Fostering Self-Direction through Design, Technology, and Research (DTR)

Haoqi Zhang

slides+readings: haoqizhang.com

Delta Lab | Design, Technology, and Research (DTR) | Northwestern University

Design, Technology, and Research (DTR)

I want to be better at getting feedback
from myself.

Navin

• Ask for help more often &
without excessive hesitation.

• Get better at ~~conduct~~ using lit
to drive work.

Be aware/ of when my emotions
curious
are leading to reactions &
step back from my emotions to plan
whats actually helpful. RYAN

Outcomes (11 yrs)

- 176 students (152 UG, 11 MA, 15 PhDs) who led 70+ research projects.

- 50% women!

- 73 undergraduate research grants

- 30 papers + extended abstracts; 7 winners at major ACM Student Research Competitions

- Many DTR undergraduates placed at Apple, Google, Microsoft, Meta, and Amazon; others have founded their own companies.

Success beyond Northwestern

✤ Founded Agile Research University (ARU) to support 70+ faculty at universities across the world using the Agile Research Studios model (even in the humanities!)

✤ Produced the DTR documentary, *Forward* See: http://forward.movie

✤ DTR annual letters to start deeper conversations on mentoring and learning See: http://dtr.northwestern.edu/letters
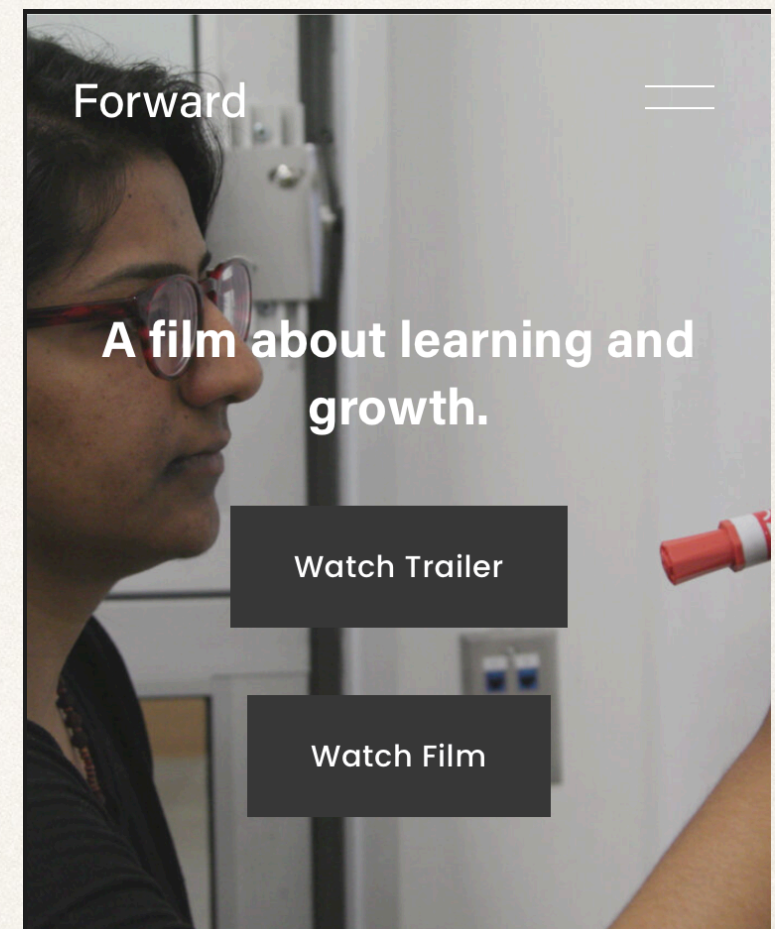
Thanks so much for teaching me how to advocate for myself & my ideas, embrace failure & inexperience & search for truth rather than bullshit.
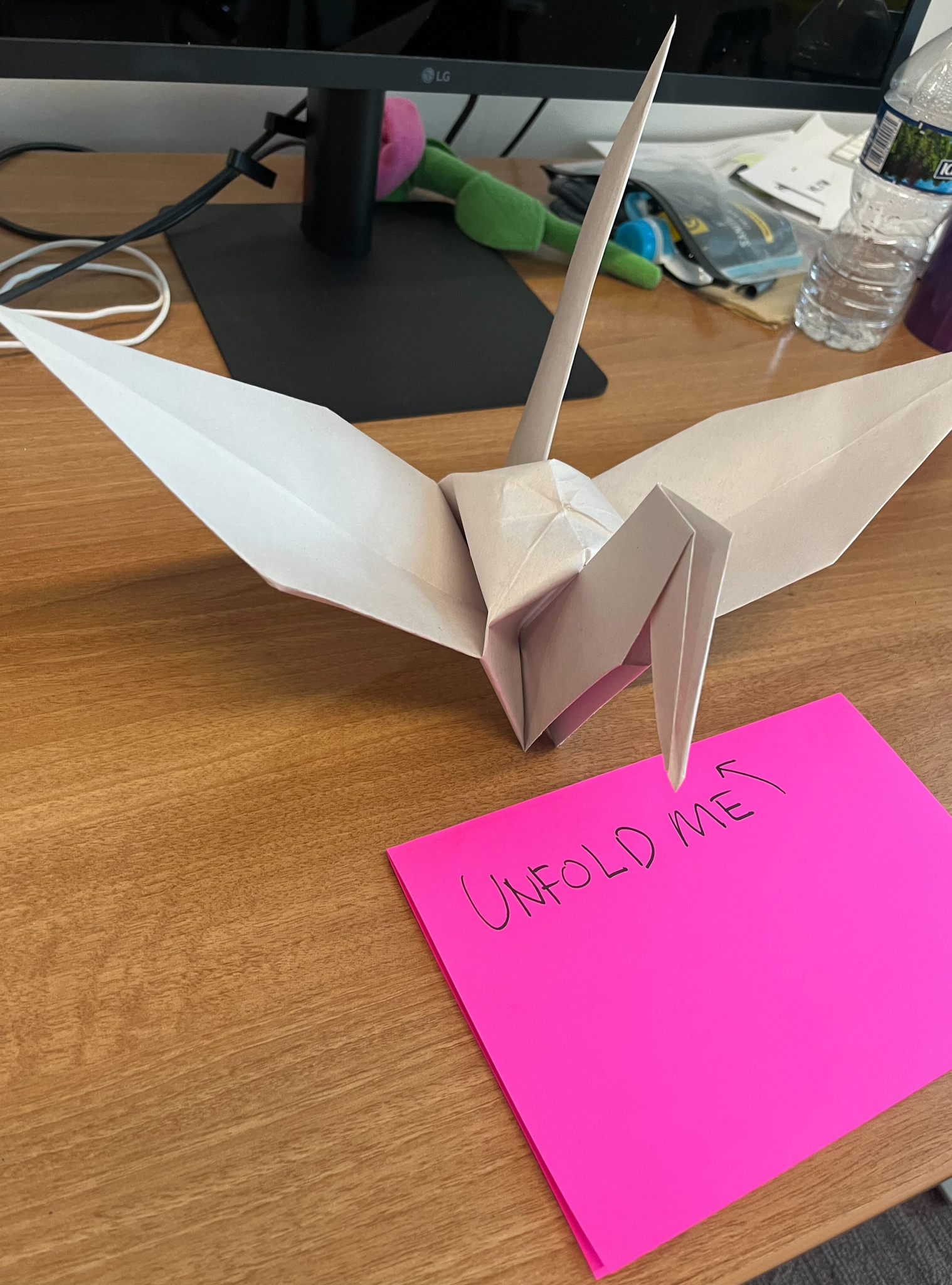
Hi Haoqi,

Thank you! for how much you genuinely care about & pay attention to not just our work, but our development as researchers & as people.

