

# **Knowledge – a Core Concept Difficult to Grasp: Meta-analytic Examination of the Knowledge-is-Power Hypothesis**

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# The Knowledge-is-Power Hypothesis

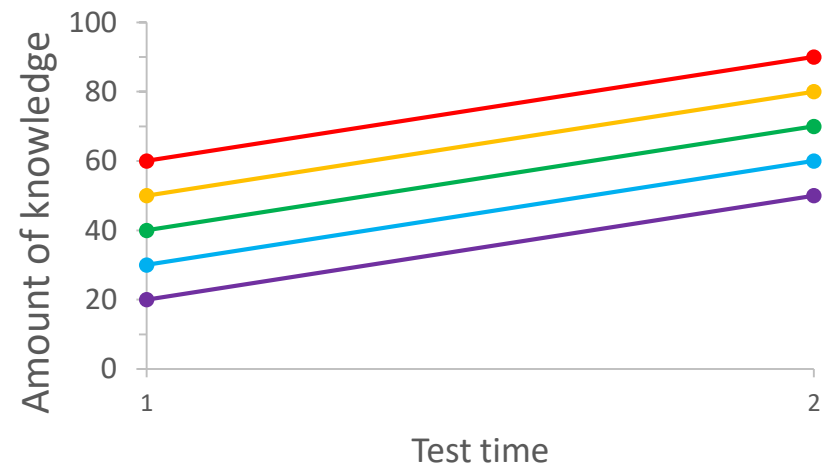
- Prior knowledge has a very strong influence on learning.
- “The most important single factor influencing learning is what the learner knows already” (Ausubel, 1968, p. vi)
- “It is difficult to overestimate the importance of prior knowledge” (Dochy et al., 1999, p. 145)
- “One of the most influential ideas to emerge in cognitive psychology during the past 25 years” (Hambrick and Engle, 2002, p. 340)
- But *how strong* is the influence of prior knowledge on learning?

