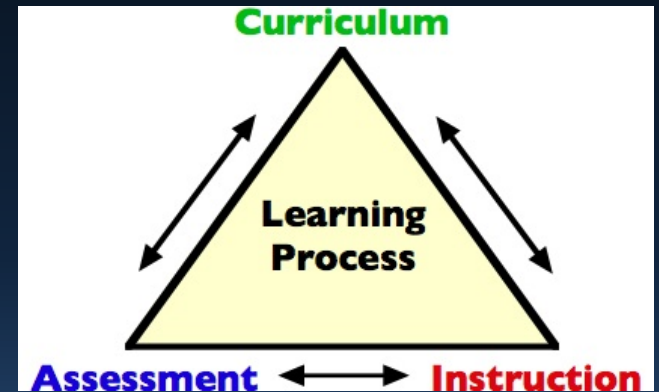# A Framework for Including Multiple Pedagogies for STEM Education

"All discussion of reform must begin with the ordinary student, not the genius, not the prospective scientist or professor of abnormal psychology but the citizen of the republic who must earn a living in addition to living a humane life." - Paige Smith, *Killing the Spirit: Higher Education in America*, 1990, p. 200

Autar Kaw

http://AutarKaw.com

University of South Florida

2020 ISFT

January 7, 2020

Expected types of course outcomes

- *Cognitive*: "What will students completing this course know?"

- *Behavioral*: "What will students completing this course be able to do?"

- *Affective*: "What will students completing this course care about or think?"

Active learning

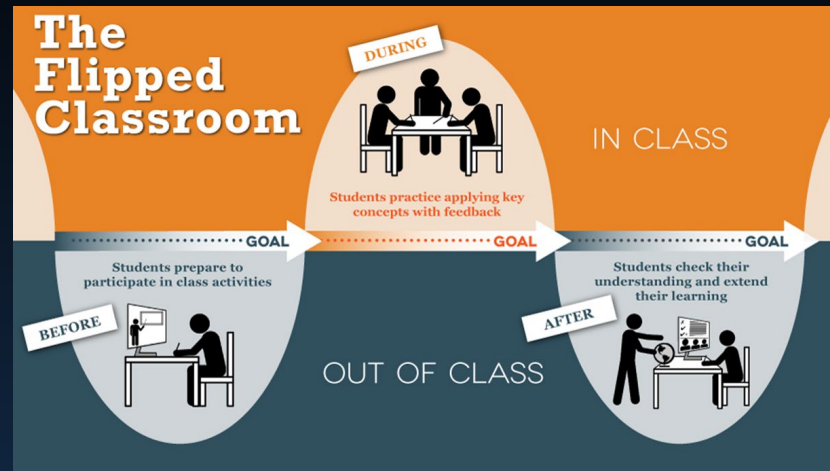Student performance on examinations and concept inventories under active learning, effect size=0.47

$$Effect\ Size = \frac{Difference\ between\ averages}{Standard\ Deviation}$$

Small =0.2 | Medium =0.5 | Large =0.8

Teaching techniques

- Lecturing
- Blended
- Flipped
- Hybrid
- Adaptive
- Problem based
- Case study
- …
- …

Flipped learning

"The results raise questions about the continued use of traditional lecturing as a control in research studies" Freeman, et. al., 2014
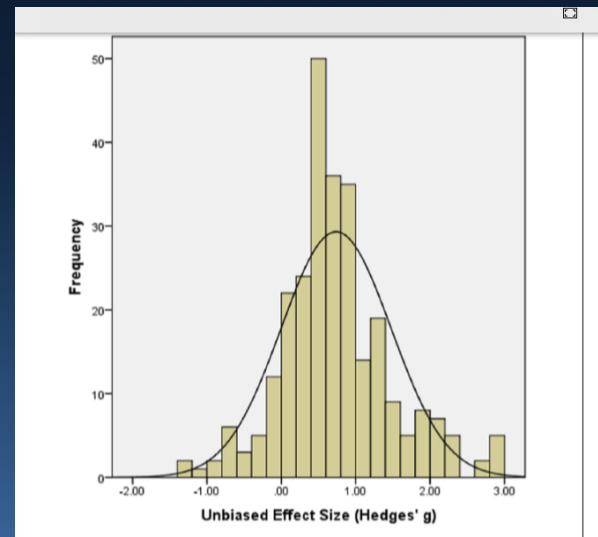
Practice testing

Effect size =0.74

FIGURE 2. *Distribution of 272 independent effect sizes obtained from 118 articles (M = 0.74, SD = 0.74).*

Distributed practice

Concentrated Practice **VS.** Distributed Practice

Effect size=0.46

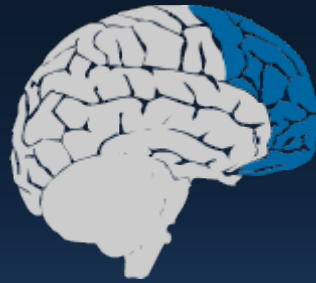# Universal design for learning (UDL)

The trinity of UDL

1. Multiple means of representation

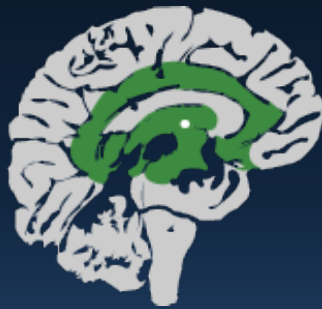## What – Recognition network

The trinity of UDL

2. Multiple means of action and expression

How – Strategic Network

The trinity of UDL

3. Multiple means of engagement

Why – Affective Network

A Framework for Including Multiple Pedagogies for STEM Education

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