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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

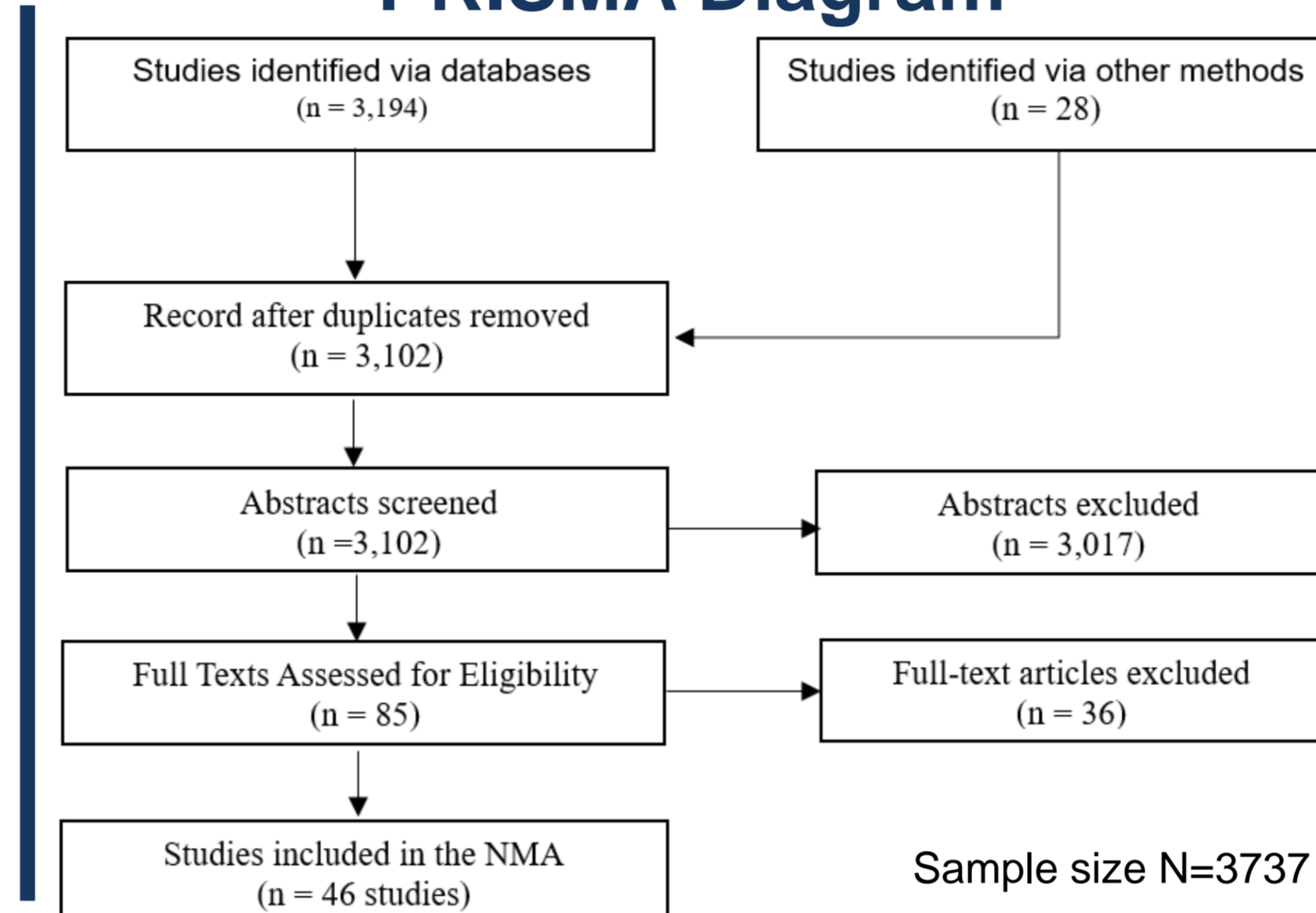
AIM

- 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

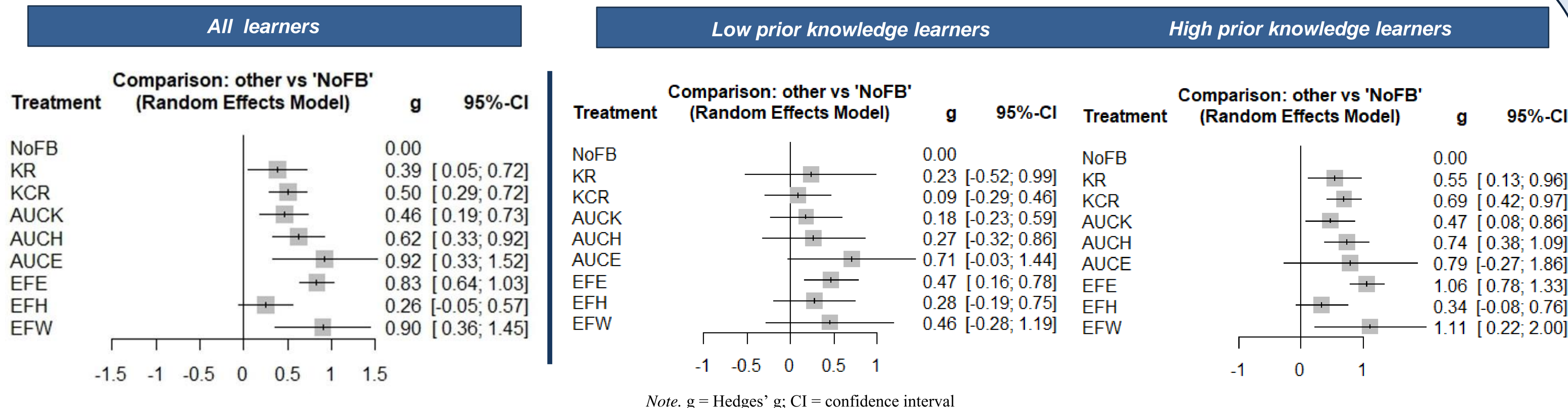


