Using Reflection to Support Student Learning

Cynthia J. Atman, Ph.D.

Director, Center for Engineering Learning & Teaching
Co-Director, Consortium to Promote Reflection in Engineering Education
Professor, Human Centered Design & Engineering
University of Washington

Collaborators
Jennifer Turns, Ph.D.; Jim Borgford-Parnell, Ph.D.; Ken Yasuhara, Ph.D.; Brook Sattler, Ph.D.;
Lauren Thomas, Ph.D.; Julie Elworth, Ph.D.; Mania Orand; Lauren Sepp

CELT
CENTER FOR ENGINEERING LEARNING & TEACHING

CPREE
CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

The blank signature, Magritte, 1965

Outline for today:

- ► What do we mean by reflection?
- ► How does reflection connect to teaching?
- ► Identifying and supporting reflection in engineering education
  - A grant
  - A list
  - A **brief** worked example
  - A url
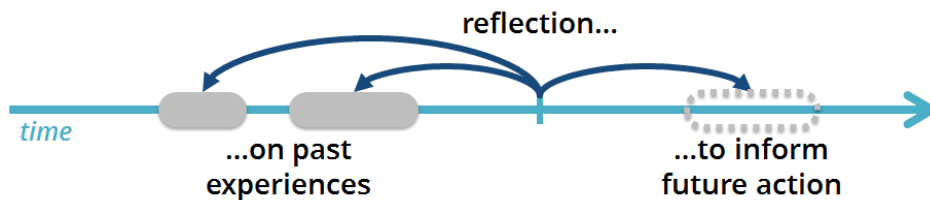
What do we mean by reflection?

reflection...

time

...on past experiences

...to inform future action

Connecting to teaching: from Dance to Dewey

CELT
CENTER FOR
ENGINEERING
LEARNING &
TEACHING

► "Reflective writing can be used to chart student progress over time, helping connect a student's cognitive processes to what occurs during studio practice, thus creating a more comprehensive picture of the student's learning and growth." (Cooper, p. 6, 2013)

► "…students learn by doing, but only when they have time to reflect—the two go hand in hand." (Ambrose, p. 1, 2013)

(Cooper, 2013; Ambrose, 2013)

Atman, 2015 April   5

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Connecting to teaching: from Dance to Dewey

CELT
CENTER FOR
ENGINEERING
LEARNING &
TEACHING

► "People often need help in order to use relevant knowledge that they have acquired, and they usually only need feedback and reflection so that they can try out and adapt their previously acquired skills and knowledge in new environments." (Bransford et al., p. 203, 1999)

► … we must learn to make our own interpretations rather than act on the purposes, beliefs, judgments, and feelings of others…[t]ransformative learning develops autonomous thinking." (Mezirow, p. 5, 1997)

► "To 'learn from experience' is to make a backward and forward connection between what we do to things and what we enjoy or suffer from things in consequence." (Dewey, p. 164, 1922)

(Bransford, Brown, & Cocking, 1999; Mezirow, 1997; Dewey, 1922)

Atman, 2015 April   6

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Connecting to teaching…

► How have you supported student reflection in your teaching?
► Turn to your colleague next to you
  ● Briefly state how you have supported student reflection in your teaching
  ● Please jot down your idea on a sticky note and leave it on a flip chart after the talk

Atman, 2015 April   7

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Our story…

► Two years ago, we proposed that educators like yourselves are already supporting reflection, but we don't hear about because we just don't talk about.
► We proposed a consortium that would give educators a platform for describing their activities.
► We got funded.
► But would it work?

Atman, 2015 April   8

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Our story…

► Two years ago, we proposed that educators like yourselves are already supporting reflection, but we don't hear about because we just don't talk about.

► We proposed a consortium that would give educators a platform for describing their activities.

► We got funded.

► But would it work?

