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► **To cite this version:**

Xiaodan Zeng, Salomé Cojean, Pascal Pansu. The Impact of Computer-Based Feedback Strategies on Students' Learning: A Network Meta-Analysis. International Society for the Study of Behavioural Development (ISSBD), Jun 2024, Lisbon (Portugal), Portugal. hal-04607898

**HAL Id: hal-04607898**

**<https://univ-rennes2.hal.science/hal-04607898>**

Submitted on 11 Jun 2024

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# The Impact of Computer-Based Feedback Strategies on Students' Learning: A Network Meta-Analysis

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## BACKGROUND

- **Feedback (FB)** : crucial component of successful learning / information to learners about their performance / intended to modify learners' thinking or behavior for the purpose of improving learning (Newman et al., 2021; Shute, 2008).
- Most effective in a computer-based environment :  
**Elaborated feedback (EF)** : information about the task, process, and level of self-regulation  
**Answer-Until-Correct feedback (AUC)** : opportunity to retry to find the right answer

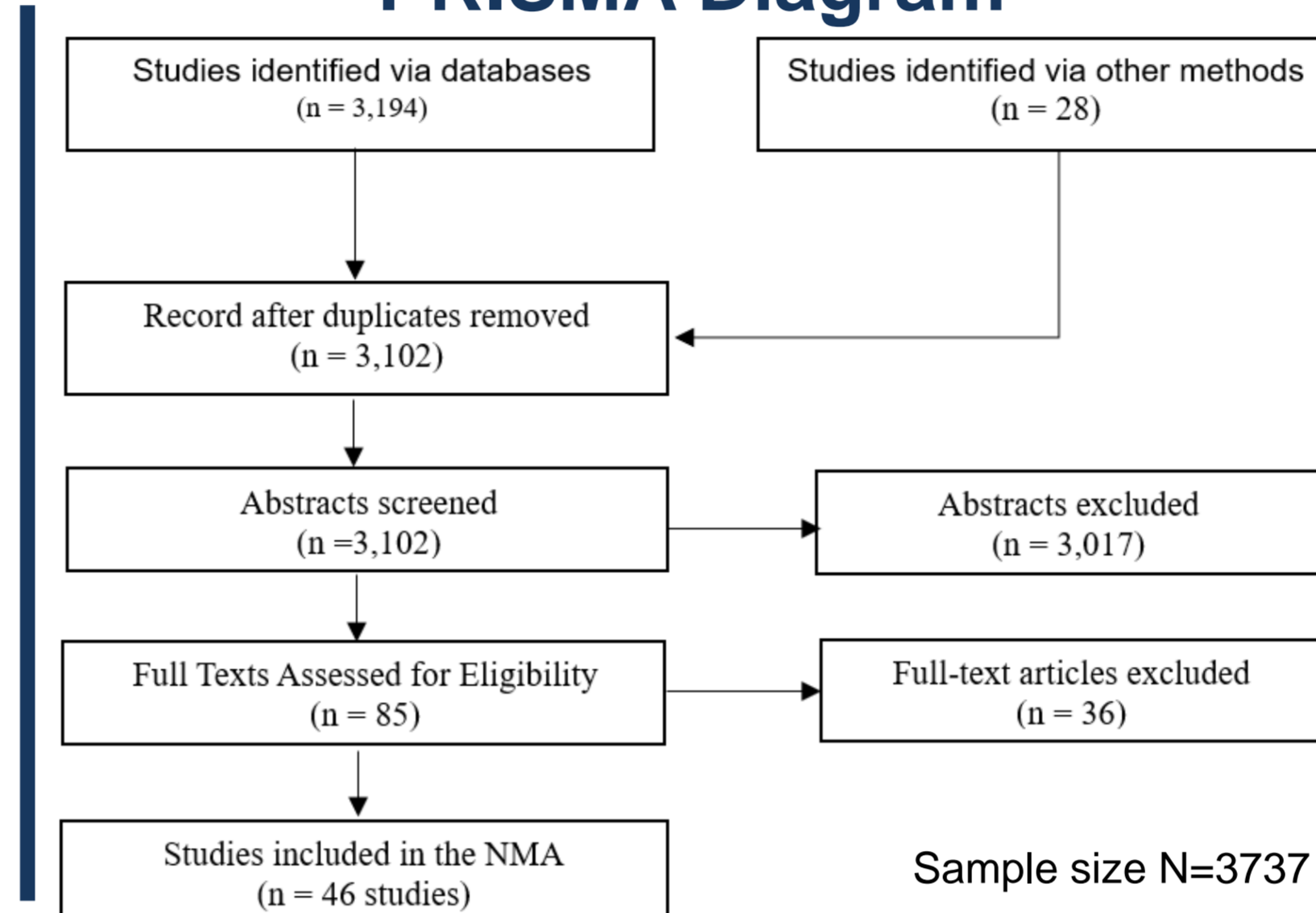
