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Department of Education Sciences, Faculty of Education



Processes of learning,
motivation and self-regulation
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How students perceived formative assessment predicts their motivation and metacognition: A multilevel analysis

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Outline



CONTEXT



PROBLEM



THEORETICAL
PERSPECTIVE



METHOD



RESULTS



LIMITATIONS



CONCLUSION

Context: Tanzania

Policy



Competence based education reforms



Learner-centered pedagogies



Formative assessment for continuous feedback

Practice

- Systemic barriers e.g., limited assessment literacy, resource constraints, large class about 73:1 average student-teacher ratio (Senjro & Lupeja, 2023).
- Teacher-centered, with severe accountability, societal pressure tied to national examinations (Halai et al 2023).
- Formative assessment misinterpreted as continuous testing (Shafii & Berger, 2025).

Problem

What we know

- Formative assessment is associated with motivational beliefs and metacognition (Luo & Lim, 2024; Monteiro & Passarinho, 2026)
- Evidence mostly from high-income contexts

What we do not know

- Does this association hold in overcrowded, exam-driven classrooms like those in Tanzania?

Luo, W., & Lim, S. Q. W. (2024). Perceived formative assessment and student motivational beliefs and self-regulation strategies: A multilevel analysis. *Educational Psychology*, 44(3), 284–302. <https://doi.org/10.1080/01443410.2024.2354686>

Monteiro, V., & Passarinho, B. B. (2026). Formative Assessment and Self-Regulated Learning in Lower Secondary Mathematics: Students' and Teachers' Perceptions. *Education Sciences*, 16(3), 452. <https://doi.org/10.3390/educsci16030452>

Theoretical perspective

- Formative assessment (Black & Wiliam, 1998).
- Motivational beliefs: Expectancy-Value-Cost model (Barron & Hulleman, 2015) extending the Expectancy-Value Theory (Wigfield & Eccles, 2000)
- Metacognition (knowledge and regulation) (Brown, 1987).



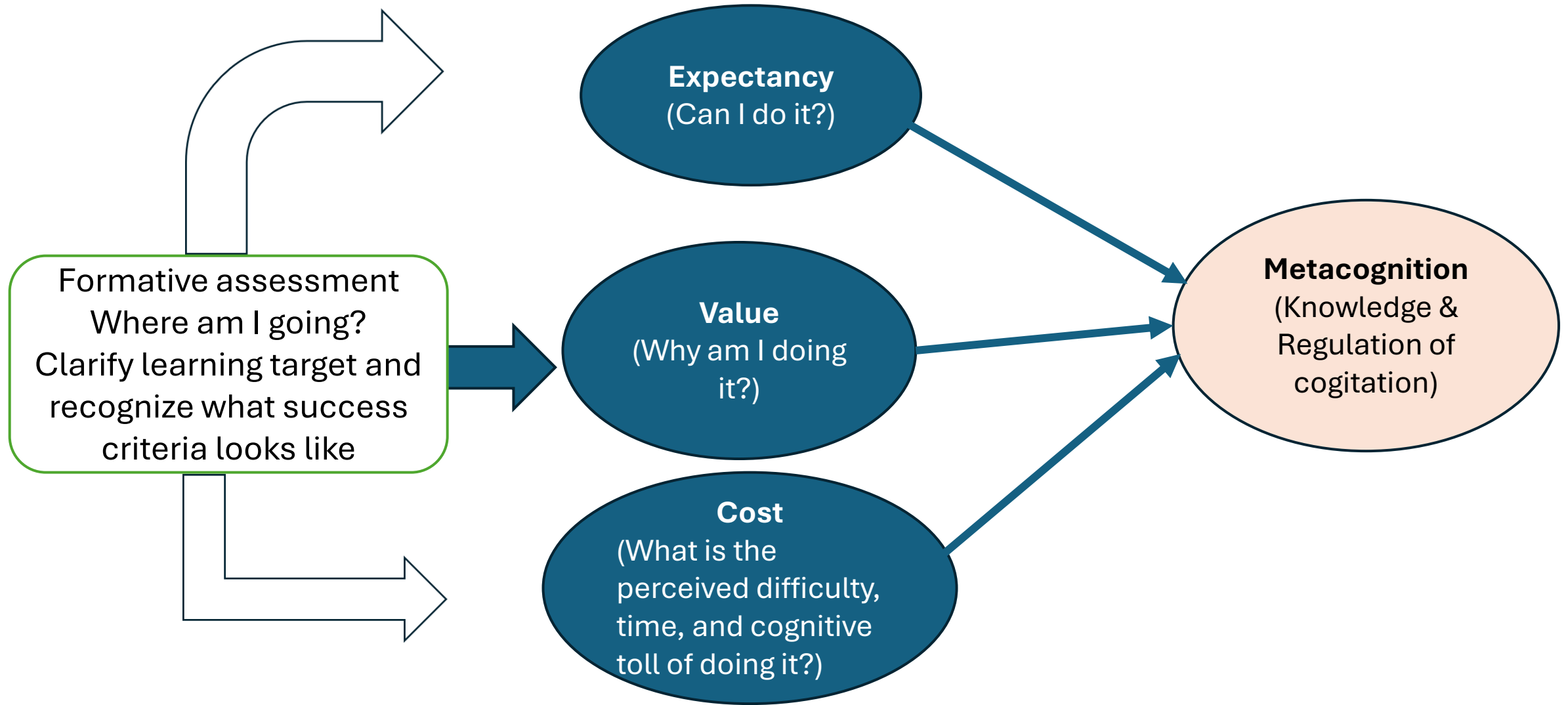
Barron, K. E., & Hulleman, C. S. (2015). Expectancy-value-cost model of motivation. In *International encyclopedia of the social & behavioral sciences* (pp. 503–509). Elsevier.