► Yes

Atman, 2015 April   9

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Identifying and supporting reflection in engineering education — a grant

► Consortium to Promote Reflection in Engineering Education (CPREE)

► The Leona M. and Harry B. Helmsley Charitable Trust

► Cataloguing 120 examples of reflection in engineering education across 12 campuses (Year 1)
  ● Field Guides

► Promoting reflection (Year 2)
  ● 18,000 student experiences
  ● 240 educator experiences

Atman, 2015 April   10

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Identifying and supporting reflection in engineering education — starting a list

CELT
CENTER FOR
ENGINEERING
LEARNING &
TEACHING

► Muddiest point or minute cards

► Journaling/prompted writing

► Exam wrappers

► Course reflection

► Portfolios

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Identifying and supporting reflection in engineering education - starting a list at UW

CELT
CENTER FOR
ENGINEERING
LEARNING &
TEACHING

► Characteristics of good team members
  ● Jim Borgford-Parnell, CELT
► Course wrap-up
  ● Alyssa Taylor, BioE
► Presentation design debrief
  ● Kate Mobrand, HCDE
► Choices for successful learning
  ● Sonya Cunningham, CoE STARS
► Exam wrapper
  ● Colleen Craig, Chemistry
► Reflecting on design processes
  ● Cindy Atman; HCDE, CELT

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Adding to the List at UW:
CTL Learning Community this quarter

► Focused on reflection in STEM education
- Various reflection activities
- Motivating students to reflect
- Helping students reflect more effectively
- ...and more

► Thursdays, 1:30–2:20 pm, CTL

► Contact Ken Yasuhara, yasuhara@uw.edu

Atman, 2015 April   13

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Identifying and supporting reflection in
engineering education – an example

► Research findings on design expertise (Atman)

► Leading to ideas to use *reflection* to help students learn about design processes (McDonnell and Atman)

(McDonnell & Atman, 2015)

Atman, 2015 April   14

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION
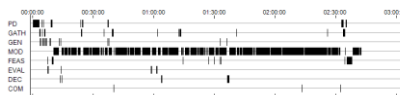
Design research findings…

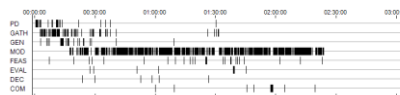First-Year #1 (Quality Score = 0.37)
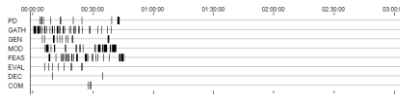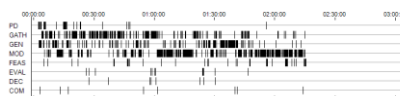
Graduating Senior #1 (Quality Score = 0.38)
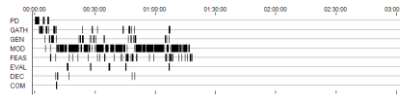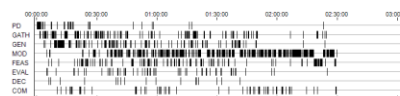
First-Year #2 (Quality Score = 0.45)

Graduating Senior #2 (Quality Score = 0.53)

First-Year #3 (Quality Score = 0.62)

Graduating Senior #3 (Quality Score = 0.63)

(Atman, Chimka, Bursic, & Nachtmann, 1999, Atman, Adams, Cardella, Turns, Mosborg & Saleem, 2007, Borgford-Parnell, Deibel, & Atman, 2010)

Atman, 2015 April

15

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Using Reflection to Teach Design

► Activity: Representing Design
- Create new representations from design timelines
- Do your own design, *reflect* on your experience of designing and represent your own design process

