Aligning Deep Learning with Classroom Time Use: A View of Disciplinary Variations among Faculty

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FSSE faculty survey of student engagement

@NSSEsurvey

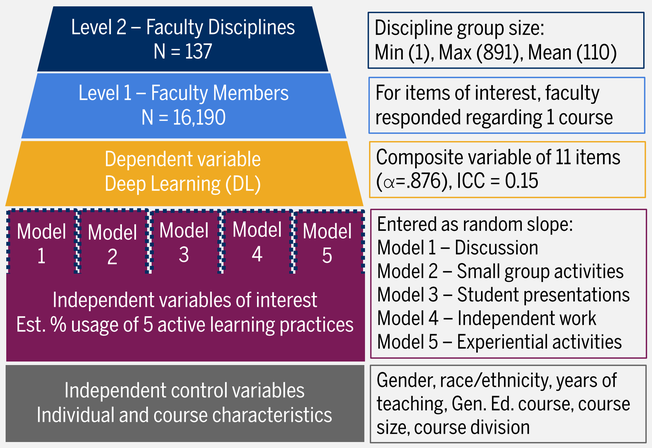
Purpose and Framework

- Does the importance and emphasis faculty place on educationally effective practices translate to what they do in the classroom?
- Educationally effective practices engage students in **deep learning** (Nelson Laird, Shoup, Kuh, & Schwarz, 2008)
- With deep approaches, students **actively work to understand material in more meaningful ways**, for example, by integrating multiple resources, synthesizing new ideas, or reflecting on connections between ideas (Martin & Säljö, 1976; Nelson Laird et al., 2008)
- Deep learning is supported by cognitive theories of learning that suggest such **meaningful learning promotes expertise and long-term transfer** (Bransford, Brown, & Cocking, 2000; NASEM, 2018)
- **Active, learner-centered environments** and faculty practices most effectively promote student engagement and learning (Bransford et al., 2000; Chickering & Gamson, 1987; Kuh, Kinzie, Buckley, Bridges, & Hayek, 2004)
- A substantial body of research identifies **disciplinary differences** in how faculty approach teaching (e.g., Michael, Campbell, & Dilsizian, 2018; Nelson Laird et al, 2008)
- This study considers the intersection of teaching attitudes and approaches across over 120 disciplines with the following research questions:

1. How does faculty members' teaching practices relate to their attitudes on deep approaches to learning?
2. How do relationships between faculty attitudes on deep approaches to learning and their teaching practices vary across disciplines?

Methods and Analyses

Multilevel random-slope model structure
using 2019 Faculty Survey of Student Engagement (FSSE)



- Slope random effects tested with **Chi-square Likelihood Ratio Tests (LRT)**
- For significant variance in random slopes, **empirical Bayes estimates** of posterior means were conducted for additional insight

Primary Measures

- Deep learning (DL) computed from 11 items measured on 4-pt. Likert scales. Responses converted to 0-60 scale and averaged

	Min.	Max.	Mean	S.D.
Deep Learning (DL)	0	60	43.68	1.43

- Estimated % of active class time uses computed from 8 items measured on 8-pt. Likert scales. Responses converted to midpoint of scale range, then divided by sum of all 8 converted scores

	Min.	Max.	Mean	S.D.
Est. % of discussion	0	95	19.51	13.47
Est. % of small group activity	0	81	12.30	11.05
Est. % of student presentation	0	95	7.37	8.87
Est. % of independent work	0	95	8.57	11.32
Est. % of experiential activity	0	100	7.97	11.95

- Primary measures standardized as Z-scores prior to entering into models

Sample Descriptives

- Primarily identify as women (42%) and White (59%) with an average of 17 years of teaching experience
- Courses most commonly included general education courses (43%), 20 or fewer students (31%), and upper-division courses (45%)

Results

- All five active learning practices were **positively, significantly** related to faculty attitudes on deep learning
- **Discussion** shows largest (though small) effect sizes, while **small group and experiential activities** show the smallest effect sizes
- All individual characteristics, and some course characteristics were positively, significantly related to deep learning
- Discussion, presentation, independent work, and experiential activity had **significant variance in slopes across disciplines**
- **Increasing usage** of discussion, student presentation, and independent work tend to (slightly) **minimize differences across disciplines**
- For discussion and student presentation, though **STEM disciplines** have lower emphasis on deep learning, active learning has greater positive effects
- **Biological sciences** tend to emphasize deep learning more than other STEM disciplines