## AIM

- To synthesize the available literature evaluating different EF and AUC strategies
- To study the effects of moderators on the effectiveness of different types of EF and AUC feedback : students' prior knowledge level, learning domains, learning outcome orders and test format.

## METHOD

- **Inclusion criteria**: RCTs; high school students, undergraduate, adult learners; EF and AUC feedback strategies/interventions; low and moderate risk bias, after 2000
- **Frequentist network Meta-analysis**: Random effects models; Hedges' g values, 95% confidence intervals, p values, and SUCRA values
- **Subgroup analyses** : network meta-analyses per moderator
- **Publication bias**: funnel plots

### PRISMA Diagram

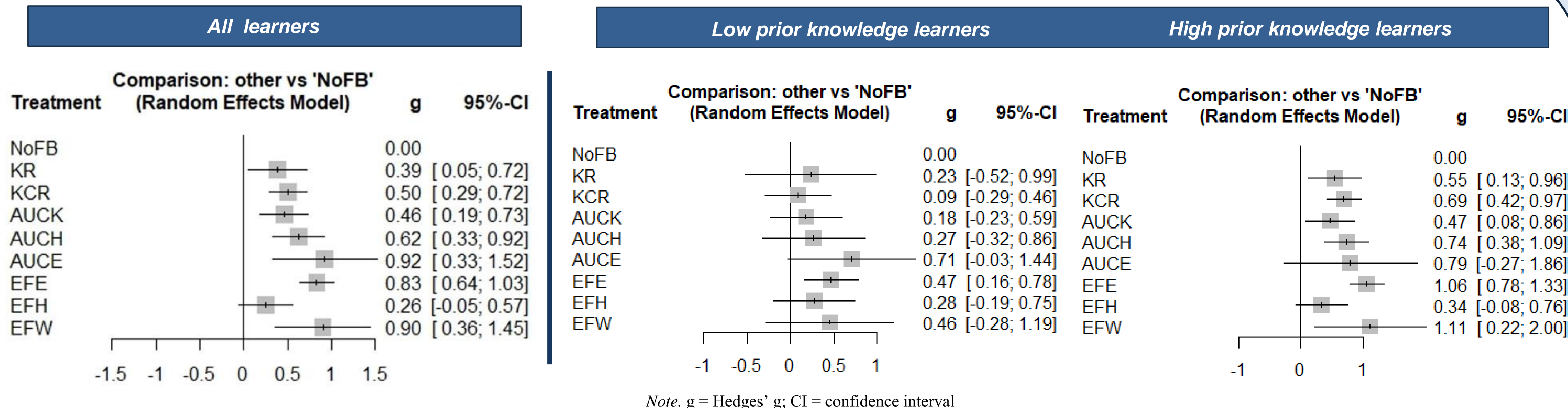


### Different EF and AUC feedback

**AUCK** = Answer-Until-Correct with Knowledge of correct response feedback;  
**AUCH** = Answer-Until-Correct with Hints  
**AUCE** = Answer-Until-Correct with Explanations feedback  
**EFE** = Elaborated Feedback with Explanations;  
**EFH** = Elaborated Feedback with Hints,  
**EFW** = Elaborated Feedback with Worked example similar with the concerning task

