

How Do Math Learning Gaps Arise in Preschool Years? The Multiplicative Roles of Family Environment, Cognitive Skills, and Math-specific Skills

Children start developing their ability to think mathematically and explore and understand mathematical concepts and skills, e.g., counting, sorting, and matching, in daily routines and activities. The early math knowledge and skills learned in preschool lay the foundation for developing more complex mathematical concepts, critical thinking skills, and problem-solving abilities in school and later life. Children's early competence in math has implications for later math and science achievements. With a poverty rate of 23.6% in Hong Kong (Census and Statistics Department, 2022), many children face risks when learning math that can cause substantial problems for themselves, their families, and society. The family socioeconomic status (SES) and home math environment (HME) profoundly shape children's quality and frequency of early math learning. Children who grow up in family environments with risk factors, such as low SES and poor HME, face a heightened risk of encountering math difficulties. Children from low-SES families are more likely to have inadequate exposure to math learning, few math learning resources, and poor parent-child interactions. Compared with their peers, children growing up in harsh environments generally have lower and slower development of early cognitive, language, and math skills, adversely affecting their later academic achievement and school success. This development gap among children with a low vs. middle family risk environment may begin in kindergarten and persist throughout their formal education. However, longitudinal research has rarely focused on the relationships between cognitive and math-specific skills and early math learning for Chinese children with different profiles of family environment risks. The proposed study will examine the Moderated Pathways Model that considers the impact of family environment factors on the associations of cognitive skills (i.e., language, executive functions, visuospatial) and math-specific skills (i.e., symbolic numeracy, patterning, and nonsymbolic quantity skills) in children's early math development. This study will also examine the developmental trajectories of math learning outcomes in children in the three preschool years (from K1 to K3) who face different family environment risks and what predictors will decrease the math learning gap between children that do and do not face family environment risks. The findings can offer research-based evidence to raise children's early math performance and address issues related to family environment risk. Teachers and policy-makers can also gain insights into developing educational policies and curricula while targeting children at risk of experiencing early math learning issues across the preschool years.