# Correlation $r_p$ with Posttest Knowledge

Correlation with posttest:  $r_p = 1.00$

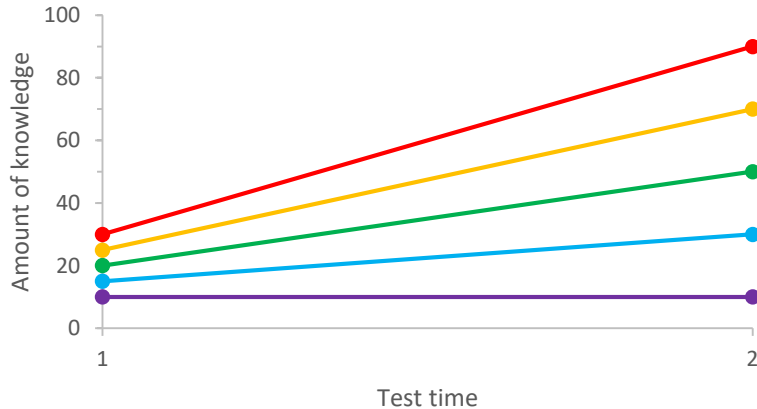


Correlation with posttest:  $r_p = 1.00$

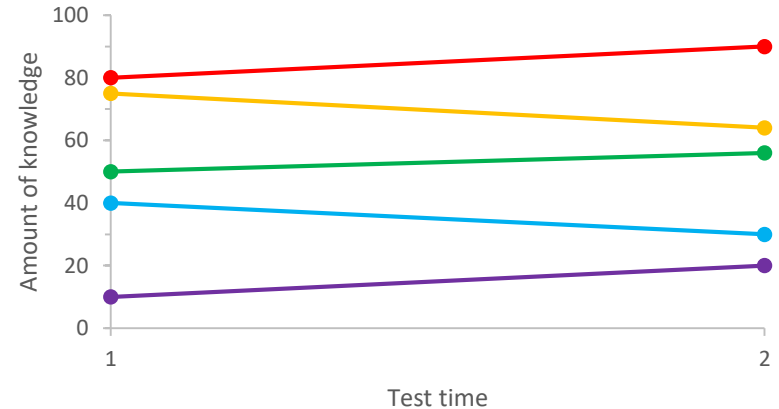


# Correlation with Posttest Knowledge vs. Correlation with Knowledge Gains

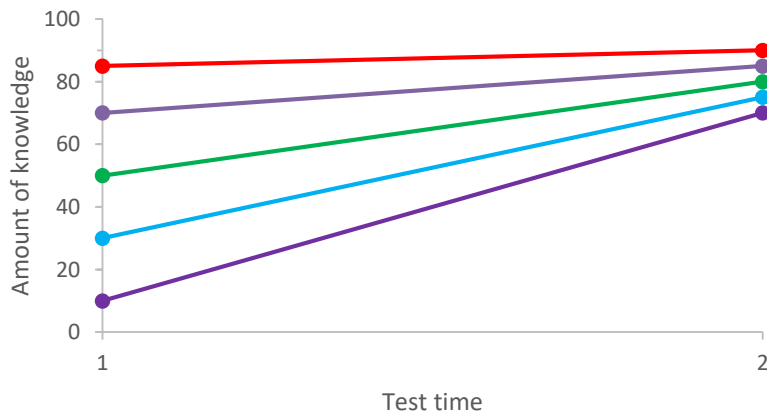
Correlation with posttest:  $r_p = 1.00$   
 Correlation with gains:  $r_{NG} = 1.00$



Correlation with posttest:  $r_p = .93$   
 Correlation with gains:  $r_{NG} = .03$



Correlation with posttest:  $r_p = 1.00$   
 Correlation with gains:  $r_{NG} = -0.92$

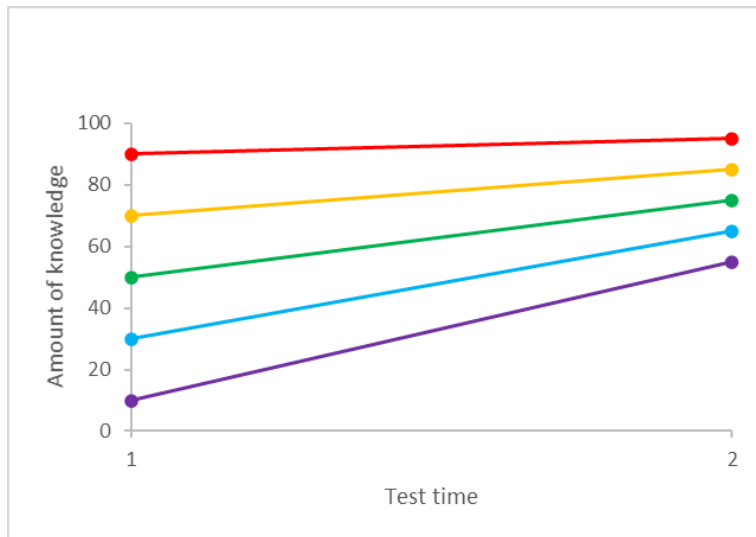


Correlation  $r_p$  with posttest  
 → stability of individual differences over time

Correlation  $r_{NG}$  with gain score  
 → Predictive power of prior knowledge for learning