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Brown, A. L. (1987). Metacognition, Executive Control, Self-Regulation, and Other More Mysterious Mechanisms. In F. E. Weinert & R. Kluwe (Eds.), *Metacognition, Motivation, and Understanding* (pp. 65-116). Hillsdale: L. Erlbaum Associates.

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Research questions

RQ1(Individual level): To what extent do individual students' perceptions of formative assessment practices predict their motivational beliefs and use of metacognition?

RQ2 (classroom level): Does the shared classroom environment regarding formative assessment practices predict overall classroom motivation and metacognition across different classrooms?



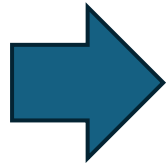
Method

Participants



1,543 primary school students (Ages 9-15, 53.5% girls, 46.5% boys) from 37 public schools, 67 classrooms across 3 Regions (Mwanza, Coastal, Morogoro) in 5 subjects: Math, Science, Moral Education, Swahili and English.

Measures



Translated/adapted:
7-item Formative Assessment Scale (Luo & Lim, 2024),
10-item EVC Scale (Kosovich et al., 2014),
18-item JrMAI (Kim et al., 2017; Sperling et al., 2002)

Luo, W., & Lim, S. Q. W. (2024). Perceived formative assessment and student motivational beliefs and self-regulation strategies: A multilevel analysis. *Educational Psychology*, 44(3), 284–302.

<https://doi.org/10.1080/01443410.2024.2354686>

Kim, B., Zyromski, B., Mariani, M., Lee, S. M., & Carey, J. C. (2017). Establishing the factor structure of the 18-item version of the Junior Metacognitive Awareness Inventory. *Measurement and Evaluation in Counseling and Development*, 50(1–2), 80–91. <https://doi.org/10.1177/0748175616671366>

Kosovich, J. J., Hulleman, C. S., Barron, K. E., & Getty, S. (2014). A practical measure of student motivation: Establishing validity evidence for the expectancy-value-cost scale in middle school. *The Journal of Early Adolescence*, 35(5–6), 790–816. <https://doi.org/10.1177/0272431614556890>

Analysis

- Multilevel analysis, Maximum Likelihood Robust (MLR) estimation.
- Group-mean centering using Mplus
- **Model 1:** Individual level (perceive FA → motivation → metacognition)
- **Model 2:** Classroom level (classroom → shared classroom FA climate)
- **Model 3:** Subjects controlled (classroom → Subjects → shared classroom FA climate)

Results

Individual level

Table 1: Multilevel models predicting motivational beliefs and metacognition

		Model 1			Model 2			Model 3		
IVs	DVs	Estimate	Std. Error	p-value	Estimate	Std. Error	p-value	Estimate	Std. Error	p-value
PFA (within-level)	Metacognition	0.391	0.050	< .001	0.391	0.050	< .001	0.292	0.110	.008
	Expectancy	0.299	0.061	< .001	0.299	0.061	< .001	0.300	0.061	< .001
	Value	0.227	0.070	.001	0.227	0.070	.001	0.186	0.178	.294
	Cost	0.489	0.082	< .001	0.490	0.082	< .001	0.491	0.082	< .001
PFA (between-level)	Metacognition	—	—	—	0.408	0.145	.005	0.409	0.143	.004
	Expectancy	—	—	—	0.245	0.115	.033	0.300	0.105	.004
	Value	—	—	—	0.315	0.137	.021	0.285	0.144	.049
	Cost	—	—	—	0.368	0.117	.002	0.382	0.114	< .001

PFA = perceived formative assessment, IVs = independent variables, DVs = dependent variables

Higher perceptions of formative assessment were associated with higher expectancy of success, task value, perceived cost, and metacognition.