As undergrads, we found home in DTR. It means more than we can say. Thank you for making DTR available to us. It's more than a class or research experience — it shaped our perspectives & helped us see new ways of being.
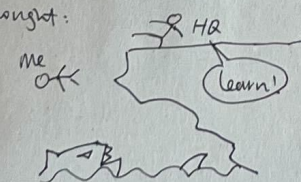
I came in trying to impress. I'm leaving trying to understand. DTR taught me that beyond doing shit furiously as if it makes meaning, we can chart a path incrementally & deliberately towards truth. This has be a place of "no familiar scars, no broken hearts. This territory goes uncharted." (Uncharted — Sara Bareilles) with the terrifying & liberating freedom to not know.

I've learned to hold onto my values when everything's loud, to push (eh!) when I believe in something — not because I'm supposed to — & to care for myself & those around me while doing it. I never expected to be given the tools to see, test, & sharpen even my most ingrained "flaws" — my stubbornness, burnout, flowy-flowy instincts — & hold them with both honesty & compassion.
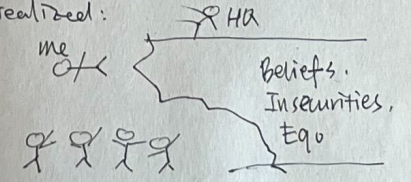
Thank you for providing the space to discover the warmth & weirdness inside me. With clarity, you helped me see who I was — & who I could be. In witnessing you building a living ecosystem so bold, rigorous, & full of heart like DTR, I started to believe I could build the world that I wish to see. I feel safe to have always had an amazing mentor to have my back as I stepped into research. Thank you, for everything. I couldn't have asked for a better 2 years.

People say that "HQ has a tough style of mentoring". However, no matter how much I tried to prepare myself, I certainly didn't expect to get kicked off a metaphorical cliff.

I thought: HQ   I realized: HQ
me (learn!)   me   Beliefs.
                                      Insecurities.
                                      Ego.

Until DTR, I had no awareness of how I was tormenting myself or how closed off I was from the world. I came in needing desperately to prove myself, telling myself that I NEEDED to get somewhere. It never occurred to me that a gentler approach was even possible, let alone effective. You taught me to pay attention & help me become more perceptive of the wonderful world around me. Thank you, for giving me the tools to become more self-aware & be able to reflect more meaningfully on what it means to be true to myself.

Best Wishes to Haoqi & DTR.

I've learned to hold onto my values when everything's loud, to push (eh!) when I believe in something — not because I'm supposed to — & to care for myself & those around me while doing it. I never expected to be given the tools to see, test, & sharpen even my most ingrained "flaws" — my stubbornness, burnout, flowy-flowy instincts — & hold them with both honesty & compassion.

Thank you for providing the space to discover the warmth & weirdness inside me. With clarity, you helped me see who I was — & who I could be.

Rest of the talk

✤ Structuring research training

    ✤ Deepening practice

        ✤ Fostering self-direction
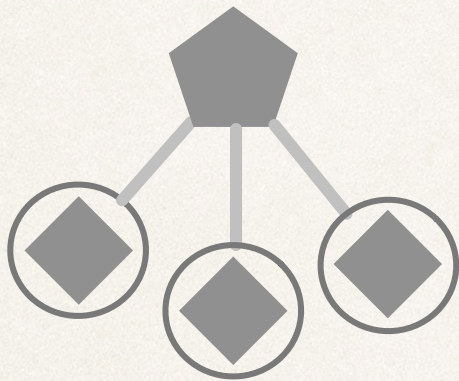
Structuring research training

Design, Technology, and Research (DTR)
Spring 2014

Design, Technology, and Research (DTR)
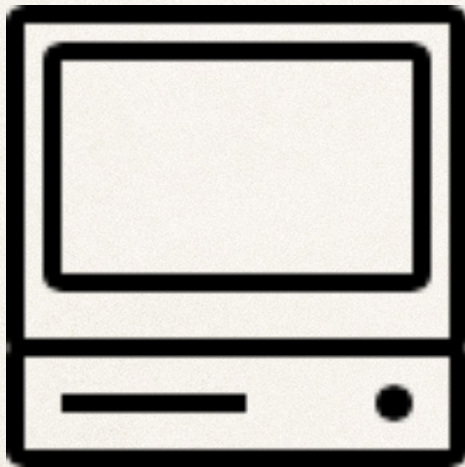
Winter 2016

Best human solution

Apprenticeship

"apprenticeship requires a very small teacher-to-learner ratio that is not realistic in the large educational systems of modern economies."

[Collins & Kapur, 2005]

Best machine solution

No AI technology can replace the mentor in the foreseeable future.

[Jarvela & Hadwin, 2013]

Options

✤ Wait for a technological silver bullet

✤ Compromise

✤ Or…?

Students need regulation skills

* **Regulation skills**: cognitive, metacognitive, motivational, and emotional skills for reaching a goal *[Jarvela & Hadwin. 2013]*

* Independent research requires regulation skills including **planning** and **seeking help** to overcome challenges.

* Students lacking these skills are confined to rote tasks, or can struggle to make progress.
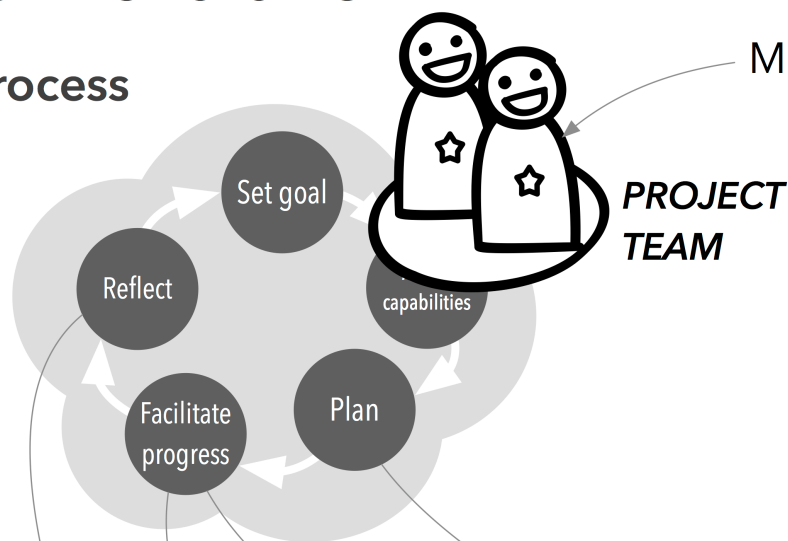
Agile Research Studio (ARS)

[Z. et al.]

