Working with school districts (and teachers' unions) to pursue a *new normal* for science classroom teaching and learning

Michigan State University
CREATE for STEM Institute Speaker Series
April 6, 2023

https://tinyurl.com/CREATESpeakerCMT

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Michigan State University Land Acknowledgement

We acknowledge that we are meeting today on the ancestral, traditional, and contemporary Lands of the Anishinaabeg - Three Fires Confederacy of Ojibwe, Odawa, and Potawatomi peoples. We recognize, support, and advocate for the sovereignty of Michigan's twelve federally-recognized Indian nations, for historic Indigenous communities in Michigan, for Indigenous individuals and communities who live here now, and for those who were forcibly removed from their Homelands. By offering this Land Acknowledgement, we affirm Indigenous sovereignty and will work to hold Michigan State University more accountable to the needs of American Indian and Indigenous peoples. We are grateful for their stewardship of the land throughout the generations--in the past, presently, and into the future.

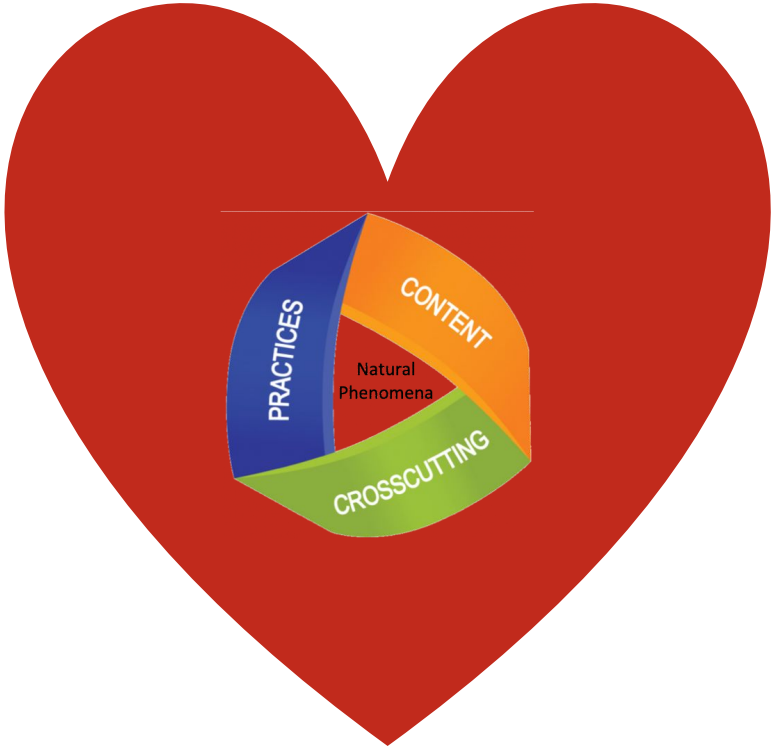
http://aisp.msu.edu/about/land/

CREATE for STEM Institute

Next Generation Project-Based Learning

Carbon TIME

science classroom teaching and learning



the goal: scientifically literate citizens

scientifically literate citizens bring science knowledge and practices to their participation in public decisions about socioscientific issues

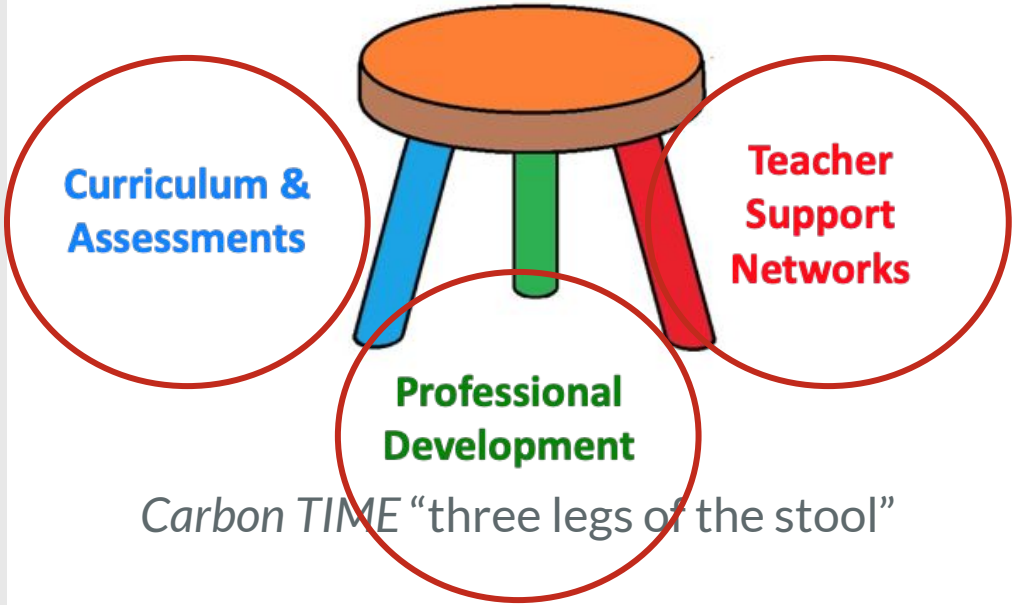
classroom contributions to students' development as scientifically literate citizens:

1. students' three-dimensional science classroom performances
2. students' science identities

(Carlone et al., 2011; Doherty et al., 2015)