Note: **Cost paradox**

Cost paradox: Objective Workload vs. Subjective Cost

Objective workload



Formative assessment does not reduce the objective difficulty of the learning task

Subjective cost appraisal



It reduce the “ambiguity of guessing” and replace it with an accurate awareness of the time and cognitive effort required for mastery

Without formative assessment

e.g., Write an essay about Science



Low anticipated effort due to vague scope, lead to superficial strategy and failure rate

With formative assessment

e.g., Write an essay about science. The essay should include paragraph with definition, examples and a well labelled diagram.



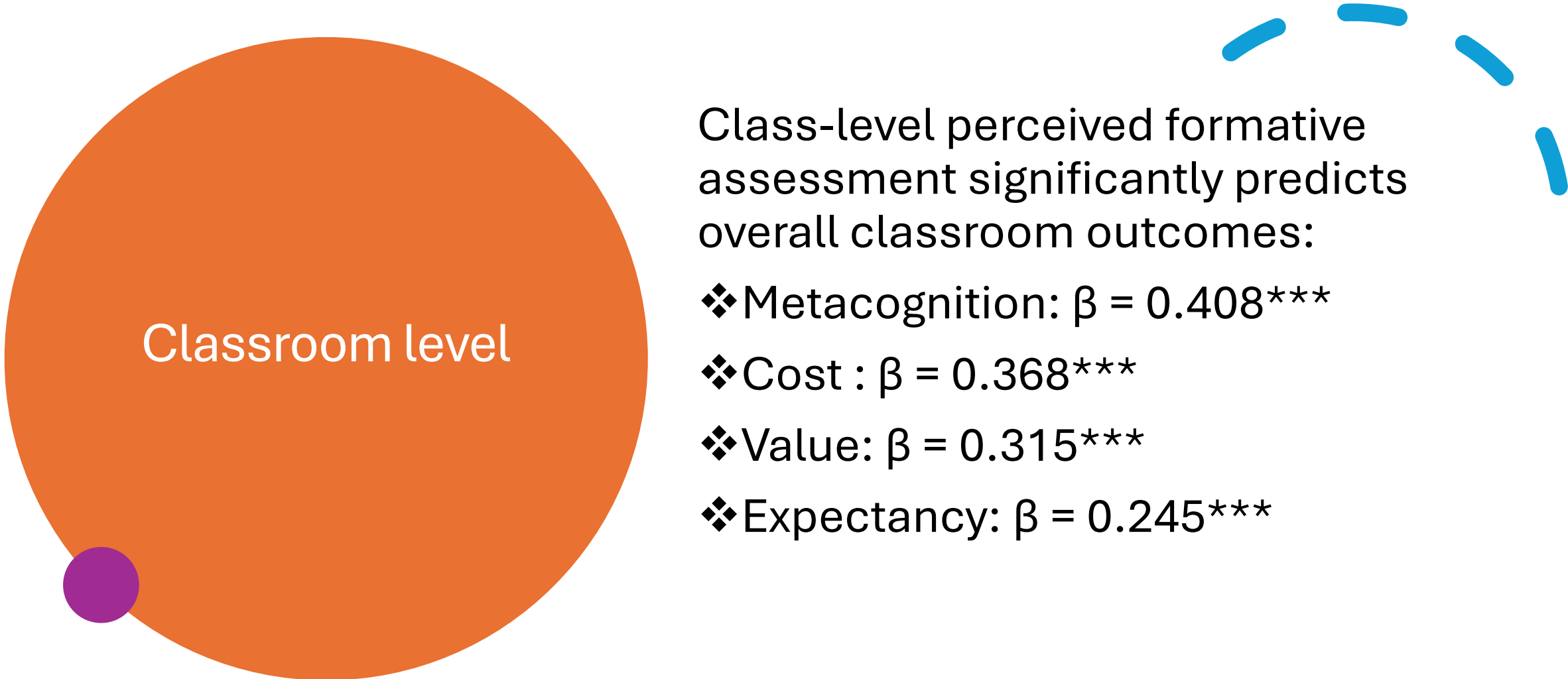
High anticipated effort (high perceived cost), but a high accurate effort estimation leading to deep learning

Take away:

Formative assessment does not shield students from difficulty; it make a true cost of deep learning transparent.



Therefore, increased cost here is a marker of regulation not a barrier. It creates a “desirable difficulties” (Bjork & Bjork, 2011) that align students' expectations with the cognitive effort actually required.