Different EF and AUC feedback

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

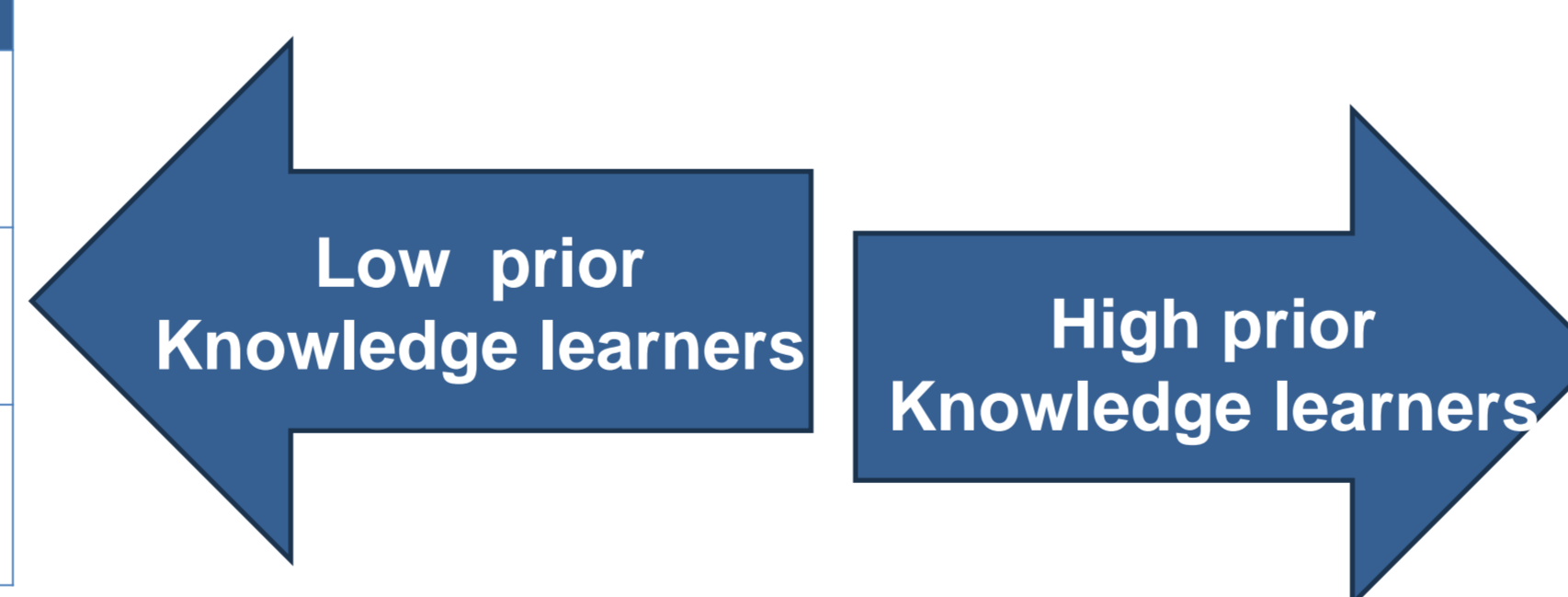


Effect size for each feedback type per moderator

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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