Carbon TIME: Transformations in Matter and Energy

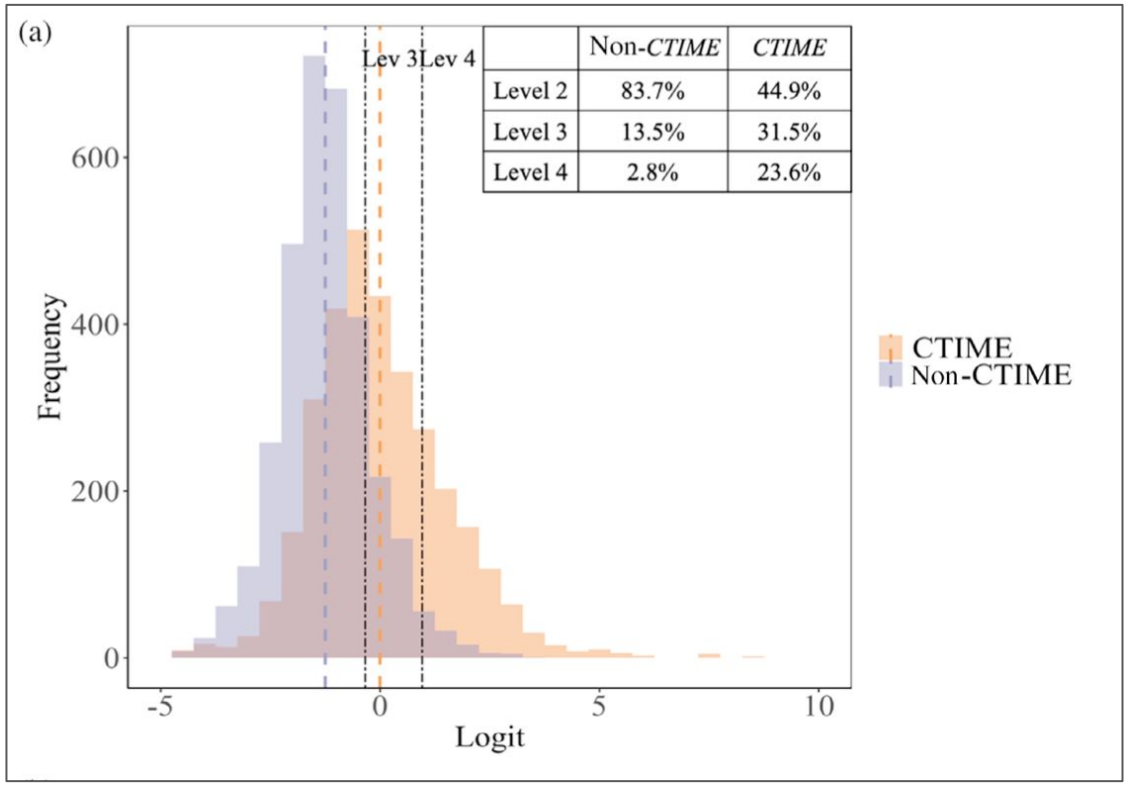
Carbon TIME



Carbon TIME "three legs of the stool"

https://carbontime.create4stem.msu.edu/

evidence of students' three-dimensional science learning



	Non-*CTIME*	*CTIME*
Level 2	83.7%	44.9%
Level 3	13.5%	31.5%
Level 4	2.8%	23.6%

(Figure 3a, Lin et al., 2022)

teachers matter for students' three-dimensional science learning

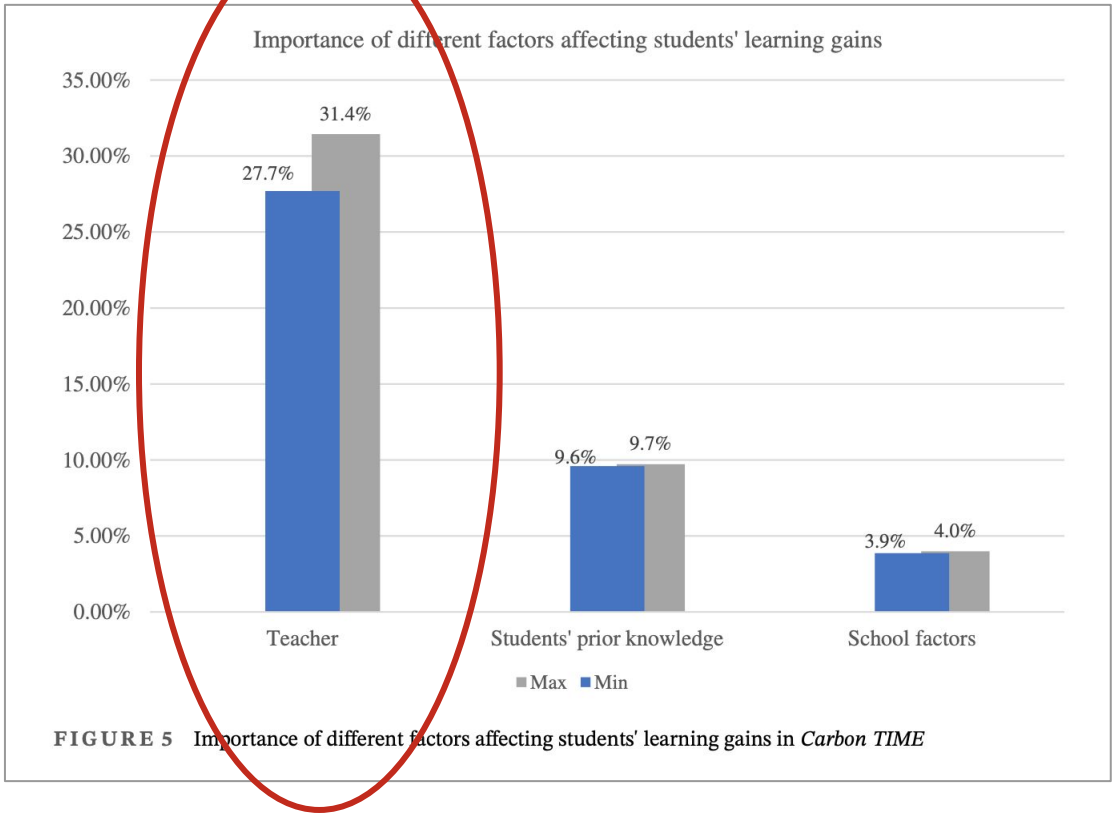


FIGURE 5 Importance of different factors affecting students' learning gains in *Carbon TIME*