✤ Model for research training in a learning community

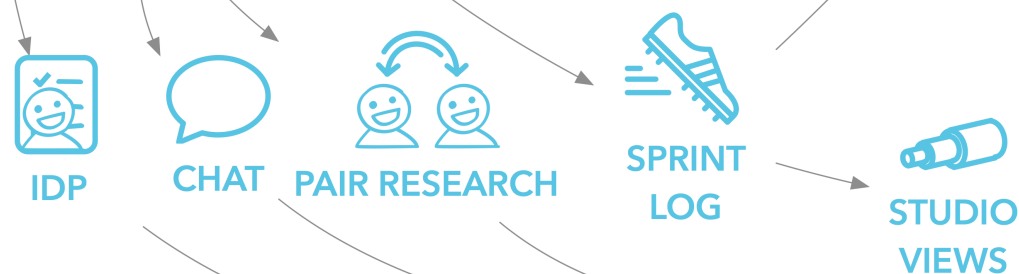✤ All students, regardless of seniority, conduct independent research and receive authentic research practice.

Project cycle

Set goal

Learn

Plan

Make progress

Reflect
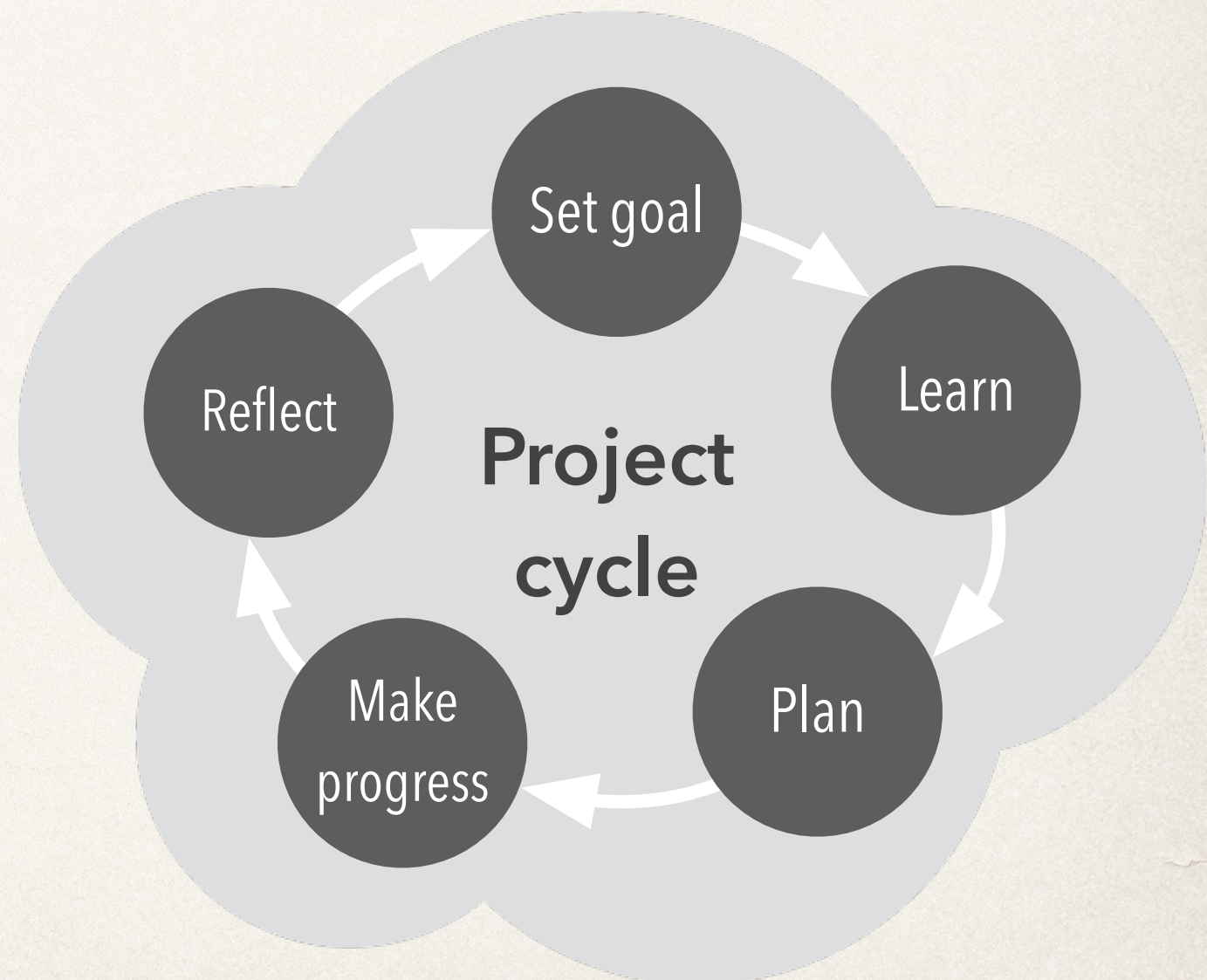
Agile Research Studio (ARS): a socio-technical model for developing regulation skills
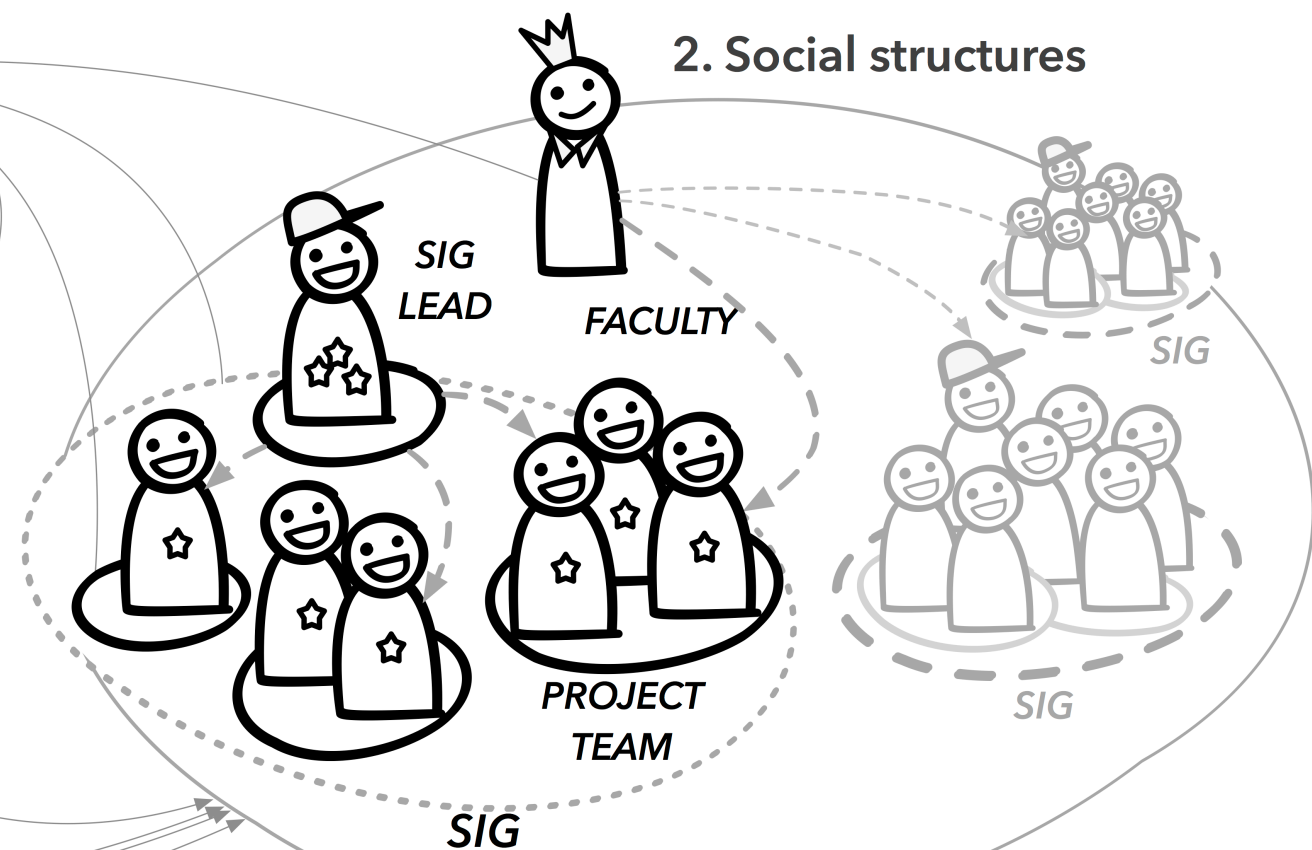
[Z., Easterday, Gerber , Rees Lewis, Maliakal]