► Activity: Creating Design Memory Aid
- Look back and *reflect* on the activities during the research seminar
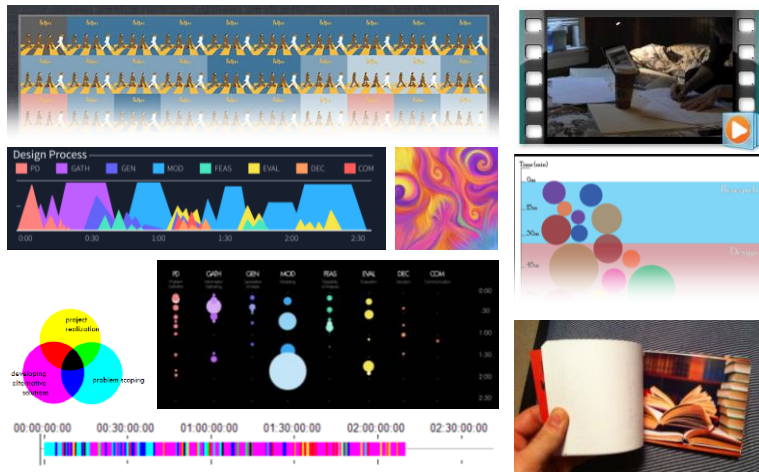- Create a representation to help you remember about design processes in your future career

(Mølhave, McDonnell, & Atman, 2011, McDonnell & Atman, 2015, Atman, McDonnell, Campbell, & Borgford-Parnell 2015)

Atman, 2015 April

16

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Reflecting on design processes:
Representing design

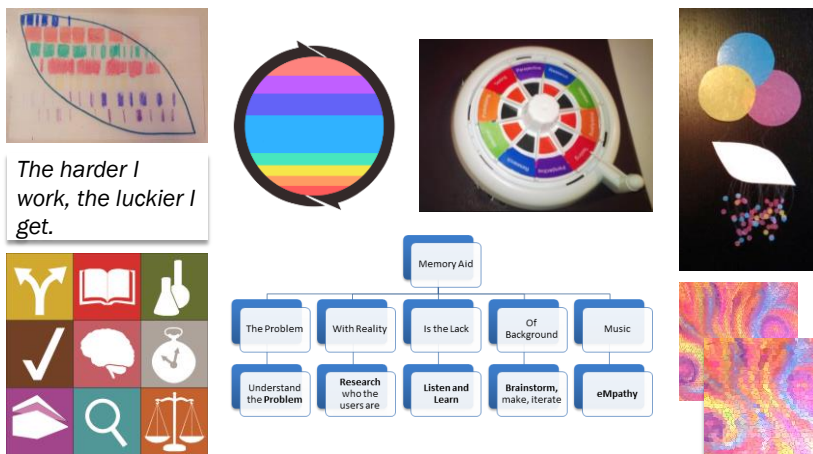Atman, 2015 April   17

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Reflecting on design processes:
Creating design memory aid

The harder I work, the luckier I get.

Atman, 2015 April   18

CPREE   CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

Identifying and supporting reflection— adding to the list

- ► Muddiest point or minute cards
- ► Journaling/prompted writing
- ► Exam wrappers
- ► Portfolios
- ► Feedback forms: What surprised you?
- ► Team experiences as learning
- ► Course wrap-up
- ► Strategy for a class presentation
- ► Have you made good choices today?
- ► Your idea 1
- ► Your idea 2
- ► Your idea 3
- ► ...

Atman, 2015 April 19

CPREE CONSORTIUM TO PROMOTE REFLECTION IN ENGINEERING EDUCATION

CELT
CENTER FOR ENGINEERING LEARNING & TEACHING

Consortium to Promote Reflection in Engineering Education

Cynthia J. Atman

Mitchell T. & Lella Blanche Bowie Endowed Chair

Director, Center for Engineering Learning & Teaching

Co-Director, Consortium to Promote Reflection in Engineering Education

atman@uw.edu

Adding to the list at UW: to participate in CPREE contact:

