Effects of a Story-Inspired Robotics Coding Curriculum on Children's Computational Thinking and School Readiness Skills

Existing evidence highlights the importance of computer programming or coding experience in fostering children's computational thinking (CT) (Sullivan & Bers, 2018). While coding is a transferable skill that can help solve problems efficiently and is important in improving students' CT (Curriculum Development Council, 2020), very little research has been done with young children, especially in Hong Kong. Without evidence-based and culturally appropriate curricula, it is difficult for teachers to incorporate coding experiences into early childhood classroom practices and ensure that children can benefit from such activities.

To fill this gap, this project will develop a coding curriculum for Hong Kong kindergartens and evaluate its effectiveness using a classroom-based randomized controlled trial (RCT) design. Building on the Principal Investigator's pilot study, this study will develop a Story-Inspired Robotics Coding (SIRC) curriculum to be implemented in Hong Kong kindergartens. The curriculum design will be informed by constructionist learning and sociocultural learning theories, which would allow children to learn how to program a robot to celebrate cultures or solve problems based on the story context of picture books. We will then evaluate the curriculum with a cluster RCT in eight Hong Kong kindergartens. For each kindergarten, three classes of 5-year-old children will be invited to participate, resulting in a study involving approximately 24 classrooms, 48 teachers, and 360 children. Each classroom will be randomly assigned to either the treatment or the wait-list control condition. Children in both conditions will participate in story-related sessions of approximately 35 minutes which would be held once a week over two months; the treatment teachers and children will engage in SIRC activities, while the control group will read the same stories and learn through normal instruction. Pre- and post-tests will be used to measure children's CT and school readiness skills (i.e., early literacy, math, self-regulation, and social skills). Multilevel modeling will be used to evaluate the intervention effects. Videotaped classroom observations will be analyzed to investigate children's learning process in SIRC. Teachers will be interviewed to investigate enablers and barriers to the SIRC curriculum implementation.

This project will be the first to evaluate the impact of an early coding curriculum, not only on CT, but also on the academic, cognitive, and social outcomes important for children's school readiness. It will rigorously examine the effects of an instructional design for early

coding education with picture books and programmable robotics and help build human capital for the digital future.