ARS transforms student and faculty's roles

Apprenticeship

Hierarchical, 1:1:1

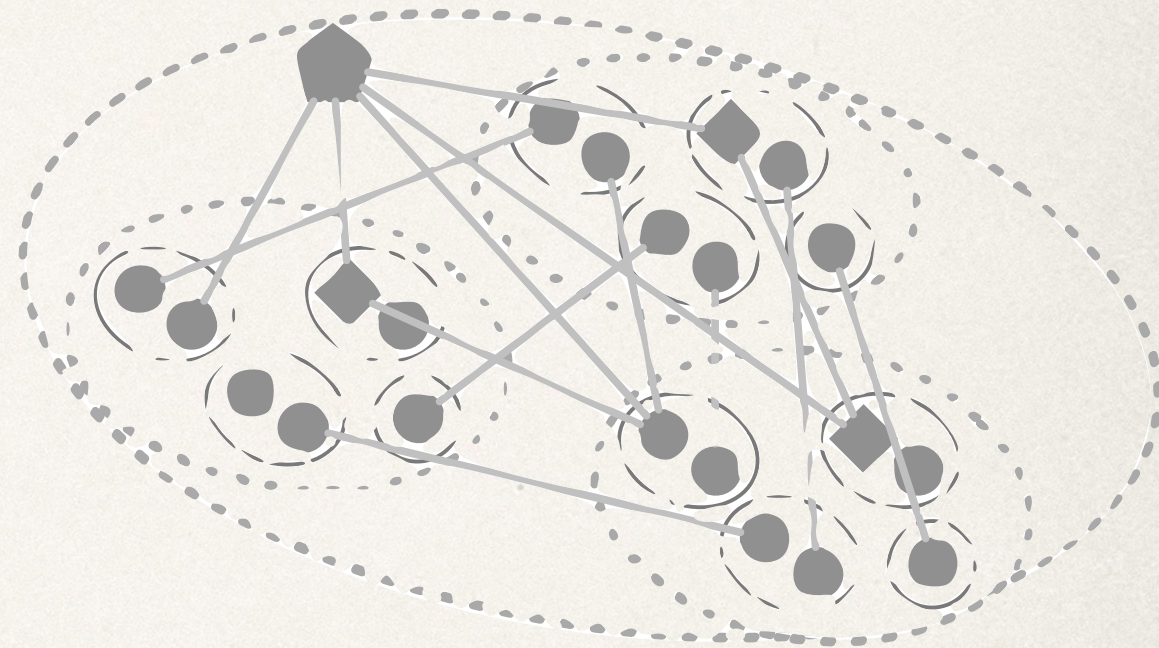The ARS approach:
Dispersed Control
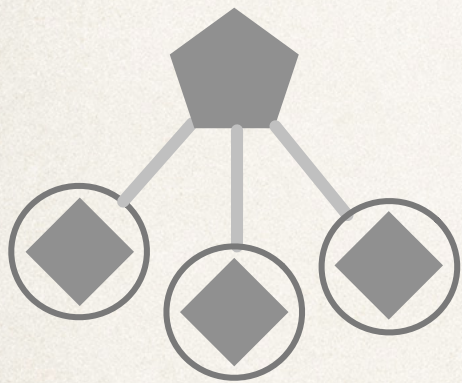
very small teacher
to student ratio
[Collins, 2005]
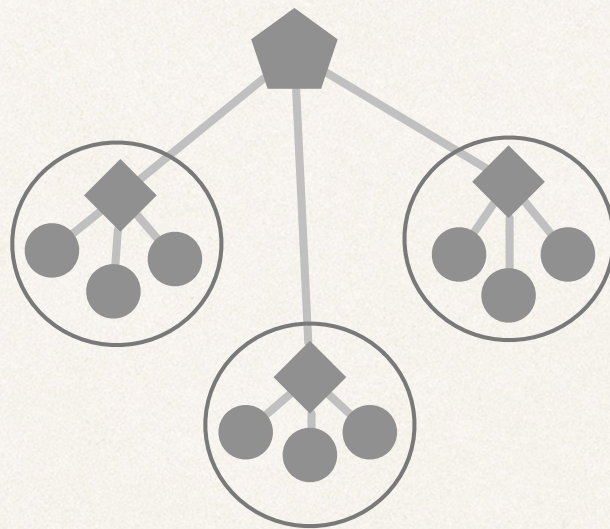
grad students are
novice mentors
[Shulman, 1986]

overcome 1:X
[Bain & Weston, 2012]

ARS: planning

Process:
Sprint planning

2 weeks

Social structure:
SIG meeting

Studio tool:
Sprint log
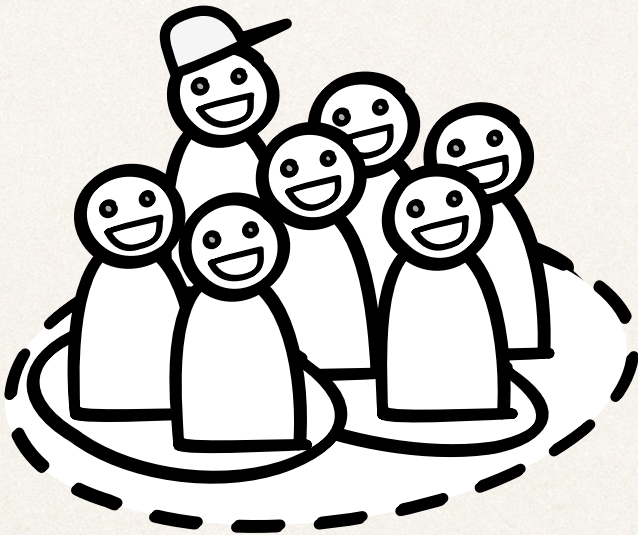
Team	Points Available	Points Committed	D	T	R	Hours Spent	D	T	R	Progress
Leesha	35	35	12	8	15	19.75	5	7	8	56%
Christina	16	19	1	17	2	6	1	6	0	32%
Total	51	54	13	25	17	25.75	5.75	13	8	48%