Classroom level

Class-level perceived formative assessment significantly predicts overall classroom outcomes:

- ❖ Metacognition: $\beta = 0.408^{***}$
- ❖ Cost : $\beta = 0.368^{***}$
- ❖ Value: $\beta = 0.315^{***}$
- ❖ Expectancy: $\beta = 0.245^{***}$

Formative assessment can establish a shared instructional climate, not just an isolated teacher-student interactions

Controlled subjects

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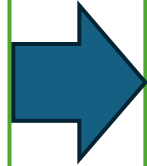
PFA = perceived formative assessment, IVs = independent variables, DVs = dependent variables

- Results suggest that students cannot be compelled to value a subject solely through clarifying success criteria and the provision of quality feedback.
- Therefore, value is constructed through subjective interpretations of utility, attainment and interest inherent in the specific subject being taught.

Synthesis of ecological flow

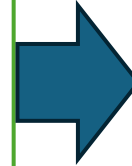
Classroom assessment norm

Formative practices are embedded as a collective ecology, not just an individual tool



Individual regulation

Students internalize success criteria, recalibrating their subjective interpretation of reality (Expectancy, Value and Cost)



Metacognition

With reality calibrated, students can effectively plan, monitor, and regulate their cognition (KOC & ROC).

Random slopes and variability analysis

Table 2: Between-level residual variances for Model 2 and Model 3

	Model 2			Model 3		
Outcome Intercepts	Variance (σ^2)	Std. Error	p-value	Variance (σ^2)	Std. Error	p-value
Value	.074	.022	.001	.074	.021	< .001
Expectancy	.042	.010	< .001	.036	.009	< .001
Cost	.036	.008	< .001	.035	.008	< .001
Metacognition	.043	.018	.014	.041	.015	.008
Random Slopes						
Slope (Metacognition on PFA_c)	.037	.013	.004	.026	.016	.097
Slope 2 (Value on PFA_c)	.045	.021	.033	.005	.031	.861

PFA_c = Student-level formative assessment (centered)

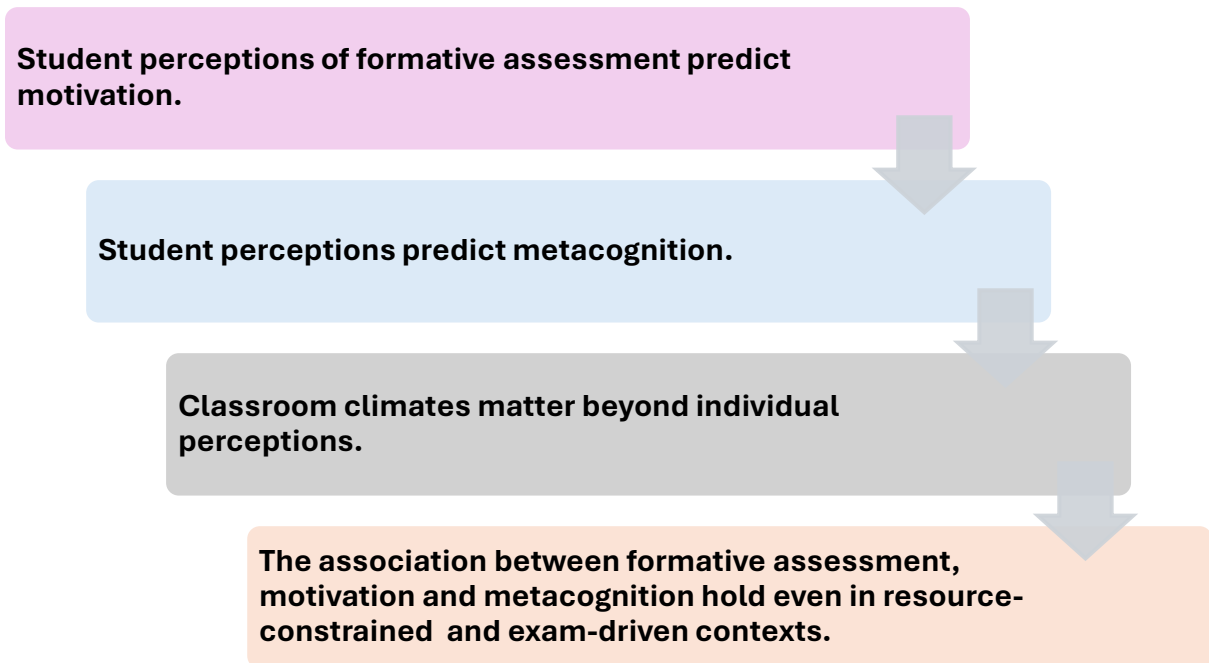
The relationship between students' perceptions of formative assessment and their motivation and metacognition is context dependent.

