

Effectiveness of instructional principles from cognitive psychology for higher education: Reviewing the evidence



Digital Poster

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Background

Effective instructional strategies are essential to engage students in learning. Student learning has been extensively studied in **cognitive psychology**, resulting in multiple theories and frameworks. In this study we considered theories that provide concrete guidelines for educational practice:

- (1) **Cognitive Load Theory (CLT)** (Sweller, 1988)
- (2) **Cognitive Theory of Multimedia Learning (CTML)** (Mayer, 2005)
- (3) **Desirable Difficulties Framework (DDF)** (Bjork & Bjork, 2011)

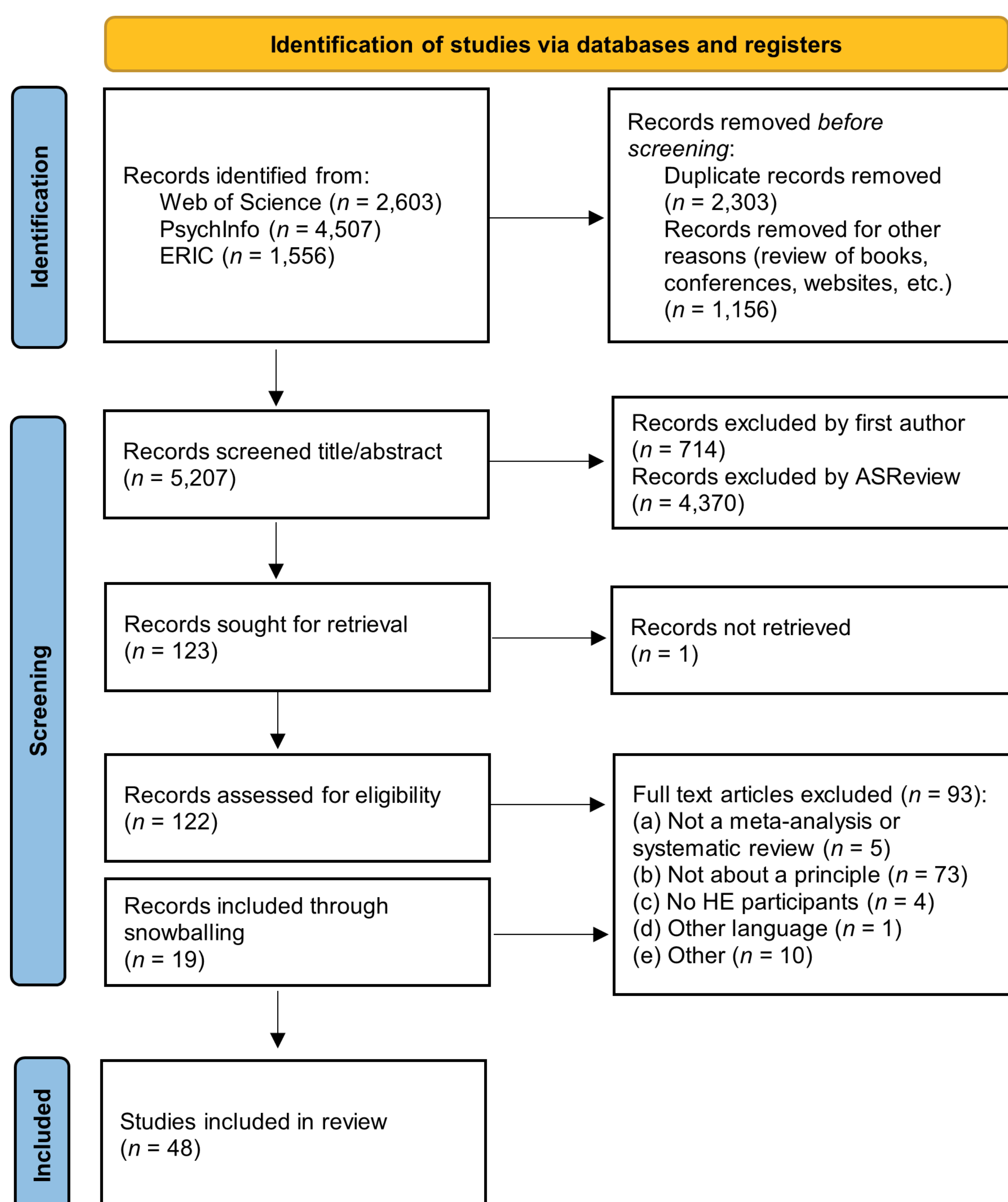
Aim

Despite extensive research, a **comprehensive overview** of empirical support for instructional principles in higher education classrooms is **lacking**. Much research spans **different educational levels** and **age groups** or occurs in **controlled settings**, limiting its direct application to higher education classrooms (e.g., Agarwal et al., 2021). The current review **addresses this gap** and **analyses the empirical support for these principles in higher education classrooms**. Our main research question is:

Which instructional principles derived from cognitive load theory, cognitive theory of multimedia learning, and the desirable difficulties framework have sufficient empirical support in the context of higher education to improve instructional pedagogy in the classroom?

Method: Review of reviews

Figure 1 PRISMA 2020 Flow Diagram of the Review of Reviews



Results

The total of 48 reviews covered 15 instructional principles.

Table 1 Number of meta-analyses and reviews reporting variables as part of the total number of included reviews (N = 48)

Reported variables in included meta-analyses and (systematic) reviews	N
Proportion of higher education participants reported	30
Mean effect sizes on learning outcomes for higher education participants reported	19
Number of studies conducted in classroom setting (all educational levels) reported	18
Mean effect sizes on learning outcomes for classroom settings (all educational levels) reported	10
Number of studies conducted in higher education classroom setting reported	3
Mean effect sizes on learning outcomes in higher education classroom settings reported	3

Table 2 Overview of empirical support

Instructional principle	Instructional framework	Reported effects on learning outcome across educational levels*	Reported mean effects for higher education participants*	Reported mean effects in context of higher education classroom context*
Self-explanation	CLT	● - ●	●	●
Imagination	CLT	● - ●	●	●
Worked examples	CLT	●	●	●
Spatial split-attention	CLT & CTML	●	●	●
Modality	CLT & CTML	● - ●	●	●
Redundancy	CLT & CTML	●	●	●
Signalling	CTML	● - ●	● - ●	●
Coherence	CTML	●	●	●
Personalization	CTML	● - ●	●**	●
Segmenting	CTML	●	●	●
Image	CTML	●	●	●
Spaced practice	DDF	●	●	●
Retrieval practice	DDF	● - ●	● - ●	●
Interleaved practice	DDF	● - ●	● - ●	●

Note. *Effects were categorized as small: $d < 0.5$, $g < 0.50$, $r < 0.30$, medium: $d = 0.50 - 0.79$, $g = 0.50 - 0.79$, $r = 0.3 - 0.49$ or large $d = > 0.80$, $g = > 0.80$, $r = > 0.50$. **Although not specified, most research was conducted in higher education and educational level was not a moderating factor.

● = Small ● = Medium ● = Large ● = Mixed results ● = Not reported

Conclusion & Discussion

- Included principles show **positive mean effects on student learning** outcome in various educational levels (image-principle is exception).
- **Results for higher education participants align** with results for various educational levels, although mean effect size may differ.
- **Mean results for higher education classroom contexts are seldom** separately reported.

Future research

- Definitions of 'learning outcome' and 'higher education classroom context' should be defined **clearly**.
- More in-depth examination of the effects of instructional principles on learning outcomes specifically **within higher education classrooms** is needed.
- Research that explores how **higher education teachers** perceive and apply these instructional principles.

References

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