Stories	Tasks for Story	Points Required	D	T	R	Assigned To	Status	Hours Spent	Helpful Links
Have a functional tracking protoype that can track a runner's location and prepare data to be sent to a cheerer	start entering tasks for this story on the next line ↓	17	mark	mark	mark	enter your name below to pick up tasks ↓	mark as: in progress, backlogged, or done		
	pseudocode tracking protocol & structs	1		x		Leesha	done		pseudocode doc
	read Swift guide for protocols/syntax	2		x		Leesha	done	2	swift protocol docs
	go through Ray Wenderlich tutorial on POP	2		x		Leesha	backlogged		protocol oriented programming
	implement tracking protocol & structs	3		x		Leesha	in progress	5	
	implement tracking protocol & structs	5		x		Christina			
	Test tracking for cheerer	0.5		x		Christina			
	test tracking for runner	0.5		x		Christina			

Planning Strategies

✤ assessing risks
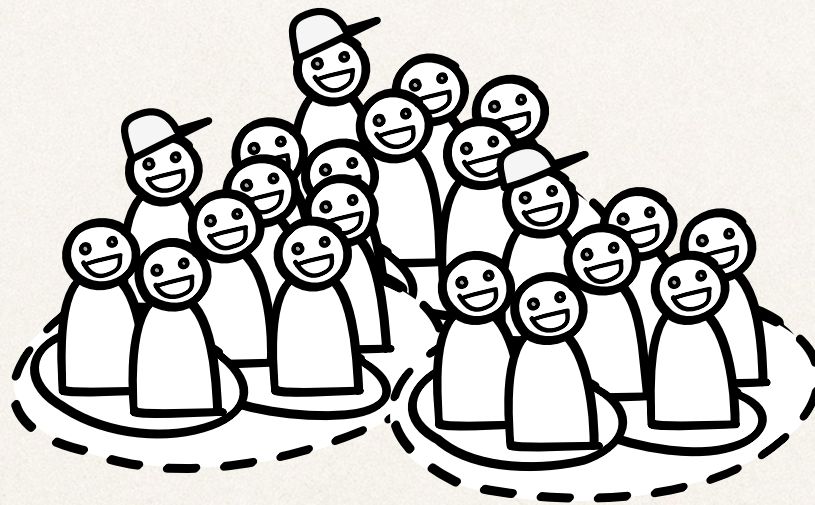
✤ using effective representations for thinking about problems and solutions

✤ building at the appropriate fidelity

✤ prioritizing important features and research questions

✤ moving on despite uncertainty or imperfect knowledge.

ARS: Help & Collaboration

Process:
Distributed help
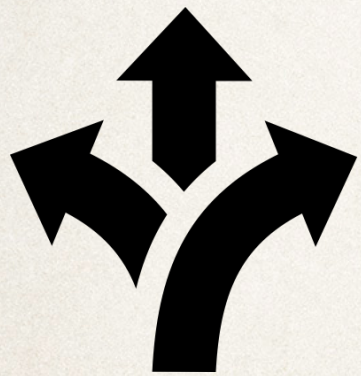
Social structure:
Studio meeting

Studio tool:
Pair research

[Miller, Z., Gilbert, Gerber]

Help & Help-seeking

✣ *"I can ask for help and that everyone asks for help and it doesn't make them stupid to need help."*
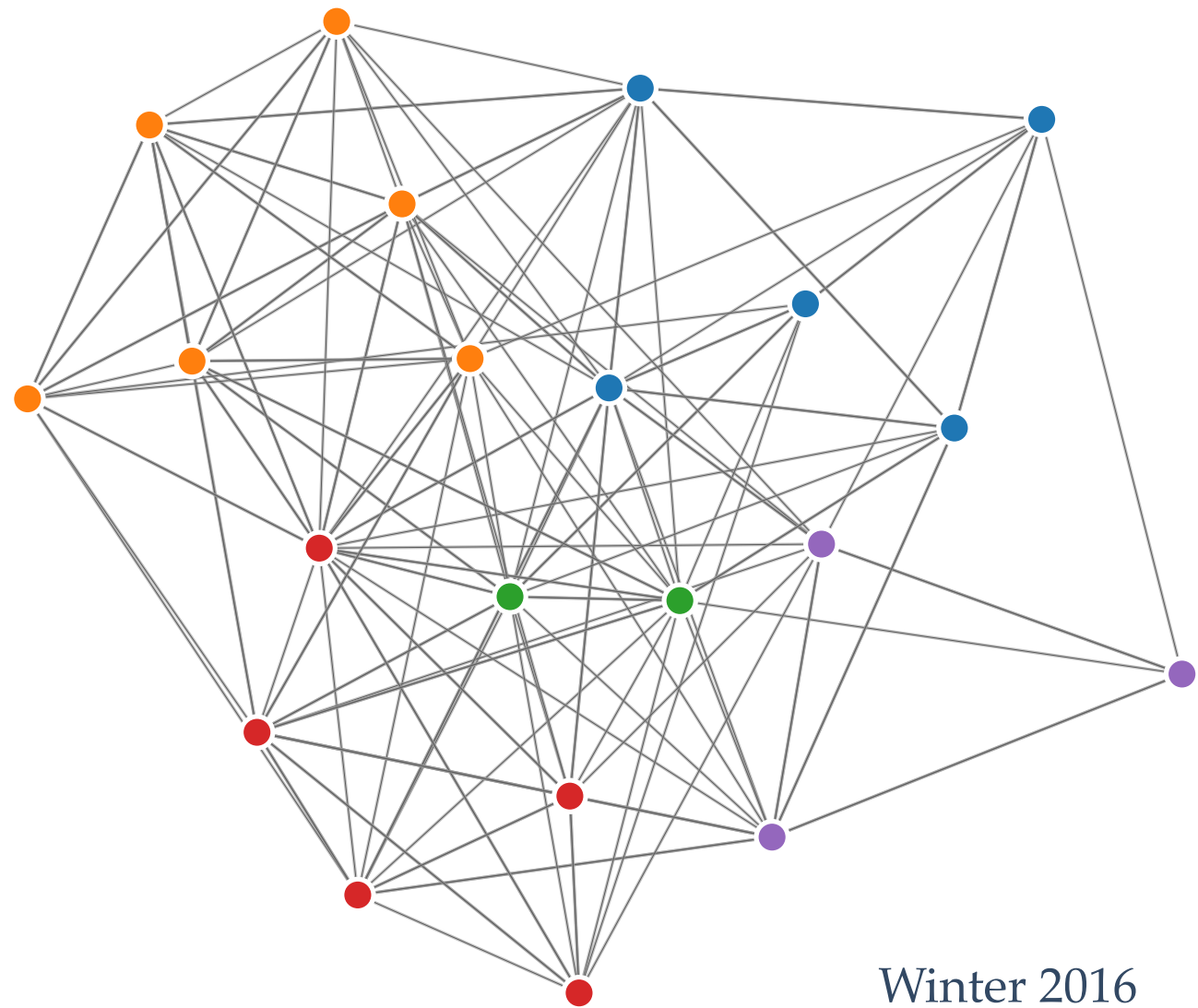
Summary: Structuring Practice

✤ Develop regulation skills for research planning and help-seeking across structured interactions

✤ Extends the scale and capacity of a community to produce and learn

Deepening Practice

Developing regulation skills for building a self-directed (research) practice

Cognitive skills

✤ representing problem and solution spaces
✤ assessing risks
✤ critical thinking and argumentation
✤ core design, research, and STEM methods

Metacognitive skills and dispositions

✤ planning: forming feasible plans and planning effective iterations
✤ help-seeking: leveraging resources; seeking help; communication skills
✤ reflection: awareness of one's own skills, abilities, and metacognitive blockers