Simplified model results of variables of interest

	Model 1 Discussion		Model 2 Small Group		Model 3 Presentation		Model 4 Independent Work		Model 5 Experiential Activity	
Random effects	Var.	Cov.	Var.	Cov.	Var.	Cov.	Var.	Cov.	Var.	Cov.
Discipline (U_{0j})	.080		.085		.078		.084		.084	
Est. % of model's active learning practice (Y_{1j}-Y_{5j})	.006	-.66	.002	.25	.017	-.48	.005	-.20	.004	.37
Individual (R_{ij})	.743		.746		.738		.745		.745	
Fixed effects	Est.		Est.		Est.		Est.		Est.	
Intercept	-.17		-.19		-.16		-.19		-.19	
Est. % of discussion	.24		.21		.20		.21		.21	
Est. % of small group activity	.06		.06		.06		.06		.06	
Est. % of student presentation	.11		.11		.16		.11		.11	
Est. % of independent work	.10		.11		.10		.12		.11	
Est. % of experiential activities	.08		.08		.08		.08		.09	

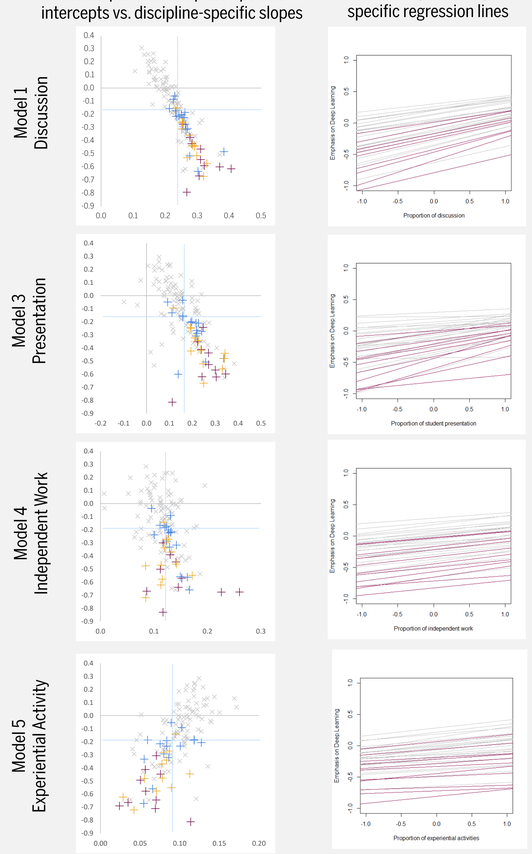
Scatterplot Key
- Non-STEM discipline
- Biological Sciences, Agriculture, & Natural Resources
- Physical Sciences, Math, & Computer Sciences
- Engineering
- Intercept and slope fixed effect estimates

Line-plot Key
- Non-STEM disciplines
- STEM disciplines

p<.01 p<.001

Scatterplots of discipline-specific intercepts vs. discipline-specific slopes

Plots of sampled discipline-specific regression lines



Conclusions

- **Active, learner-centered** teaching practices are **positively** associated with faculty attitudes towards **deep learning**
- Controlling for other active learning practices (and individual and course characteristics), **discussion** had the **strongest positive** relationship with faculty attitudes toward deep learning
- While positive, **small group and experiential activities** had the **weakest** relationships with deep learning attitudes, raising questions about how well they are implemented in courses
- **Significant variance across disciplines** was observed in relationships between four active learning practices and attitudes of deep learning
  - While **STEM disciplines tended to lag** in deep learning attitudes, **active learning tended to have stronger positive relationships** suggesting greater alignment with emphasis on deep learning
  - But not all STEM disciplines are the same. **Biological sciences tend to place higher value on deep learning**, so use of active learning may be for other pedagogical reasons, and is less aligned with deep learning

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