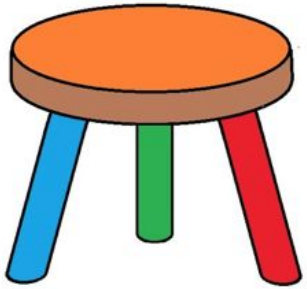
(Bleiberg et al, 2021; Figure 5, Lin et al., 2022)

how are science classrooms different?

	lower learning-gains classrooms	higher learning-gains classrooms
~~teacher-centered learning~~	activity-based teaching	scaffolding students' three-dimensional learning
~~• reliance on textbooks • teacher-centered lecture~~	• pace & novelty • high-interest activities: investigations, hands-on	• sensemaking about phenomena • cognitive apprenticeship strategies

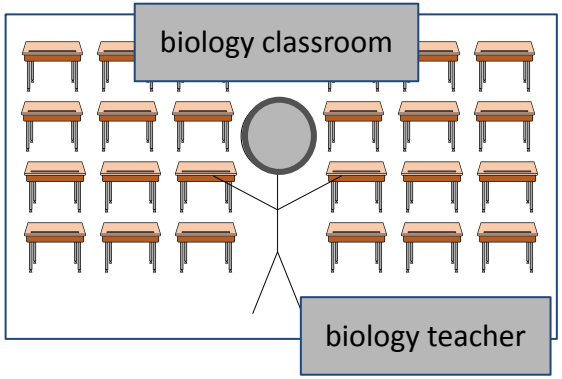
(Cohen, 1990; Cuban, 1993; Hess & Azuma, 1991; Roth & Garnier, 2007;; Morrison-Thomas et al, 2023)

activity-based teaching



Carbon TIME "three legs of the stool"

what would it take for ***every classroom*** *to be engaged in three-dimensional science experiences?*

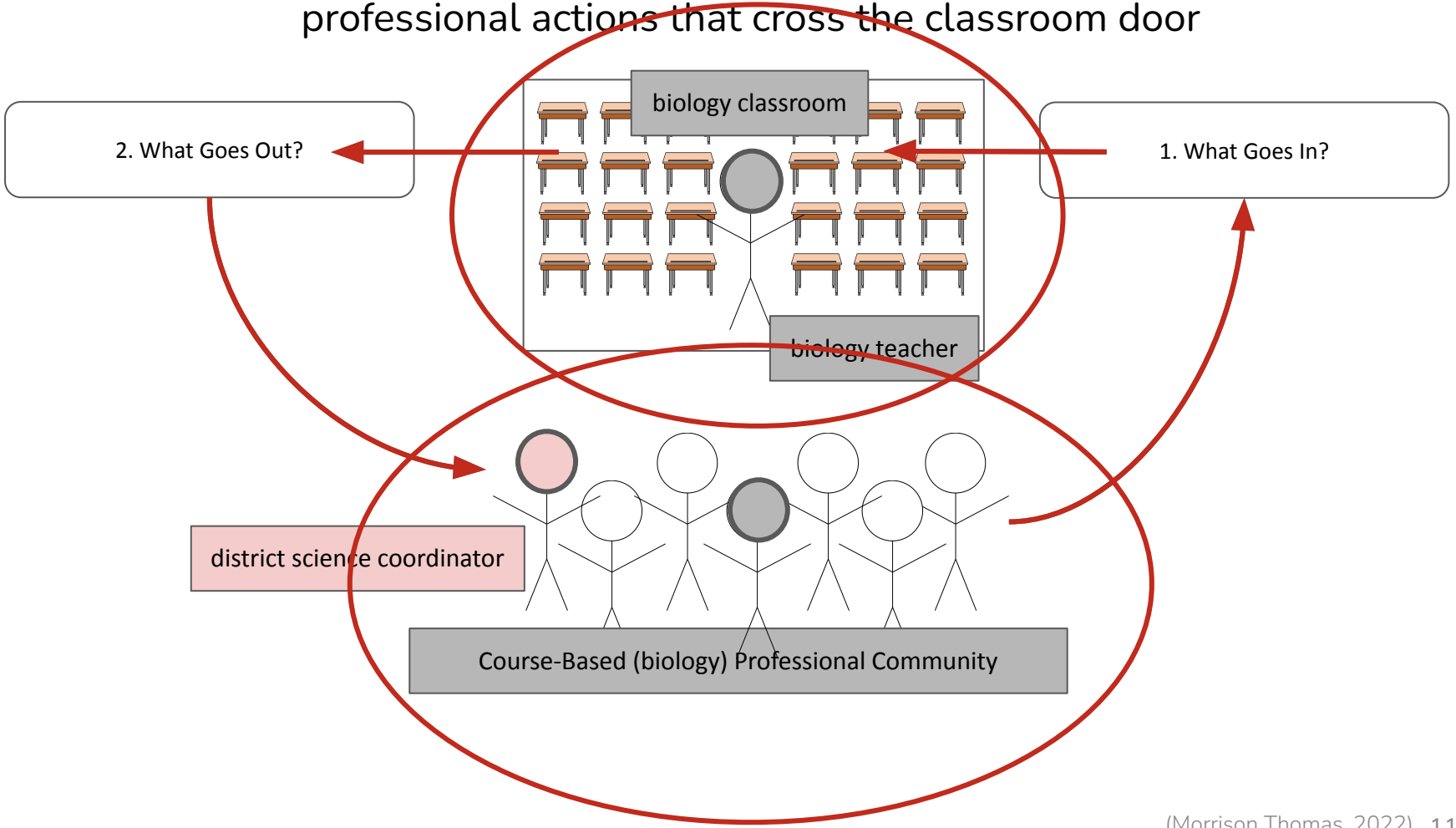


School & District Professional Communities
(teachers, administrators, district science coordinators, union leaders)