Emotional regulation and disposition toward self and learning

✤ emotional regulation: understanding one's fears and anxieties
✤ disposition: dealing with failure, embracing challenges, embracing self-direction

Challenge #1: understanding and address the gaps in students' practice and regulation is **really complicated.**
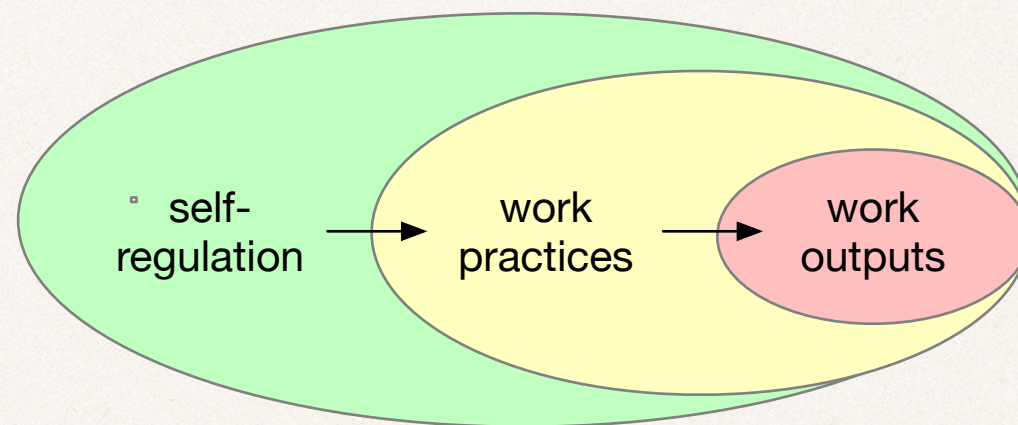
self-regulation → work practices → work outputs

- 🔴 task-focused
- 🟡 practice-focused
- 🟢 regulation-informed practice

Claim: Students and coaches tend to over-focus on issues in work output, than on understanding a students' practice and regulation

not enough attention here

mostly here

- self-regulation → work practices → work outputs

- 🔴 task-focused
- 🟡 practice-focused
- 🟢 regulation-informed practice
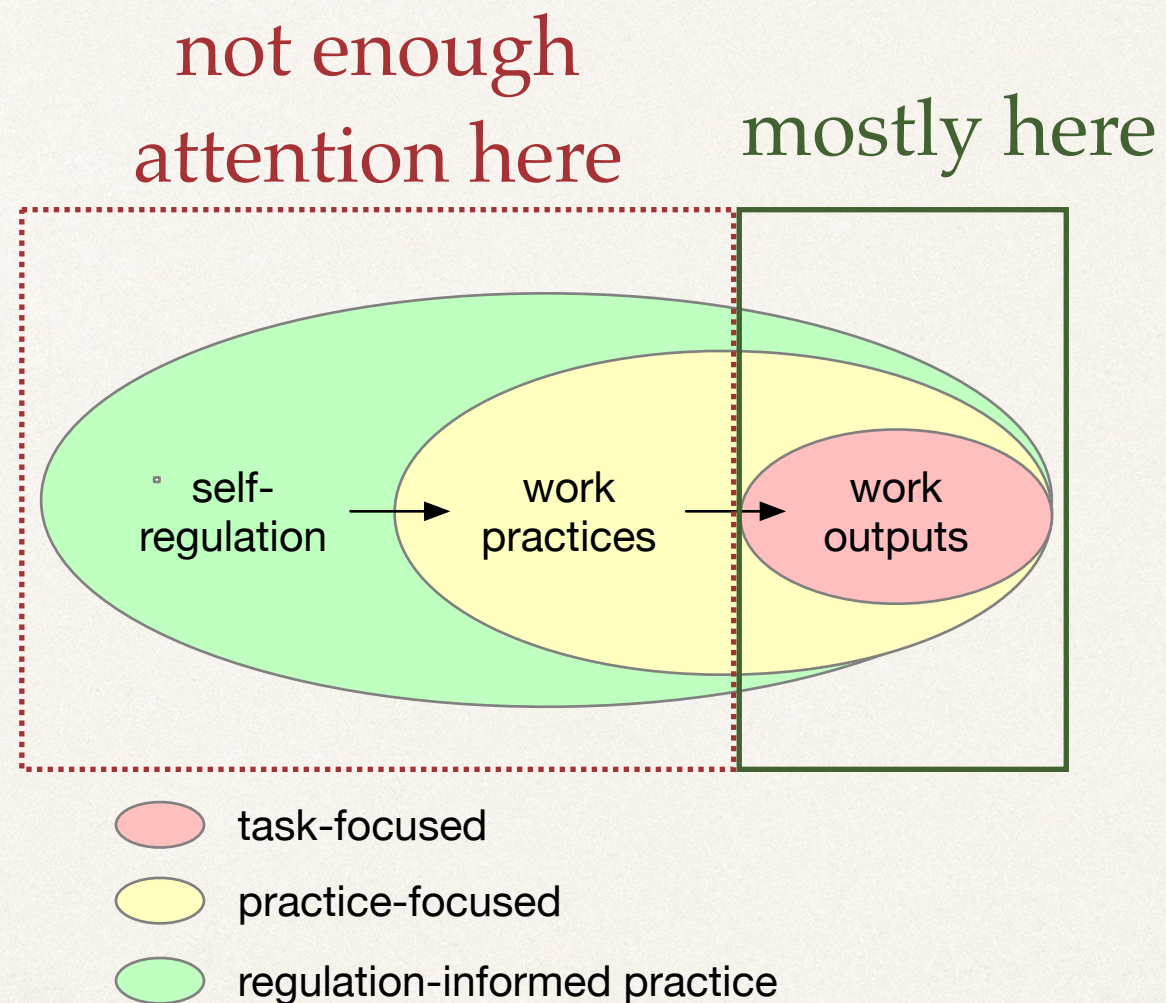
Interactive CAP Notes

[Garg, Gergle, Z., under review]

Stella, Coaching Session, End of Sprint 2

B Issues of concern:

prototype is missing a key feature

did not seek help on prototyping in pair research

A **Practice Trace**

[latest prototype](#)

[design argument](#)

[practice reflections](#)

C **Context**: what are you seeing and hearing?
- Stella: *"I am worried about getting the prototype working in time for testing"*
- Not prototyping to the design hypothesis
- Spent a lot of time building backend features

E **Stella's tracked regulation gaps**

D **Assessment:** what is happening?
- Didn't use lo-fi prototyping techniques to deliver value more quickly
- [gap] need strategies for slicing work to risk
- [gap] has a tendency to crank than to consider better strategies when overwhelmed

not slicing work to risk to more quickly advance learning

has a tendency to "crank" than to apply better strategies when overwhelmed

F **Plan:** what do we do about it?
- [work] build a lo-fi prototype that includes missing feature and test that this week
- [plan] use planning-to-iterate to slice prototype to risk this week.
- [reflect] what are some signs that you may be overwhelmed, and reacting to it by cranking?

not seeking help on key practice risks

Practice Objects for tracking practice and regulation [Garg, Gergle, Z., under review]

Practice Object

coaching meeting

CAP Notes

student practices and reflects

next coaching meeting

Work Issues

Prototype missing key feature

didn't seek help on prototyping

Tracked Regulation Gaps

slicing work to risk

…

cranking out work

Regulation Gaps

need strategies for slicing work to risk

tends to crank than use better strategies

Suggested Practices

use planning-to-iterate to slice prototype to risk

reflect: what are signs that you're cranking?

