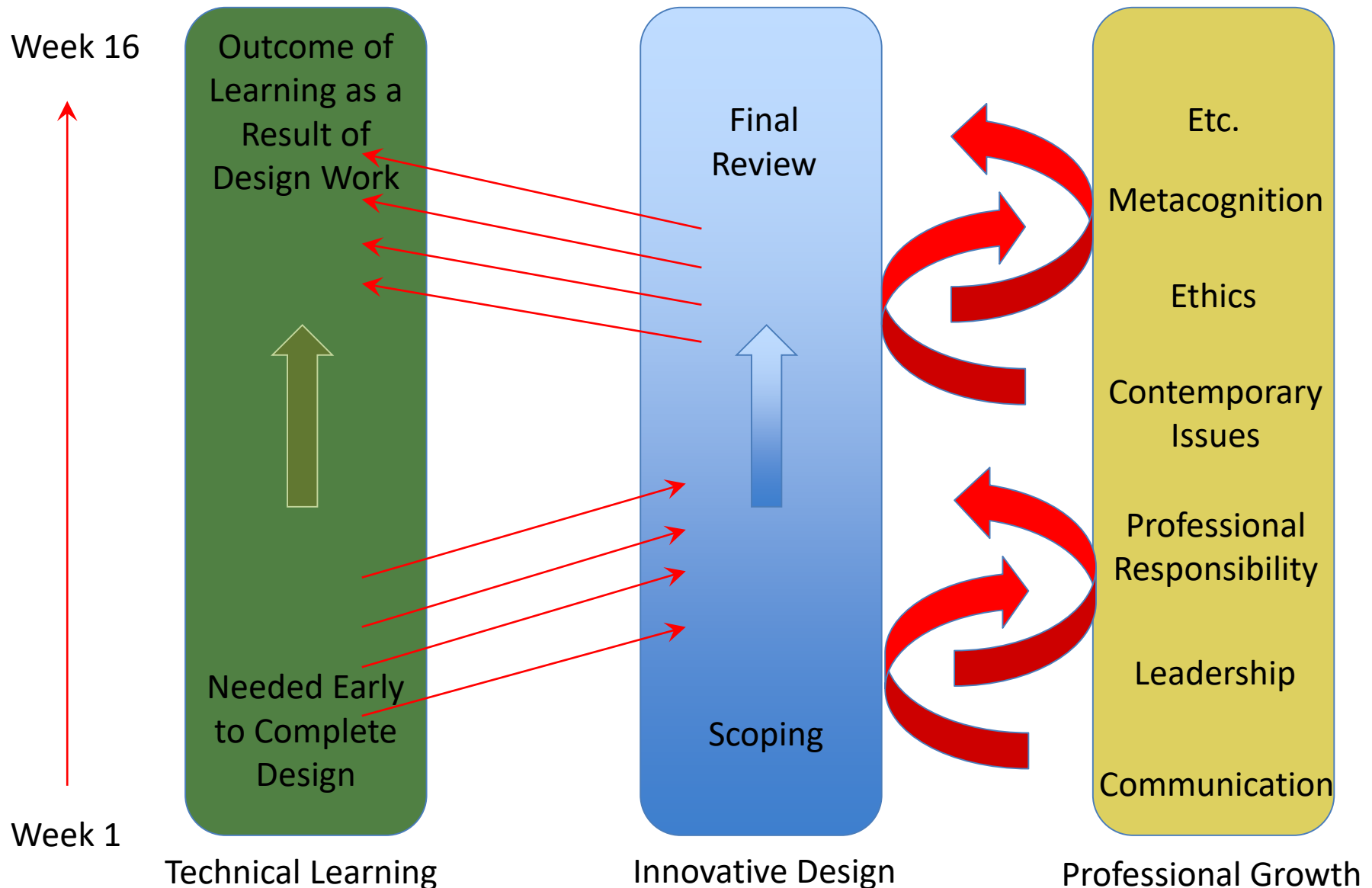
IRE project teams range in size from 3-8 students. Project duration is one 16-week semester.



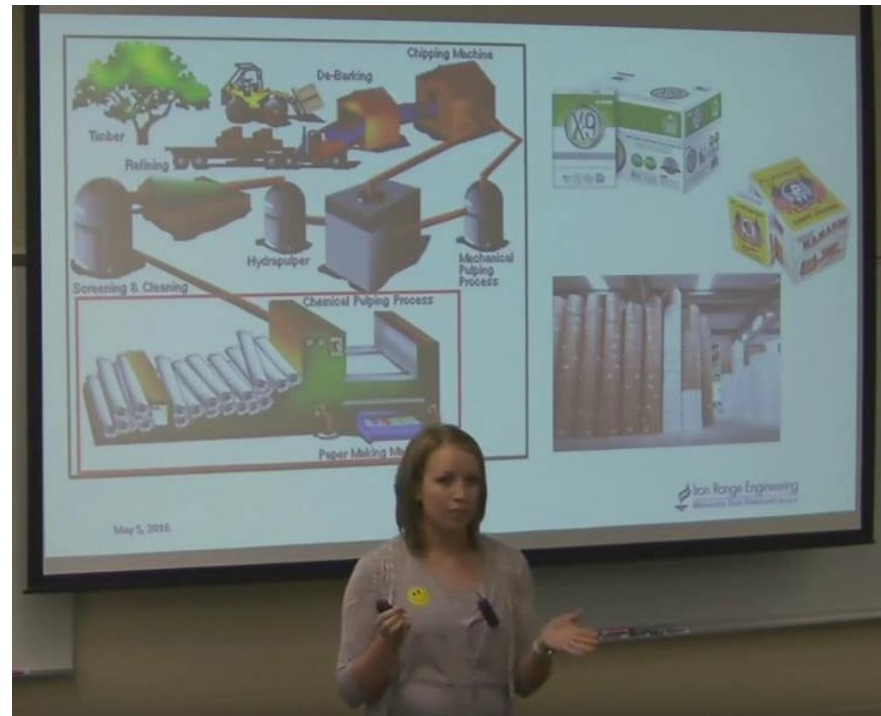
Lectures are flipped. Students watch short videos between classes. Class time is used for conversation about deeper meaning of the concepts.



Integrated Design, Technical, and Professional Learning



PhD professors guide technical learning.
Professors and practicing engineers from
industry facilitate student teams.



ABET Innovation Award 2017



MIT Report 2018

Top 10 Emerging World Leader



MIT News

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Photo: Christopher Harting

Reimagining and rethinking engineering education

New MIT report takes a worldwide look at the future of how engineers are trained.

MIT global state-of-the-art in engineering education study

Top ten emerging leaders of innovation

1. Singapore University of Technology and Design
2. Olin College
3. University College London
4. Pontifical University of Chile
- 5. Iron Range Engineering**
6. National University of Singapore
7. Technical University Delft (Netherlands)
- 8. Charles Sturt University (Australia)**
9. Tsinghua University (China)
10. Arizona State University



BELL PROGRAM

By Iron Range Engineering

What am I taking away from this keynote?

60 second exercise – write down your answer

What will I do differently tomorrow?

60 second exercise – write down your answer

Model of Learning

- Find value: Why are you here?
- Set goals: Write one goal for your learning in this conference.
- Construct knowledge:
- Apply knowledge: How can I apply this knowledge in my teaching or program?
- Relate knowledge to prior learning: How does this knowledge relate to what I already know?
- Reflect and plan future:
What am I taking away from this keynote?
What will I do differently tomorrow?

We must change.

We must change.

**We are the agents of change
who can make it happen.**



IRON RANGE --- ENGINEERING

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November 3, 2019