Ken Yasuhara yasuhara@uw.edu

20

For more Information

► **Reflection**
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). *How people learn: Brain, mind, experience, and school*. National Academy Press.
- Cooper, Betsy. (2013). Reflective Writing/Reflective Practice: Promoting Engaged Learning and Student Confidence in the Beginning Ballet Class. *Journal of Dance Education, 13*:1, 4-11,
- Dewey, J. (1922). *Human nature and conduct: An introduction to social psychology*. Carlton house.
- Mezirow, J. (1997). Transformative Learning: Theory to Practice. *New Directions for Adult and Continuing Education*, *1997*(74), 5–12. doi:10.1002/ace.7401
- Undergraduate engineering curriculum: The ultimate design challenge. *The Bridge: Linking Engineering and Society*. (2013)

► **Design**
- Atman, C. J., Chimka, J. R., Bursic, K. M., & Nachtmann, H. L. (1999). A comparison of freshman and senior engineering design processes. *Design Studies, 20*(2), 131-152.
- Molhave, A., McDonnell, J., & Atman, C. J. (2011). Seeing and Hearing Design: Elucidating the Design Process – A Workshop at Central Saint Martins College of Art and Design (Technical Report No. CELT-11-03). Seattle, WA, USA: Center for Engineering Learning & Teaching, University of Washington.
- Atman, C. J., Adams, R. S., Cardella, M. E., Turns, J., Mosborg, S., & Saleem, J. (2007). Engineering Design Processes: A Comparison of Students and Expert Practitioners. Journal of Engineering Education, 96(4), 359.
- Borgford-Parnell, J., Deibel, K., & Atman, C. J. (2010). From Engineering Design Research to Engineering Pedagogy: Bringing Research Results Directly to the Students. International Journal of Engineering Education, 26(4), 748.
- Atman, C. J., Hayes, B., Richey, W., Wang, C., & Campbell, R. C. (2013). Designing Your Personal Design Process: Report from HCDE Directed Research Group January to March 2013 (Technical Report No. CELT 13-01). Seattle, WA, USA: Center for Engineering Learning & Teaching, University of Washington.
- Atman, C. J., Arnesen, B., Bulajewski, E., Chang, S., Jones, M., Lew, A., & Campbell, R. C. (2014). Designing Your Design Process: Report from HCDE Directed Research Group September to December 2013 (Technical Report No. CELT 14-01). Seattle, WA, USA: Center for Engineering Learning & Teaching, University of Washington.
- Atman, C. J., McDonnell, J., Campbell, R. C., Borgford-Parnell, J. L., & Turns, J. (2015). Using Design Process Timelines to Teach Design: Implementing Research Results. In Proceedings of the American Society for Engineering Education (ASEE) Annual Conference (pp. 1–30). Seattle, WA, USA: American Society for Engineering Education.
- McDonnell, J. & Atman, C.J. (2015). *Paying attention to the design process: Critically examining personal design practice.* LearnxDesign Conference. June 28-30, 2015. Chicago, Il.

► **CPREE**
- Turns, J., Sattler, B., Yasuhara, K., Borgford-Parnell, J. (2014). Integrating Reflection into Engineering Education. In *ASEE Annual Conference and Exposition*. Retrieved from http://www.asee.org/file_server/papers/attachment/file/0004/4292/Integrating_Reflection_-_ASEE_2014_-_Final.pdf
- Turns, J., Sattler, B., Thomas, L., Atman, C., Bankhead, R., Carberry, A, Csavina, K., Cunningham, P., Faust, D., Harding, T., Yasuhara, K. (2015). Reflecting on reflection: How educators experience the opportunity to talk about supporting student reflection. In *ASEE Annual Conference and Exposition*.
- Sepp, L., Orand, M., Turns, J., Thomas, L., Sattler, B., Atman, C. (2015). On an Upward Trend: Reflection in Engineering Education. In *ASEE Annual Conference and Exposition*.
- Orand, M., Sattler, B., Turns, J., Thomas, L., (2015). Engineering Education meets Human-Computer Interaction (HCI): Exploring how the work on "probes" can guide the design of reflection activities. In *ASEE Annual Conference and Exposition*.

CPREE acknowledgments

The blank signature, Magritte, 1965