Practice Traces

prototyping plan

new prototype

slicing reflection

signs of cranking

work reflection

Creating space for learning about regulation

* See students and build strong relationships

* Hold space for reflection, sharing, and acceptance

* Recognize that patterns + beliefs recur, and can be quite sticky

* Value developing regulation skills over production

* Problematize how students approach problems and look at themselves (see "Interruption, Discord, and Drama" in 2025 DTR letter)

Challenge #2: Seeing and acting on the *good* of engaging in research

✤ Dancing with not knowing

✤ Re-examining phenomenon

✤ Re-examining beliefs and worldviews

✤ …

see: "The Good" and "Beyond Production" in the 2024 & 2025 DTR annual letters

These goods are largely not about producing research, but about how we engage with it, deeply.

Parallel: Historical Thinking

Sam Wineburg

"Historical thinking in its deepest form is neither a natural process nor something that springs automatically from psychological development. [But it] teaches us what we cannot see, to acquaint us with the congenital blurriness of our vision."

Learning to engage deeply in intrinsically valuable human activities

---

✤ **Dialectical activities**: human activities that are valuable for their own sake [Brewer, The Retrieval of Ethics, 2008].

✤ **Examples**: parenting, relating to other human beings, making art or music, conducting research, …

✤ Engage with an imperfect sense of their **good** and place in our lives.

✤ Self-unveiling: deepen understanding of activity's ideals by acting in pursuit of its ideals

Learning to engage deeply in intrinsically valuable human activities

✤ **Key Question:** How does a person come to engage more deeply, so as to deepen their grasp of the good in the activity in which they are engaged?

Learning to engage deeply in intrinsically valuable human activities
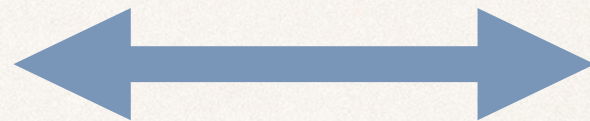
Personal Growth ⟷ Deepening Engagement

In DTR, the research process is a vehicle for shifting patterns. I see the developmental process within DTR as one of finding a greater range of movement.

"Movement," 2025 DTR Annual Letter

Learning to engage deeply in intrinsically valuable human activities
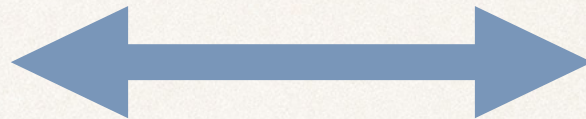
Personal Growth ⟷ Deepening Engagement

Fear of not being good <==> Production-Orientation

Fear of imperfection <==> Running away from what's actually important in the research

Fear of not knowing <==> Grasping onto existing ways of doing and knowing

Creating space for learning to engage deeply

✤ Focus on understanding oneself *and* engaging deeply

✤ "You do not have to be good"

✤ Model engaging deeply, and vulnerably <- can't fake this

Until PTR, I had no awareness of how I was tormenting myself or how closed off I was from the world. I came in here needing desperately to prove myself, telling myself that I NEEDED to get somewhere! It never occurred to me that a gentler approach was even possible, let alone effective. You taught me to pay attention & help me become more perceptive of the wonderful world around me. Thank you. for giving me the tools. to become more self-aware & be able to reflect more meaningfully on what it means to be true to myself.

Summary: deepening practice

✤ Understanding and coaching regulation as we facilitate students seeing themselves and working with their patterns

✤ Understanding that personal growth and engaging deeply go hand in hand

Fostering self-direction

What is self-direction?

What is self-direction?

Core Concepts	Description	Examples of Related Concepts
Self-regulation	Cognitive, motivational, emotional, metacognitive, and strategic behaviors for reaching desired goals and outcomes (Zimmerman, 2000; Järvelä & Hadwin, 2013)	Metacognition; mindset; planning; socio-emotional learning; intrinsic motivation; self-determination theory; autonomy supportive
Dialectical understanding	Understanding oneself and learning to live up to values one endorses (Brewer, 2009).	Narrative identity; life stories; self-actualization; introspection; virtue; dialectical activities
Aspiration	The transforming of oneself into another, desired self (Callard, 2018).	Becoming; identities and aspirational selves

Core theoretical concepts on three facets of self-direction:

self-regulation, dialectical understanding, and aspiration.

DTR uses research as a vehicle for fostering self-direction

Cognitive skills

❖ representing problem and solution spaces
❖ assessing risks
❖ critical thinking and argumentation
❖ core design, research, and STEM methods

Metacognitive skills and dispositions

❖ planning: forming feasible plans and planning effective iterations
❖ help-seeking: leveraging resources; seeking help; communication skills
❖ reflection: awareness of one's own skills, abilities, and metacognitive blockers

Emotional regulation and disposition toward self and learning

❖ emotional regulation: understanding one's fears and anxieties
❖ disposition: dealing with failure, embracing challenges, embracing self-direction

I've learned to hold onto my values when everything's loud, to push (ehl.) when I believe in something — not because I'm supposed to — & to care for myself & those around me while doing it. I never expected to be given the tools to see, test, & sharpen even my most ingrained "flaws" — my stubbornness, burnout, flowy-flowy instincts — & hold them with both honesty & compassion.

Thank you for providing the space to discover the warmth & weirdness inside me. With clarity, you helped me see who I was — & who I could be.

Thanks so much for teaching me how to advocate for myself & my ideas, embrace failure & inexperience & search for truth rather than bullshit.

Congrats!

Until DTR, I had no awareness of how I was far off I was from the world. I came in me need telling myself that I NEEDED to get somewher a gentler approach was even possible, let alone attention & help me become more perceptive of th Thank you for giving me the tools to become more more meaningfully on what it means to be true to myself.

What success looks like...

Kalina Silverman

Meg Grasse

Katherine Lin

On Becoming a Person

Carl Rogers

This process of the good life is not, I am convinced, a life for the faint-hearted. It involves the stretching and growing of becoming more and more of one's potentialities. It involves the courage to be. It means launching oneself fully into the stream of life. Yet the deeply exciting thing about human beings is that when the individual is inwardly free, [they] choose as the good life this process of becoming.

On Becoming a Person

Learning at large

What if fostering self-direction
was central to education?