empowering teachers' local, course-based professional communities

(McLaughlin & Talbert, 2006)

professional actions that cross the classroom door



study of school districts & teachers' unions

4 similar districts

- *Carbon TIME* materials in HS Biology
- size
- economic resources
- locally perceived as successful

interview participants by role, across 4 districts		
	Round 1 *May-June 2020*	Round 2 *May-June 2021*
State teachers' union	2	0
Teachers' union staff	4	1 (w/ local president)
Local teachers' union leaders	4	4
School district science coordinators	4	4
Carbon TIME classroom biology teachers	11	--
Total Interview Participants	25	9 (8 interviews)

(Morrison Thomas, 2022)

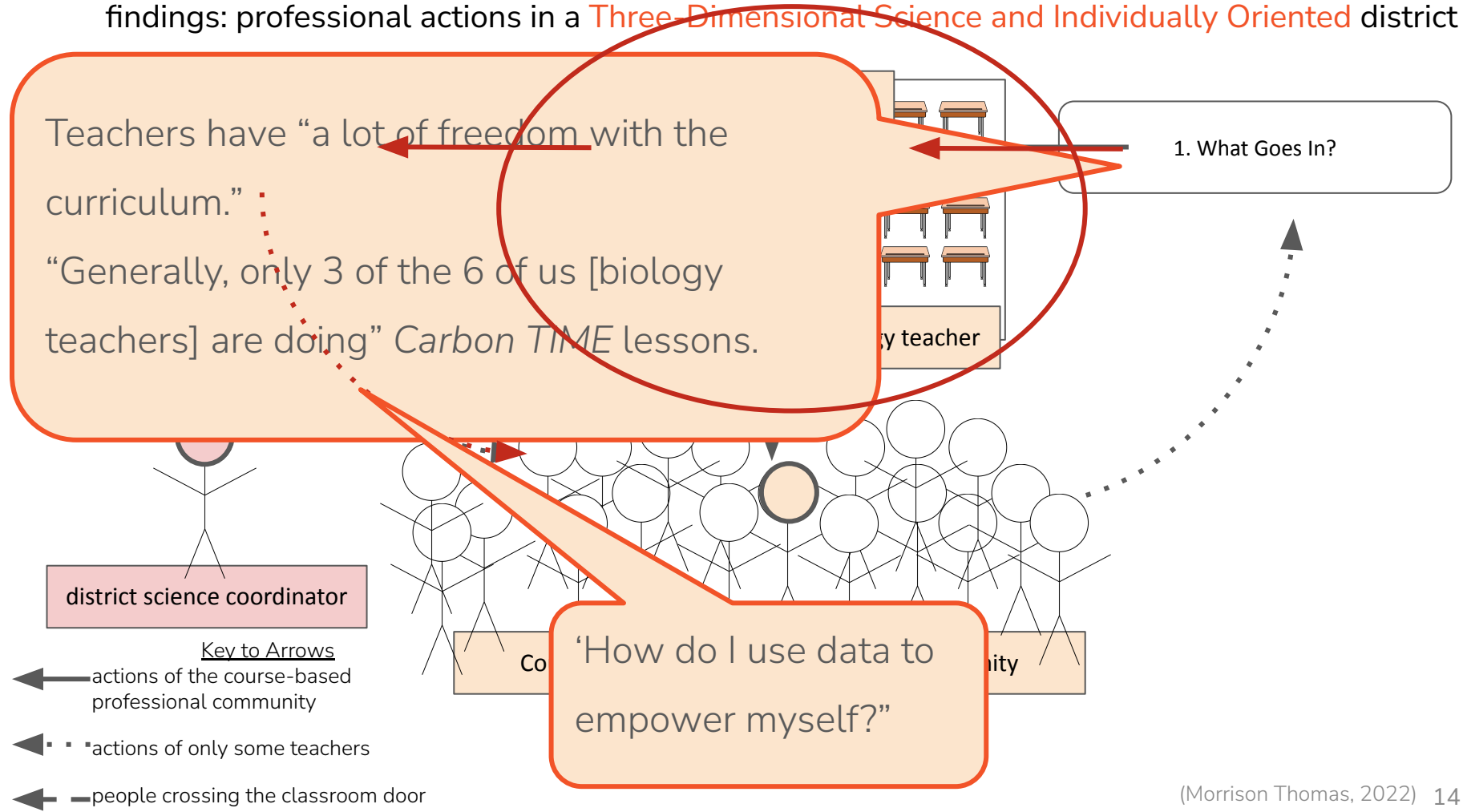
findings: teachers' course-based professional communities

