

MindScribe: Toward Intelligently Augmented Interactions in Highly Variable Early Childhood Environments

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ABSTRACT

Early childhood is a period of critical development, with impacts that can last a lifetime. And inequities in the quality of care for this vulnerable population—especially for those at-risk due to disability, family income, or trauma—can perpetuate further downstream health and school-readiness effects. Technology-enabled solutions have the ability to bridge quality-of-care gaps by intelligently augmenting daily activities. However, many traditional computational approaches to natural language interactions are not yet feasible nor affordable in highly variable and dynamic early childhood environments. Yet for rapidly developing preliterate young children, solutions are needed now. We present MindScribe, an interactive robotic object that leverages open-ended ‘serve and return’ natural language interactions to intelligently support reflective inquiry and school-readiness in highly variable and imaginative early childhood environments.

CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI); Natural language interfaces; User centered design; Accessibility technologies;** • **Computer systems organization** → **Robotics;**

KEYWORDS

Human-agent collaboration; Interactive robotic objects; Voice interaction; Natural language; Early childhood development; Constructionism; Accessibility; User-centered design.

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1 INTRODUCTION

In the constructionism theory of learning, learners create new ideas when they make some sort of external artifact which they can reflect upon and share with others [2]. While making and sharing are prevalent activities in early childhood environments, reflection is often undersupported as valuable one-on-one creative inquiry with young children requires both time and expert resources [1]. And in low-income communities, these are especially constrained assets. To scalably support this constructionist learning cycle, we sought to build an inquisitive assistant that engages reflective inquiry through the medium of imaginative storytelling—a developmentally-appropriate practice in early childhood environments.

Specifically, we sought to approximate an intelligent user interface that met the following human-centered requirements: (1) Utilize the ‘serve and return’ early childhood model of contingent reciprocity wherein cooperation occurs as partners appropriately respond to each other’s input [3], (2) interact using natural language to orally scaffold the children’s construction of reflective stories about their creative artifacts; (3) support natural language interaction given the highly variable range of young children’s speaking patterns, including pronunciation, grammar, and speech-language pathologies; (4) support the children’s development of their original, imaginative ideas; and (5) support cost-effective deployment in low-income communities. In sum, these specifications represent a highly variable, wide domain with a focus on affordable accessibility.

