



# Tracing Developmental Pathways in Mathematics Learning with MetaSEM: Integrating Evidence Across Studies

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## Abstract

Understanding how mathematical knowledge develops over time is central to both theory and practice in education. This talk presents two meta-analytic structural equation modeling (MASEM) studies that synthesize decades of research to clarify how mathematical learning builds and changes over time. Study 1 investigates the foundations of fraction learning by separating conceptual and procedural pathways linking whole-number knowledge to fraction understanding. Findings show strong within-domain continuity—conceptual whole-number knowledge predicts conceptual fraction understanding—along with distinct contributions from domain-general skills such as working memory, reasoning, and language. The strength of these effects varies by age and mathematics difficulty. Study 2 takes a broader longitudinal view, integrating data across multiple ages, time lags, and task types. Results reveal that early mathematics skills influence later achievement through both direct (snowballing) and mediated (steppingstone) pathways, shaped by age, time lag, and task similarity. Together, these studies offer a unified developmental framework showing that math learning is both cumulative and reconstructive—driven by domain-specific continuity and supported by broader cognitive resources.

**Date:** November 4, 2025 (Tuesday)  
**Time:** 16:00 – 17:15  
**Venue:** Room 411-412, Meng Wah Complex, HKU  
**Chair:** Professor Xiao Zhang

## About the speaker

Dr. Xin Lin is an Assistant Professor at the Faculty of Education, University of Macau. She earned her PhD in Special Education from the University of Texas at Austin. Her research examines mathematics learning difficulties, cognitive mechanisms underlying learning, effective interventions, and the use of artificial intelligence in special education.

Dr. Lin has published as first author in leading international journals, including *Review of Educational Research*, *Educational Psychology Review*, *Child Development*, and *Journal of Learning Disabilities*. She has also presented and published at top-tier computer science venues, including ACM CCS and CHI, reflecting her strong interdisciplinary research profile. She received the DRDS Scholar Award (2022) from the Council for Exceptional Children, U.S.

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