two orientations of teachers' course-based professional communities

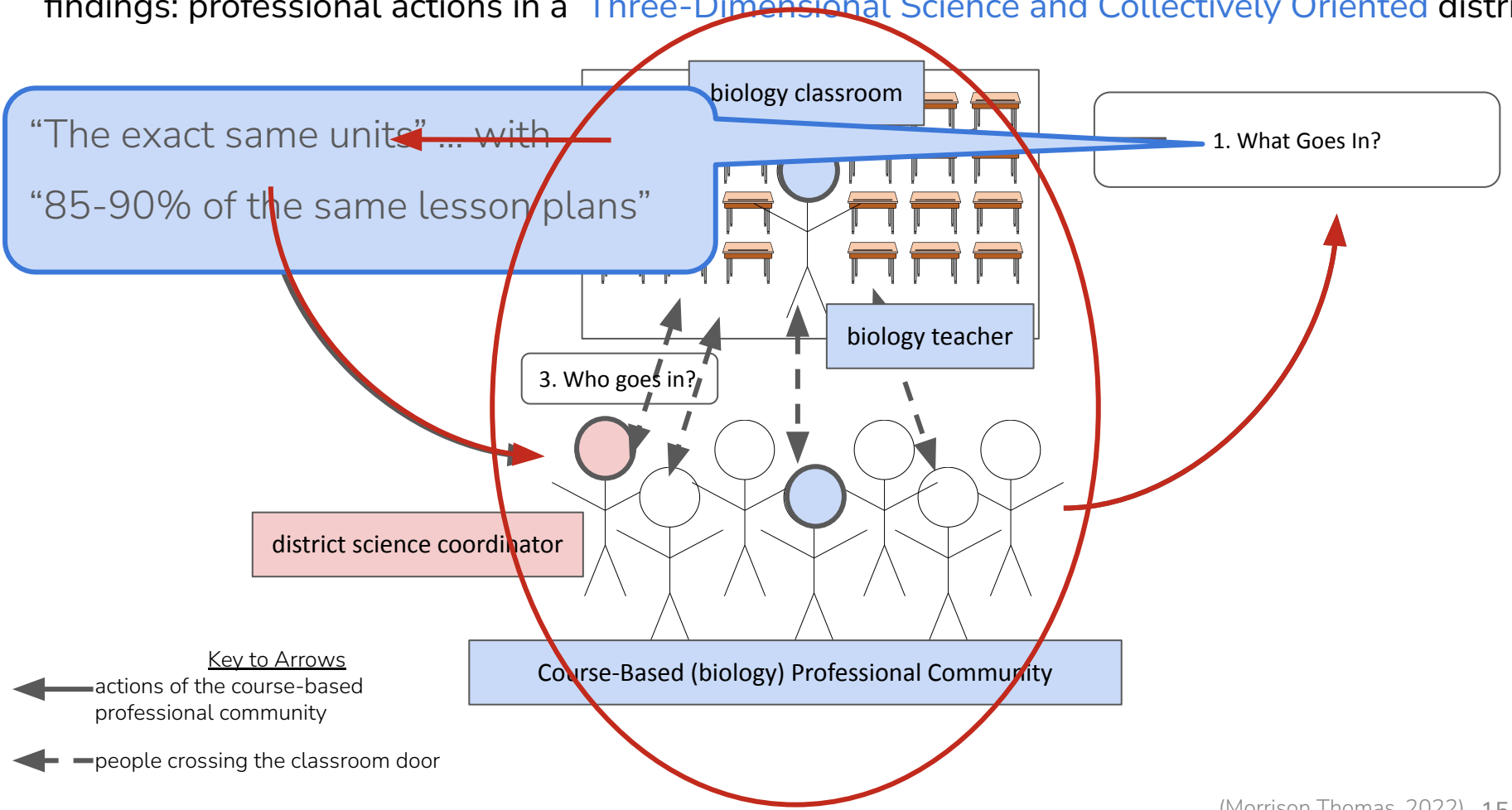
	individually oriented	**collectively oriented**
three-dimensional science: *scaffolding students' three-dimensional learning*	District A	District F, District N
not three-dimensional science: *activity-based teaching + one-dimensional rigor*	District M	

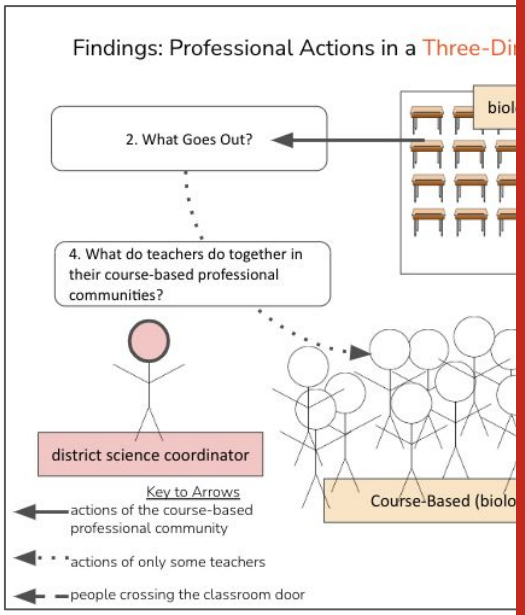
(Morrison Thomas, 2022)

findings: professional actions in a Three-Dimensional Science and Individually Oriented district

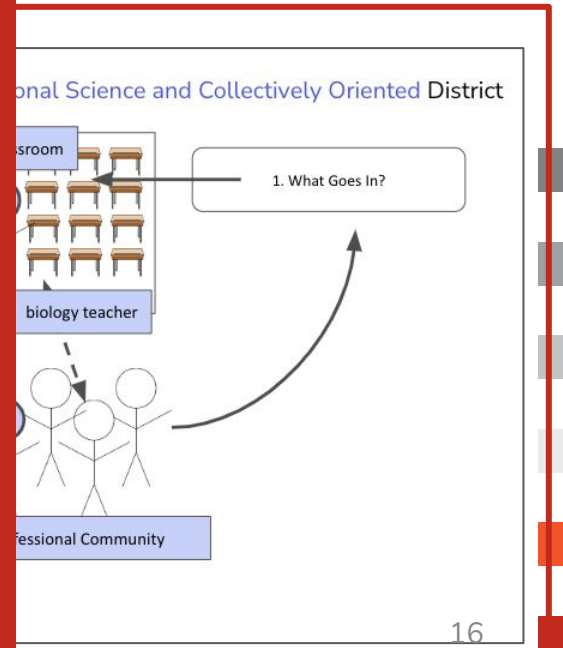


findings: professional actions in a Three-Dimensional Science and Collectively Oriented district