Limitations & Future research

- **Cross-Sectional Research Design:** it is not possible to establish a definitive cause-and-effect relationship.
- **Reliance on Student Self-Reports:** susceptible to social desirability bias.
- **Absence of Teacher-Level Data and Contextual Confounders:** the research lacks key teacher-related details (such as years of experience, professional training, and educational qualifications) and students' prior grades, which could potentially confound the relationships between perceived formative assessment, motivational beliefs, and metacognition
- **Future longitudinal and intervention studies** are needed to establish causal mechanisms.

Key Findings

Student perceptions of formative assessment predict motivation.



Student perceptions predict metacognition.

Classroom climates matter beyond individual perceptions.

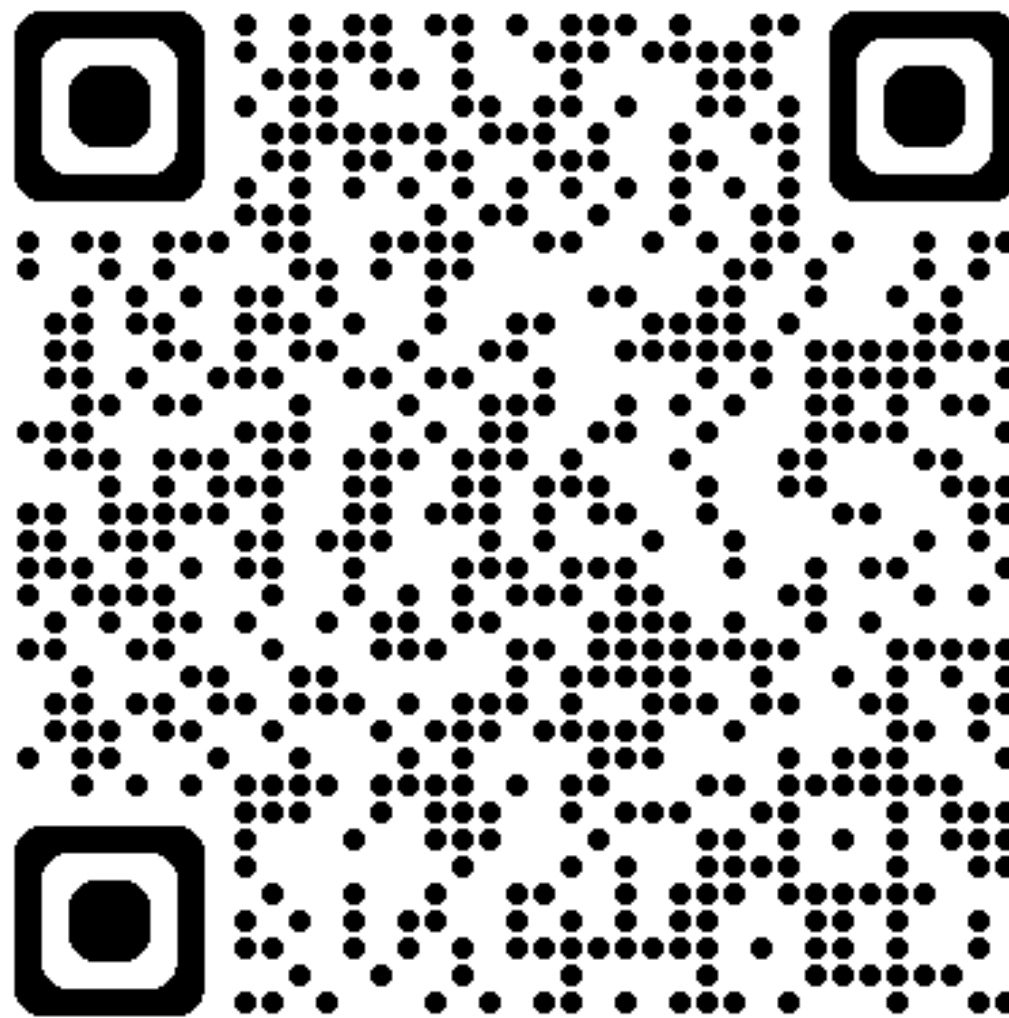
The association between formative assessment, motivation and metacognition hold even in resource-constrained and exam-driven contexts.

Conclusion:

Formative assessment is not merely an assessment strategy. It is a learning ecology that shapes how students understand effort, success, and metacognition.



Pre-print





THANKS FOR YOUR ATTENTION



QUESTIONS AND COMMENTS