# Absolute vs. Normalized Gains

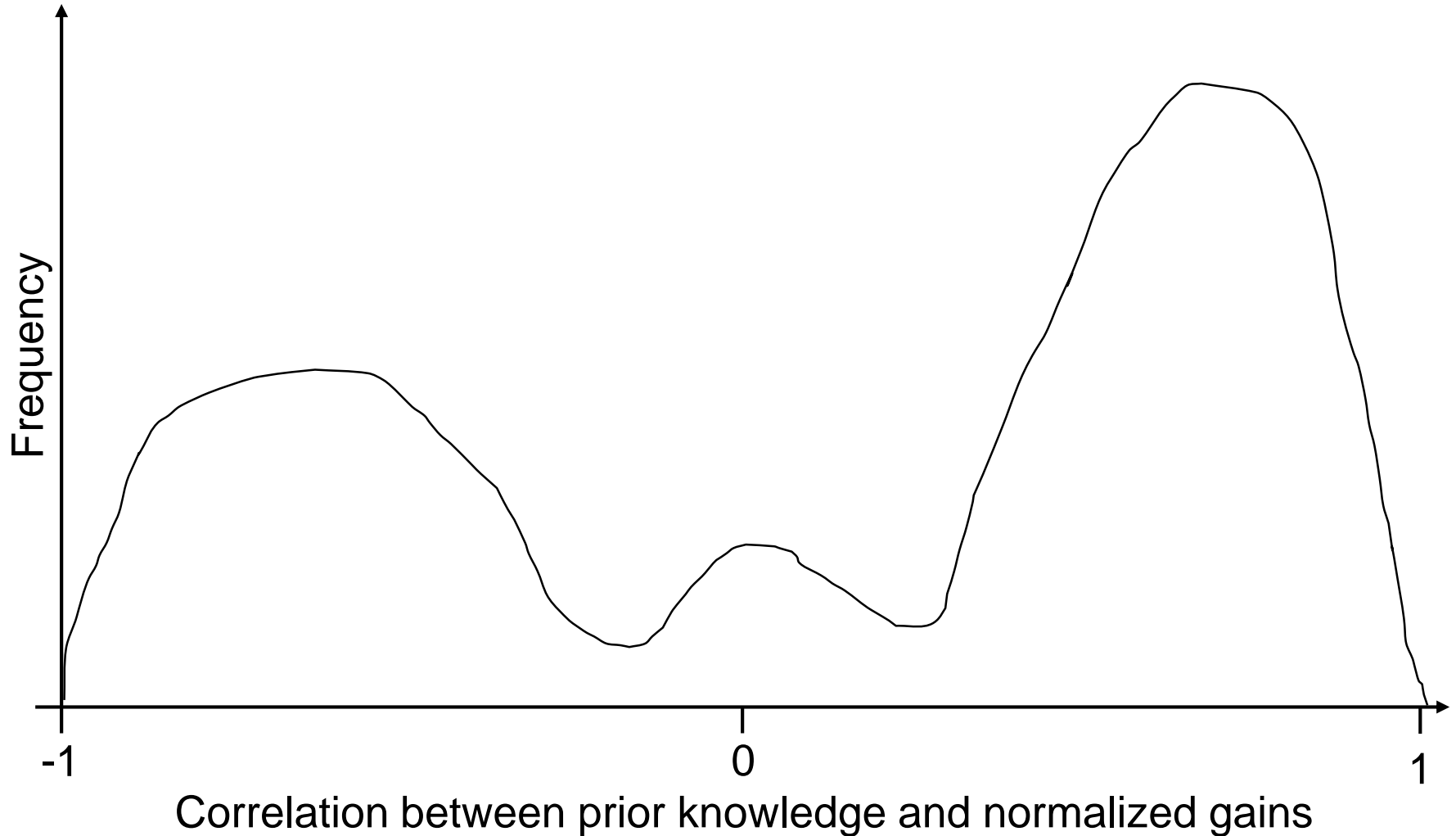
$$\text{Absolute Gain} = \text{Posttest} - \text{Pretest}$$



Pretest	Posttest	Absolute Gain
90	95	5
70	85	15
50	75	25
30	65	35
10	55	45

$$\text{Normalized Gain} = 100\% * \frac{\text{Posttest} - \text{Pretest}}{\text{Scale Maximum} - \text{Pretest}}$$