## RESULTS

### Effectiveness of different EF and AUC feedback strategies compared to the NoFB condition

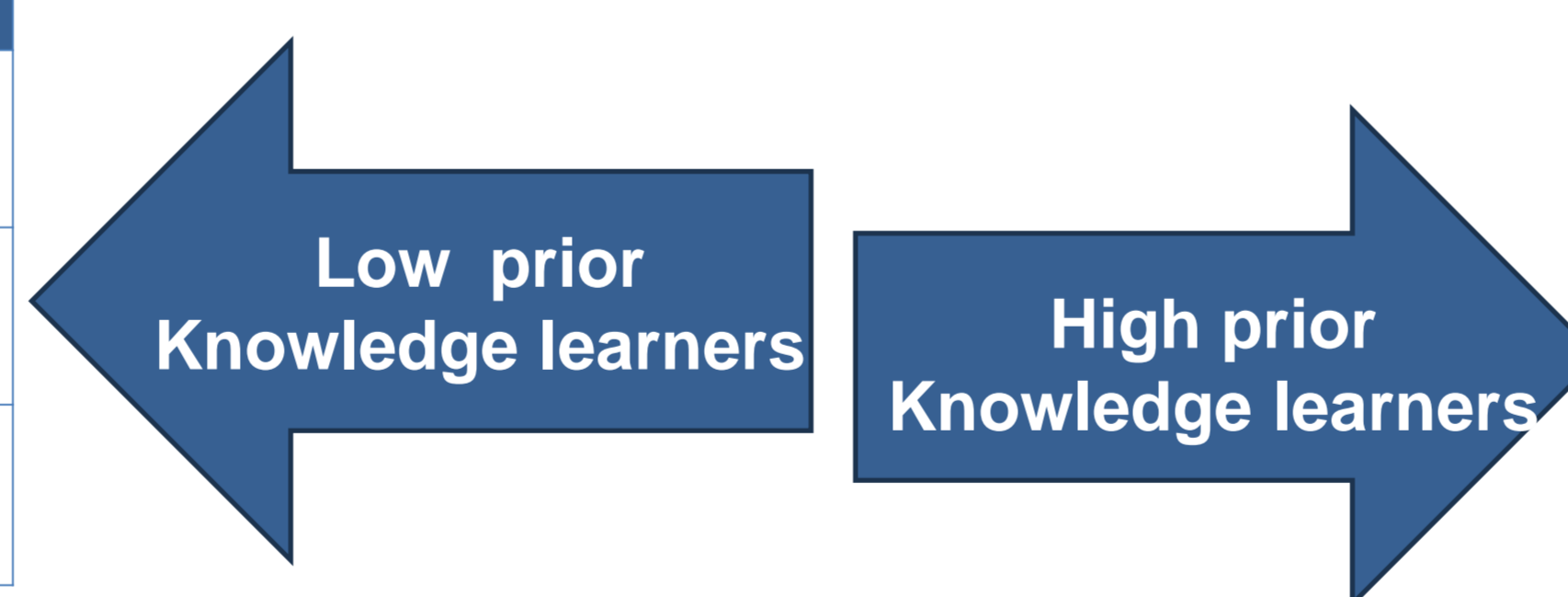


### Effect size for each feedback type per moderator

Subgroup	EHW	EFE	AUCK	AUCE
Learning order level				
High	0.73	1.23***	0.89**	1.40**
Learning domain				
General knowledge	-	1.07***	0.60	-
Test format				
CR	0.65*	0.86***	0.61*	-

Note. \*p < .05, \*\*p < .01, \*\*\*p < .001

- Comparators in this analysis :
- No Feedback (NoFB) condition
  - Knowledge of Results feedback (KR): right/wrong
  - Knowledge of Correct Response feedback (KCR) : provide the correct response



Subgroup	EHW	EFE	AUCK	AUCH
Learning order level				
Low	0.81	0.96***	0.42	0.74***
High	1.42	1.17***	0.88	0.44
Learning domain				
Mathematics	1.34*	1.39***	0.34	0.86*
Sciences	-	0.88***	0.88	0.67*
Language	-	1.15***	0.62	0.49
Test format				
CR	0.81	1.03***	0.06	0.63
MC	-	1.04***	0.70**	0.78***

Note. \*p < .05, \*\*p < .01, \*\*\*p < .001

Publication bias: Funnel plots mostly symmetrical

## CONCLUSION

- All types of Elaborated feedback and Answer-Until-Correct feedback produced positive effects on students learning except Elaborated feedback with Hints;
- Elaborated feedback and Answer-Until-Correct feedback with Explanations contained more information are most effective for low prior knowledge learners
- Effectiveness of different feedback varied based on different moderators
- More work is needed to examine the effect of Answer-Until-Correct feedback with Explanations in different learning domain and in different format, etc.

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