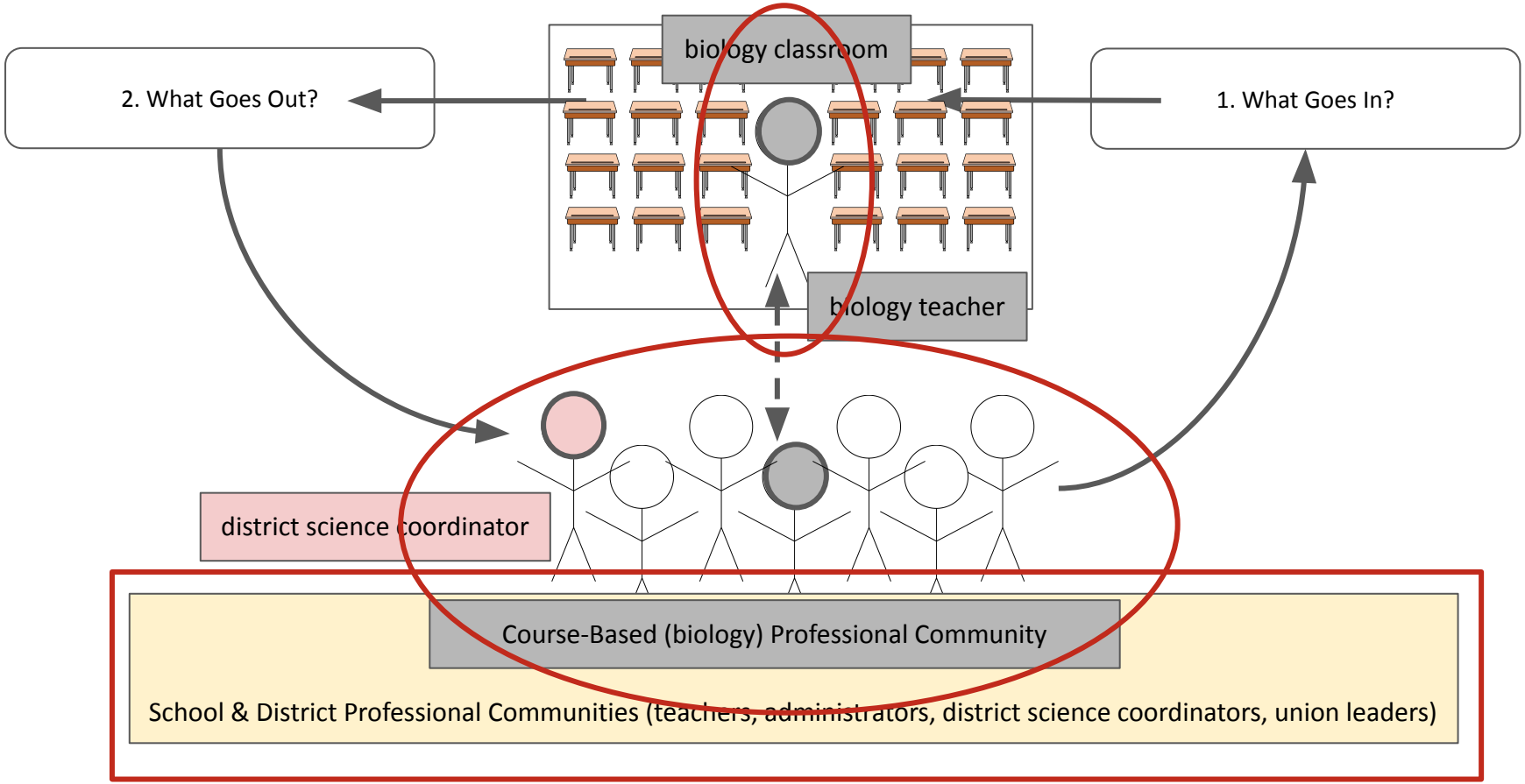


what makes the professional actions in these districts different?



(Morrison Thomas, 2022)

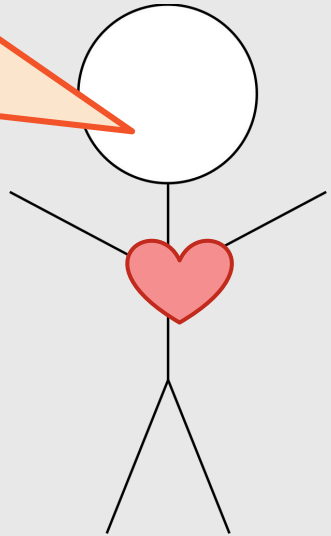
professional actions that cross the classroom door



(Jackson et al., 2018; Koppich, 2006; McDonnell & Pascal, 1988; Morrison Thomas, 2022; O'Day & Smith, 2019; Peurach et al., 2019)

findings: teachers' classroom pedagogical responsibilities

"neither way is better … it's just what works for him and what works for me."