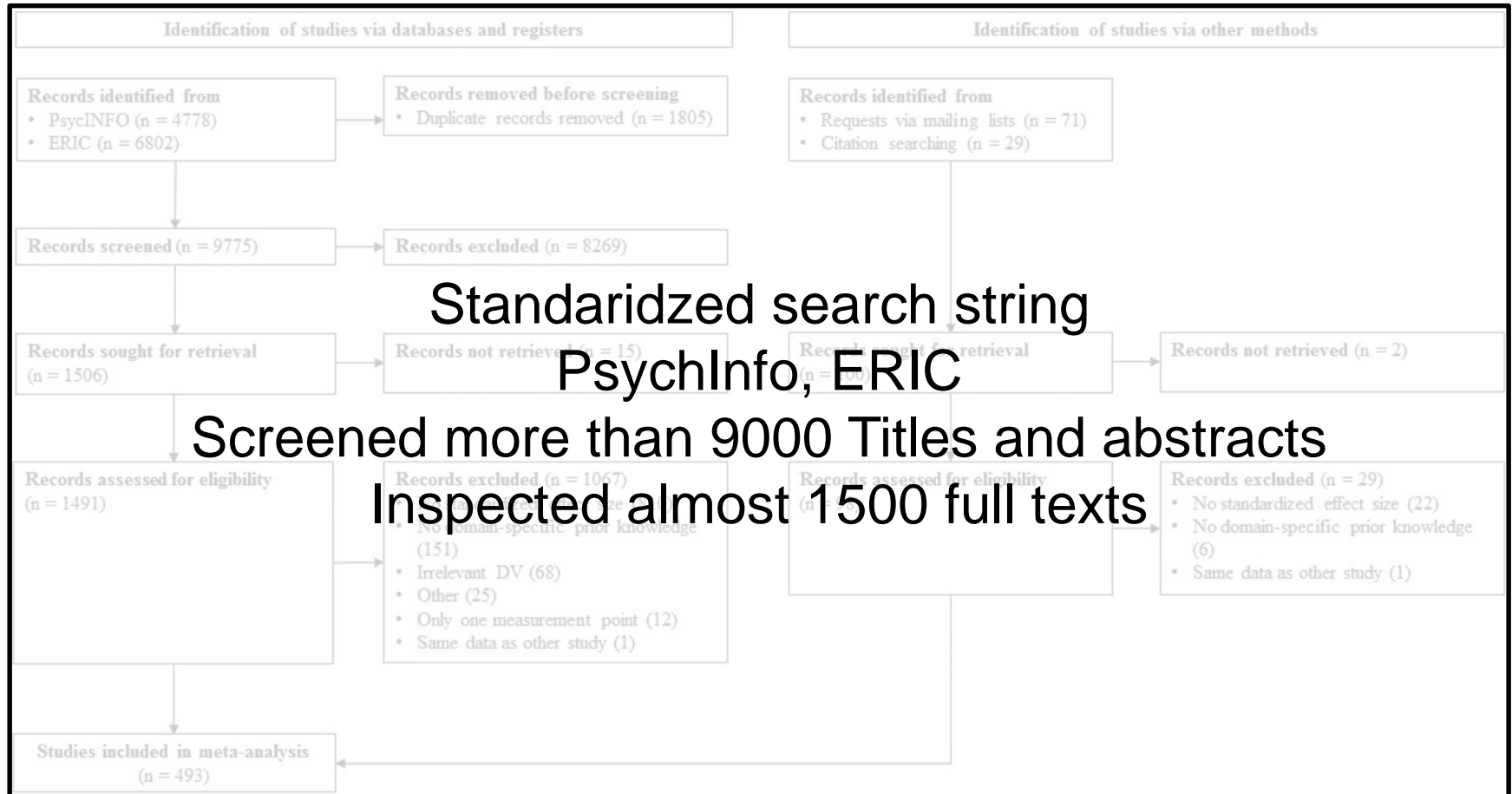
# Hypothesized Frequency Distribution of the Correlation $r_{NG}$



# Inclusion Criteria

- Knowledge at pretest was used to predict knowledge or achievement at posttest
- Study used objective measures of the amount of knowledge