Fostering self-direction in diverse learning spaces

Setting	Individuals Interviewed
Early Childhood and K-12	Kathryn Owen, *director,* Early Care and Education at UCSD Jiye (Amy) Oh, *autism education associate*, Alexa's PLAYC Julie Lythcott-Haims, *author* of How to Raise an Adult Christine Carter, *author* of The New Adolescence
Arts Education	William O'Brien, *art professor,* Art Institute of Chicago Elizabeth Wepsic, *chair of visual arts,* The Bishop's School Antonio Douthit-Boyd, *artistic director of dance*, COCA Ann Cooper Albright, *dance professor,* Oberlin College
Contemplative Practice	Trudy Goodman, *meditation teacher and founder,* InsightLA Chase Bossart, *director,* Yoga Well Institute. Tierney Lawson, *yoga facilitator*, Prison Yoga Project.
Therapy & Other Healing Modalities	Will Stillwell, *group facilitator,* Center for Studies of the Person Sara Schairer, *founder and executive director*, COMPASSION IT
Work, Careers, & Entrepreneurship	Alex Waters, *director,* CONNECT ALL @ the Jacobs Center Matt Rivaldi, *faculty*, San Diego College of Continuing Education

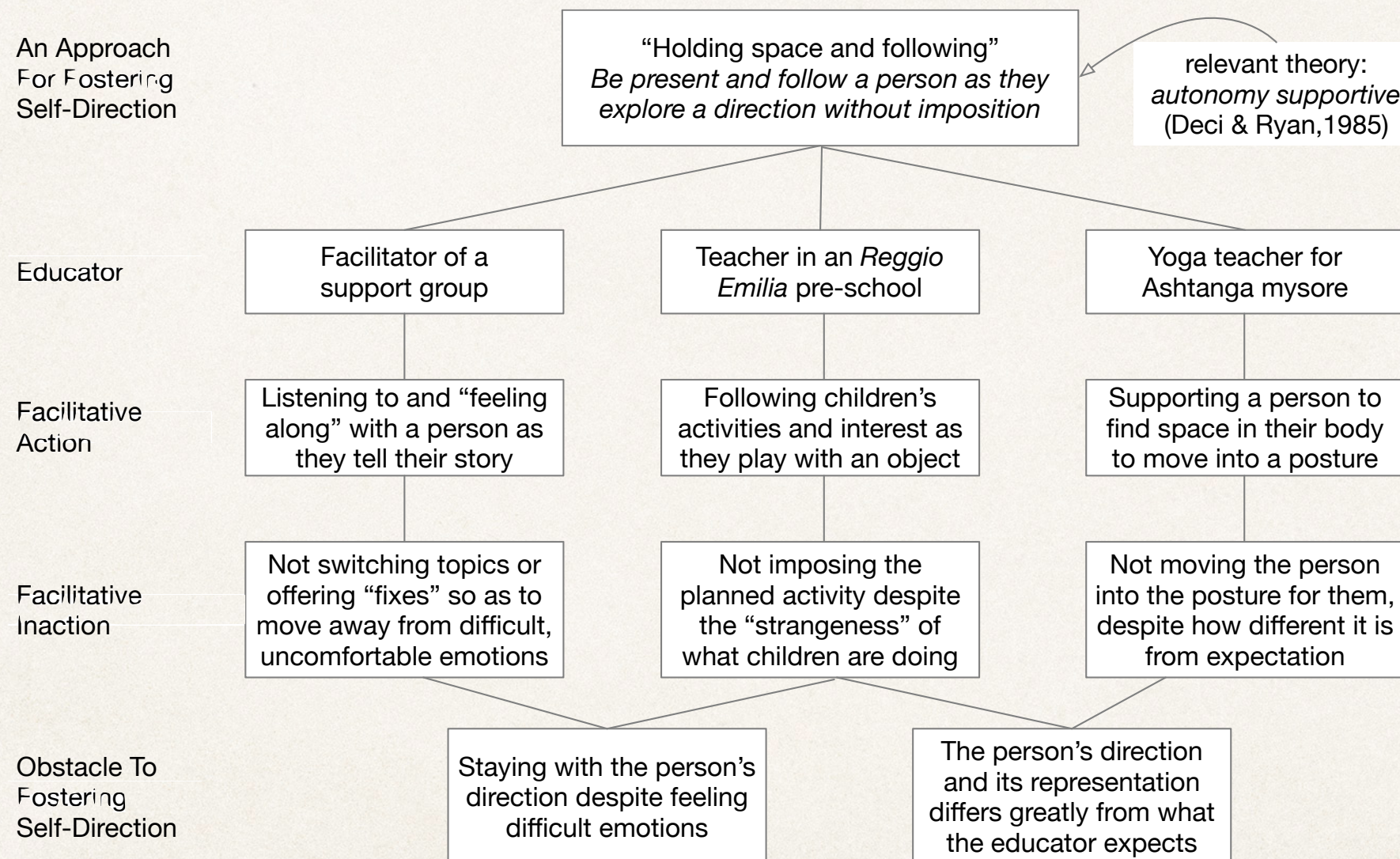# Fostering self-direction across learning domains

Figure: Illustration of a thematic analysis of the "holding space and following" approach to fostering self-direction across three distinctive settings.

Vision: centering self-direction across learning spaces, disciplines, and lifespan

thank you

DELTALAB

Haoqi Zhang

@hqz

dtr.northwestern.edu/letters
forward.movie
agileresearch.io

dtr.northwestern.edu
delta.northwestern.edu

slides+readings: haoqizhang.com

References

DTR and Agile Research Studios

✤ Allan Collins and Manu Kapur. Cognitive apprenticeship. In R. K. Sawyer (Ed.) Cambridge Handbook of the Learning Sciences (2nd Edition). Cambridge University Press, 2014.

✤ Sanna Jarvela and Allyson F. Hadwin. New frontiers: Regulating learning in CSCL. Educational Psychologist 48, 1 (2013), 25–39.

✤ Lee Shulman. Those who understand: Knowledge growth in teaching. Educational researcher 15.2 (1986): 4-14.

✤ Alan Bain and Mark Weston. 2012. The learning edge: What technology can do to educate all children. Teachers College Press.

✤ Robert C. Miller, Haoqi Zhang, Eric Gilbert, and Elizabeth Gerber. Pair Research: Matching People for Collaboration, Learning, and Productivity. Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '14), 2014.

✤ Haoqi Zhang, Matthew W. Easterday, Elizabeth Gerber, Daniel Rees Lewis, and Leesha Maliakal. Agile Research Studios: Orchestrating Communities of Practice to Advance Research Training at Scale. Proceedings of the 20th ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW 2017), 220–232.

✤ Agile Research University: Supporting Authentic Research Experiences at Scale. http://agileresearch.io

✤ DTR Annual Letter. http://dtr.northwestern.edu/letters

✤ Forward: A Story About Learning and Growth. http://forward.movie, 2020.

References

Situated Practice Systems

✣ Leesha Maliakal Shah. Agile Research Studios: Learning Ecosystems to Scale Effective Research Training. Doctoral Dissertation at Northwestern University, 2023.

✣ Kapil Garg, Darren Gergle, and Haoqi Zhang. Orchestration Scripts: A System for Encoding an Organization's Ways of Working to Support Situated Work. CHI 2023.

✣ Kapil Garg, Darren Gergle, and Haoqi Zhang. Understanding the Practices and Challenges of Networked Orchestration in Research Communities of Practice. CSCW 2022.

✣ Kapil Garg. Situated Practice Systems: Developing Worker's Capabilities for Complex Work in Networked Workplaces. Doctoral Dissertation at Northwestern University, 2024.

References

Self-direction and Human Freedom

✤ Talbot Brewer. Retrieval of Ethics. Oxford University Press, 2009.

✤ Agnes Callard. Aspiration: the Agency of Becoming. Oxford University Press, 2018.

✤ Carl Rogers. On Becoming a Person. Houghton Mifflin, 1961.

✤ J. Krishnamurti. Total Freedom. Harper Collins, 1996.

✤ Haoqi Zhang. Searching for the Non-Consequential: Dialectical Activities in HCI and the Limits of Computers. CHI 2024.