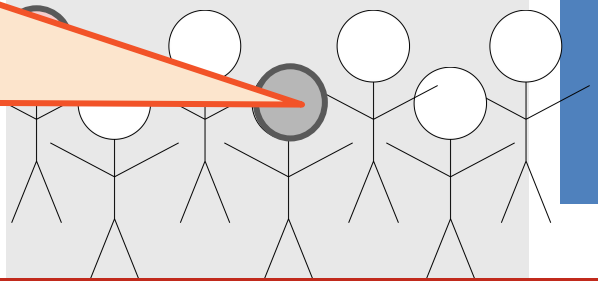


all teachers hold *classroom pedagogical responsibilities* to students' three-dimensional science classroom experiences and outcomes

(Horn, 2020; Morrison Thomas, 2022)

teachers' professional community responsibilities

"didn't want to spend time trying to convince other folks"



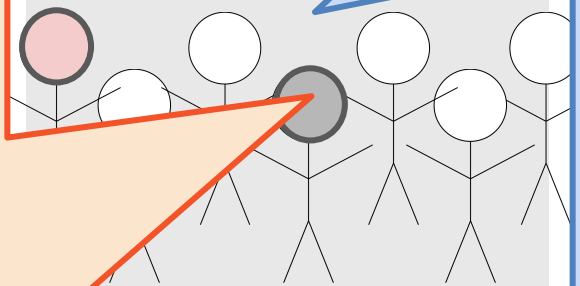
professional community work **is integral** to classroom work; it is required to realize teachers' classroom pedagogical responsibilities

working together incurs *transaction costs* (time and effort) and *conflict costs* (energy to anticipate, encounter, and resolve threats to relationships)

(Horn & Kane, 2019; Little, 1990; Morrison Thomas, 2022; Tannen, 2001)

findings: teachers' professional community responsibilities

"My colleague's philosophy is … 'Let me close my door and do what I'm doing and it works.' They might be right. Their thing might be working for them … it is not my domain … to decide what's good for other teachers."



"If a teacher were to say, 'Well, I don't want to do it that way.' Well, that's fine. Put your own twist on things and … let's talk about it afterwards and see how it went."

(Morrison Thomas, 2022)

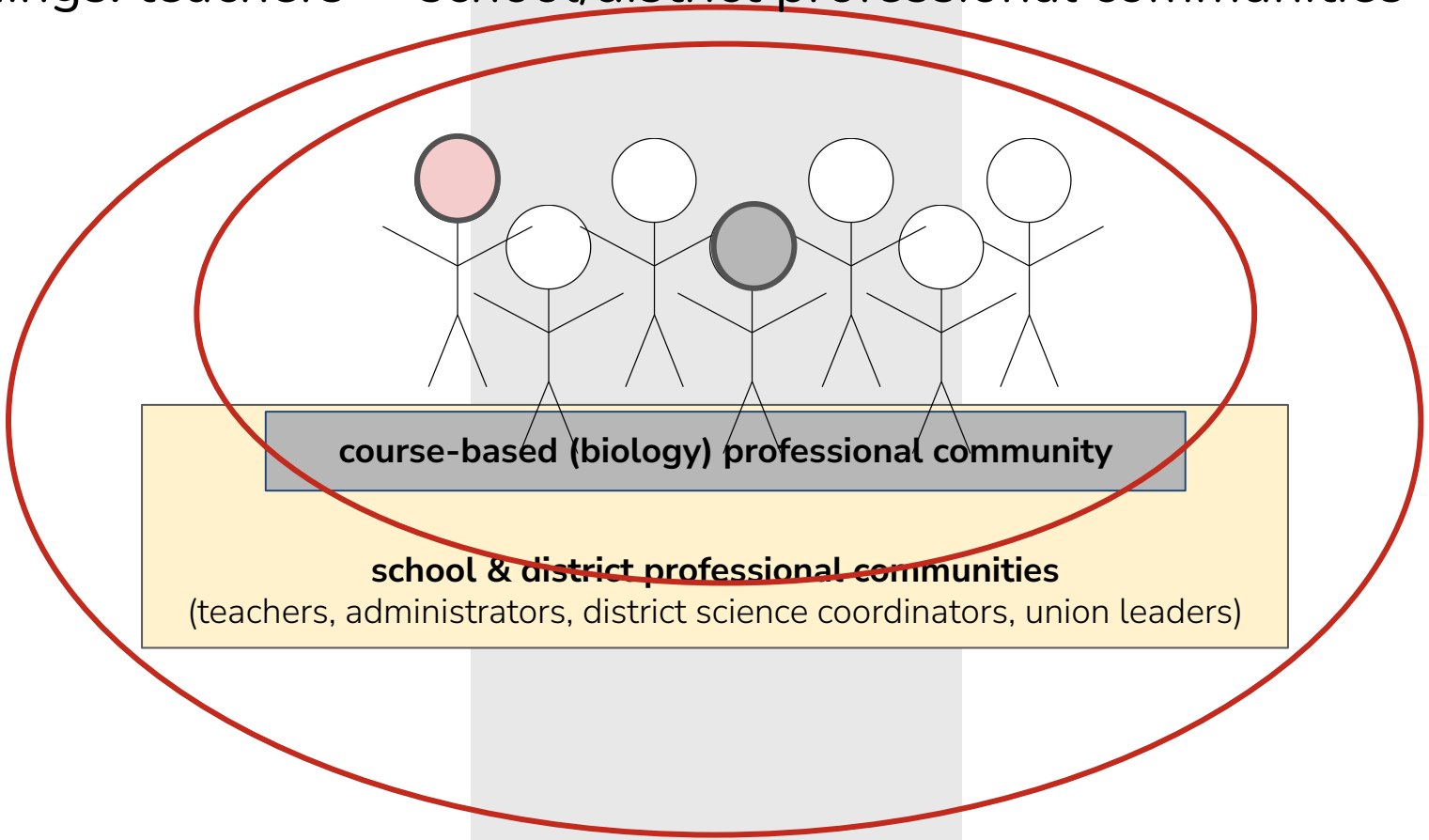
findings: district & union roles and responsibilities

"we know from research that teachers that collaborate … do better [but] it's important for teachers [to have] the autonomy"

the message from [the district] was clear: "This is not optional. *NGSS* is not optional," and the union said, "[common instruction is] what we do" here.