# Literature Search

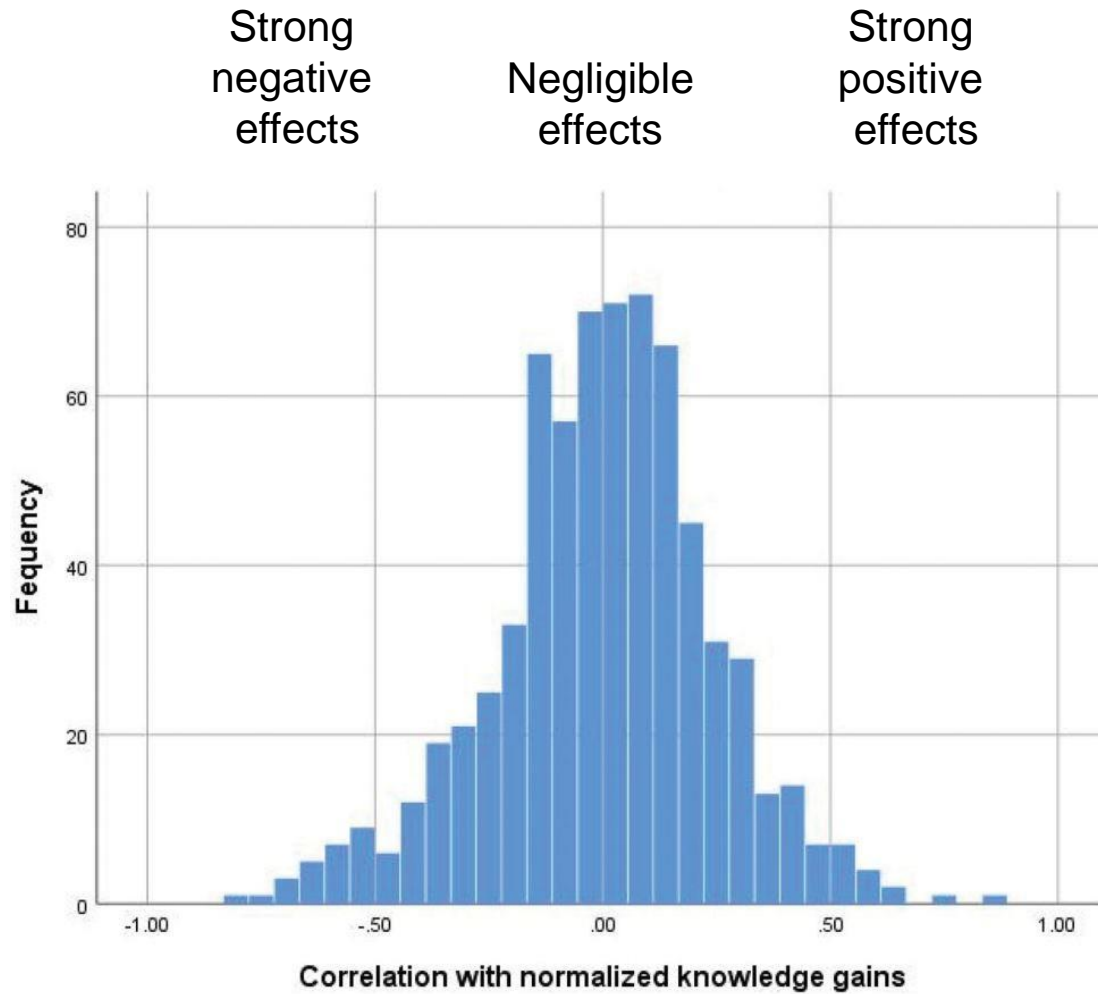




# Results

- 493 studies
- 8776 effect sizes
- 126 050 participants
- Published 1965-2020 (median: 2012)
- From 47 countries on 7 continents
- Median time between pretest and posttest: 360 days
- Sample mean age: 11.3 years (7 months – 42 years)
- No evidence for a publication bias (funnel plots, Egger)

# Results: Distribution of Effect Sizes $r_{NG}$

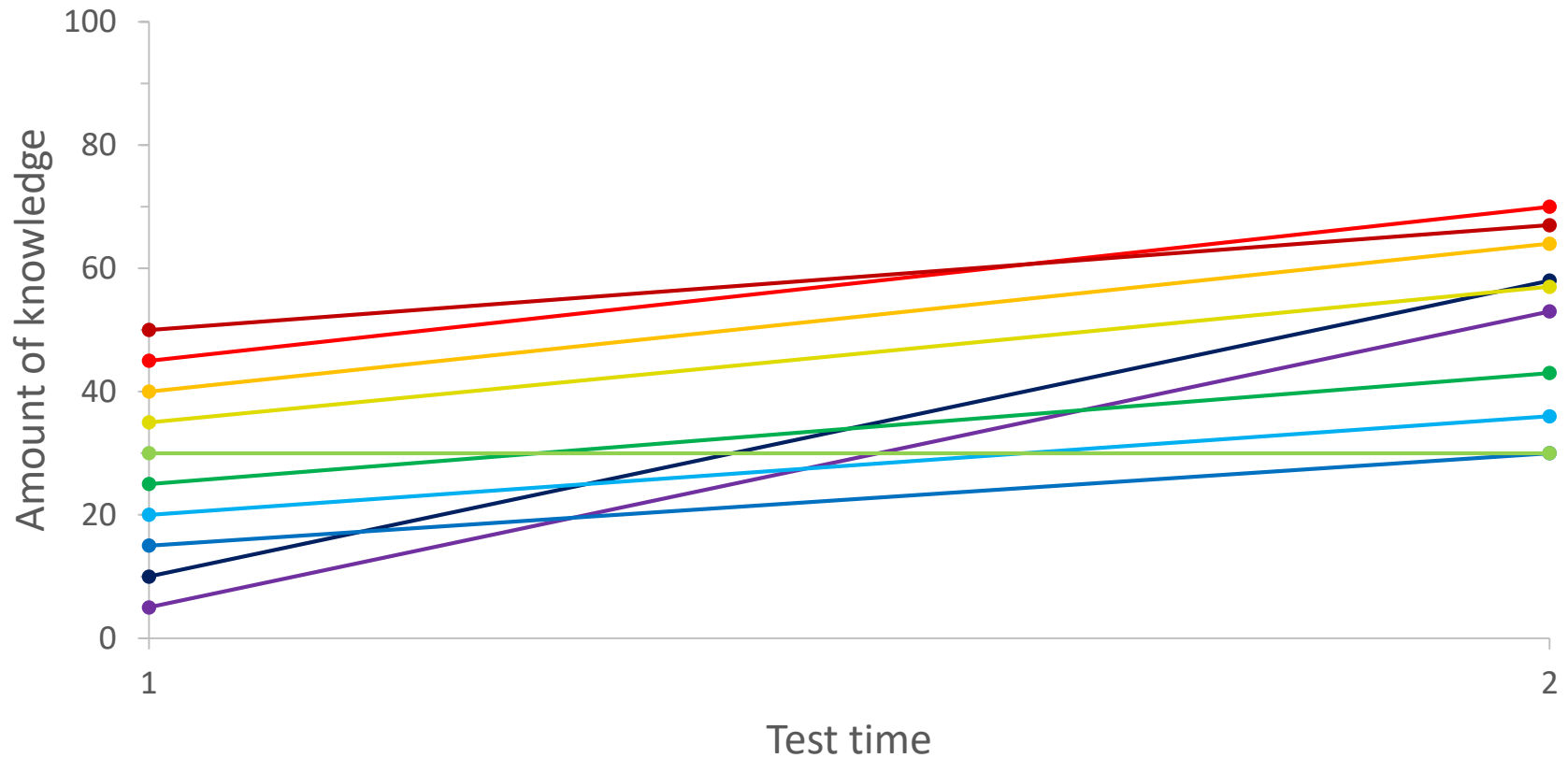


# Meta-analytic Mean Effect Sizes

Correlation of prior knowledge with	Studies	Effect sizes	$\bar{r}$	95% CI	$I^2$
Posttest $r_p$	476	7772	.531	[.509, .552]	94%
Normalized Gains $r_{NG}$	69	697	-.059	[-.150, .034]	96%