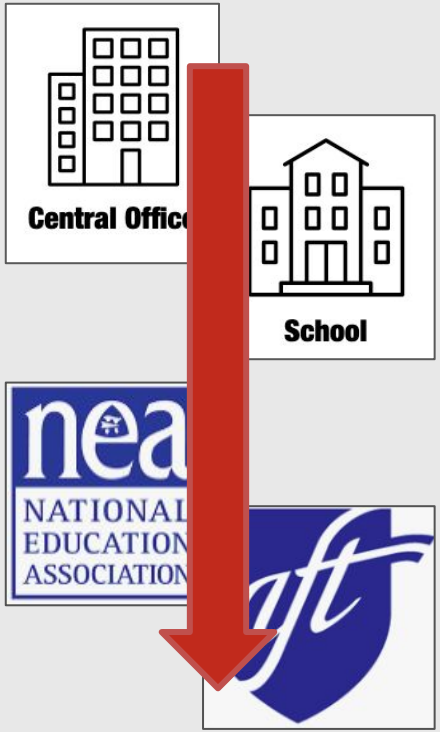
(Morrison Thomas, 2022)

findings: teachers' + school/district professional communities



findings: district & union roles and responsibilities

reduce transaction costs
by providing
course-based teacher professional communities with
time & compensation



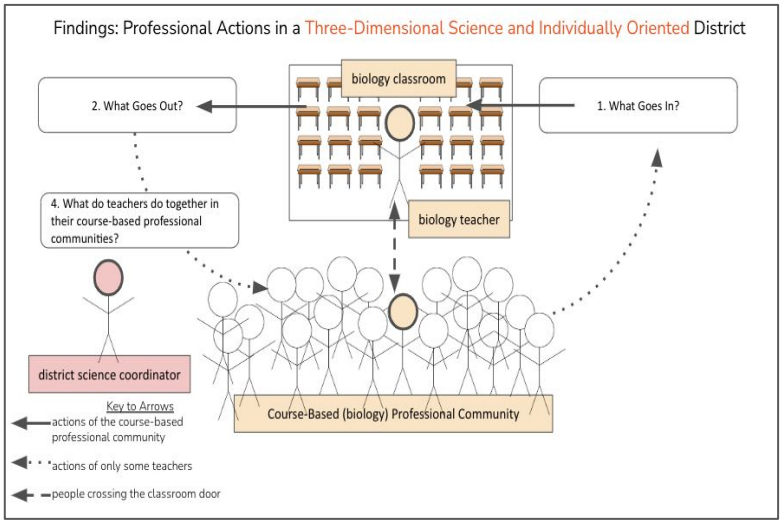
reduce conflict costs
by providing
training;
stability in assignments;
accountability to
group decisions

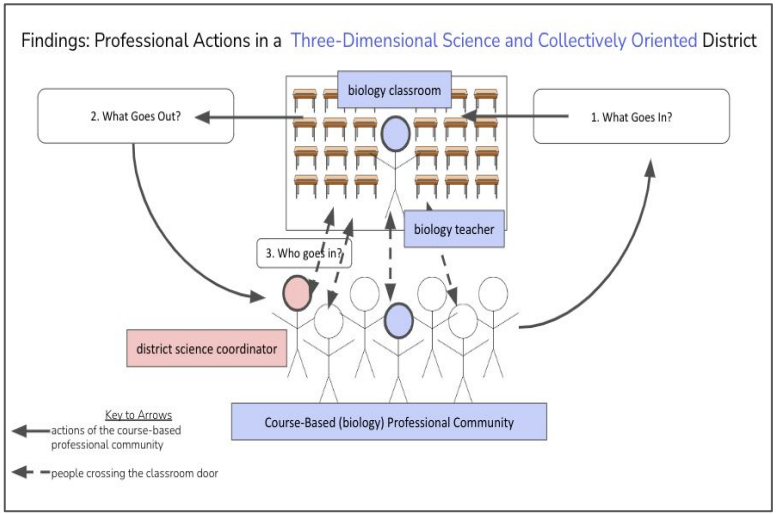
(Morrison Thomas, 2022)

what would it take for ***every classroom*** *to be engaged in three-dimensional science experiences?*

empowering teachers' local, course-based professional communities

implications: three-dimensional assessment & grading





Individually oriented district

- students' science assessment data can inform teachers' **individual improvement**
- teacher comparisons viewed **summatively**; avoid because unfair

Collectively oriented district

- comparisons viewed **formatively**
- students' science assessment data and grades can inform **course-based professional community's improvement**

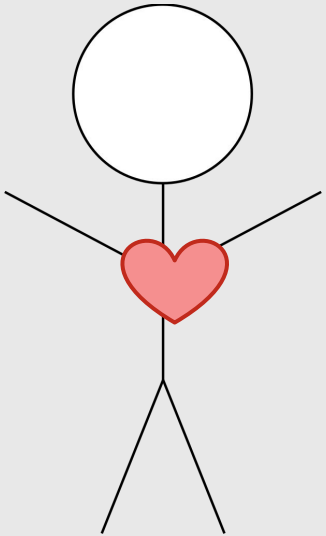
(Morrison Thomas, 2022)

advocacy & reaching out

1. our **external expertise** is valuable
2. **endorse** teachers' local course-based professional community work **as integral** to three-dimensional science classroom instruction
3. **organize and include** actions that "cross the classroom door" within teachers' local, course-based professional communities
4. **reach out to design opportunities** for future work (and **research-practice partnerships**) with teachers, school & district administrators, and union leaders that engage and **empower** local course-based professional communities

MMSLN
Michigan Math and Science Leadership Network

implications: three-dimensional assessment & grading



local student science success

- **know the DCI's** (content)
- **feel comfortable** engaging in science class activities and assessments
- understand expectations for **earning points** in science class

Changes in classroom assessments and classroom instructional practices that **reduced three-dimensional nature**

thank you

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