# Our Findings

Correlation with posttest:  $r_p = .53$ ,  
correlation with norm. gains:  $r_{NG} = -.08$



# Moderator Analyses

Table 11 Moderator Analyses on the Correlation of Prior Knowledge with Problem Persistence and Unlearning Knowledge Gain									
Moderator	k	N	SE	95% CI	p	Heterogeneity	Moderator		Heterogeneity
							I <sup>2</sup>	p	
Overall	0.16	112	0.01	0.13	0.19	0.00	0.00	0.00	0.00
<b>Gender</b>									
Male	0.15	102	0.01	0.12	0.18	0.00	0.00	0.00	0.00
Female	0.17	10	0.02	0.13	0.16	0.00	0.00	0.00	0.00
<b>Age</b>									
18-24	0.14	50	0.01	0.11	0.17	0.00	0.00	0.00	0.00
25-34	0.16	30	0.01	0.13	0.15	0.00	0.00	0.00	0.00
35-44	0.17	20	0.01	0.14	0.16	0.00	0.00	0.00	0.00
45-54	0.18	10	0.02	0.15	0.17	0.00	0.00	0.00	0.00
55-64	0.19	10	0.02	0.16	0.18	0.00	0.00	0.00	0.00
65+	0.20	10	0.02	0.17	0.19	0.00	0.00	0.00	0.00
<b>Education</b>									
High school	0.15	50	0.01	0.12	0.18	0.00	0.00	0.00	0.00
College	0.16	30	0.01	0.13	0.16	0.00	0.00	0.00	0.00
Postgraduate	0.17	20	0.01	0.14	0.17	0.00	0.00	0.00	0.00
<b>Problem Persistence</b>									
High	0.14	50	0.01	0.11	0.17	0.00	0.00	0.00	0.00
Low	0.18	10	0.02	0.15	0.19	0.00	0.00	0.00	0.00
<b>Unlearning Knowledge Gain</b>									
High	0.15	50	0.01	0.12	0.18	0.00	0.00	0.00	0.00
Low	0.17	10	0.02	0.14	0.20	0.00	0.00	0.00	0.00

# Conclusions 1: Methods

- Correlation  $r_P$  between prior knowledge and posttest knowledge indicates stability of individual differences in knowledge
- Correlation  $r_{NG}$  between prior knowledge and normalized knowledge gains indicates the predictive power of prior knowledge for learning
- Conceptual and empirical differences
- Importance of reporting and interpreting both

## Conclusions 2: Knowledge-is-Power Hypothesis

- Prior knowledge is an excellent predictor of knowledge after learning
  - Even after controlling for intelligence
  - Useful for predicting future knowledge
- Prior knowledge rarely/weakly predicts knowledge gains
  - Knowledge-is-Power Hypothesis too general
  - Prior knowledge *can* have strong positive and negative effects on learning, but mostly it doesn't

## Conclusions 3: Questions for Research and Practice

- Open question for research: Why did prior knowledge affect learning less often than expected?
- Open question for educational practice: What are the boundary conditions under which teachers should pay special attention to prior knowledge?





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## Domain-specific prior knowledge and learning: A meta-analysis

Bianca A. Simonsmeier, Maja Flaig, Anne Deiglmayr, Lennart Schalk & Michael Schneider

The results in this presentation here have been published as:  
Simonsmeier, B. A., Flaig, M., Deiglmayr, A., Schalk, L., & Schneider, M.  
(2021). Prior knowledge and learning: A meta-analysis. *Educational Psychologist*. doi: 10.1080/00461520.2021.1939700

[\[full text link\]](#)

# THANK YOU!