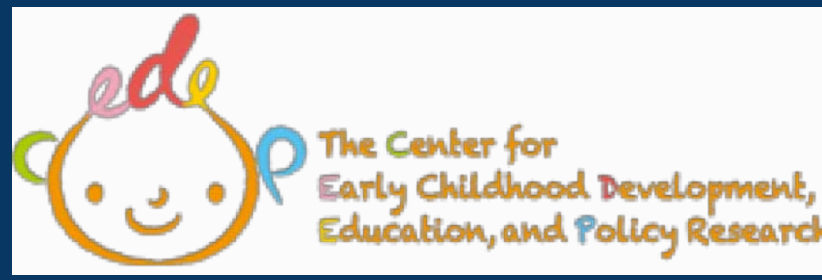


# Emergent Processes in the Drawing Activities of Young Children Using Digital Tools

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## Research Aims

### Background

- ◆ OECD Education 2030 refers to “**Creating New Value**” that leads to innovation in **collaboration with others**, a social competence that is necessary for the future.
- ◆ With the rapid evolution of ICT, young children increasingly own, access, and use new technologies on a daily basis; **how can we use digital tools to effectively foster creativity among young children in their expressive work?**

### Relationship to previous research

- ◆ **Interactions during drawing activities**
  - ✓ Children nurture creativity by imitating the drawings of others (Oku, 2012).
  - ✓ The “languageization of drawing,” “association,” “imitation,” and “addition of drawing” are factors related to children’s collaboration in drawing activities (Wakayama et al., 2009).
- ◆ **The effect of digital drawing**
  - ✓ Digital drawing software and tools give children more opportunities than ever to express themselves creatively (Moberg & Lindén, 2008; Zevenbergen, 2007).
- ◆ **The psychological content of digital play**
  - ✓ Digital play can enrich children’s play opportunities, which promotes play complexity and increased social and cognitive demands on children; together these aspects can be theorized as a positive force in children’s development (Fleer, 2018).

### What is missing from the literature

- In daily childcare, **various social structures of the classroom are seen as forming a systemic whole** rather than being experienced as separate parts.
- There is a need to not only understand the individual elements but also attend to **the interconnections between the elements along with the emergent properties of these interactions using digital tools.**

### Purpose of this study

- This study investigates **how to incorporate digital tools into drawing activities and how to give rise to the emergence of expressive activity among children in a daily childcare setting.**
- “**Emergence**” is a philosophical notion that dates back to the earliest writings in 19th-century psychology and also to classical views of society as a **living organism** (Sawyer, 2003). In this study, we use this term in the sense of **collective social products** that cannot be equated with any specific child’s mental schema and are irreducible to social component parts.

## The Theoretical Framework

- ◆ This study relies on the **Social Infrastructure Framework** (Bielaczyc, 2006). This model highlights four dimensions of classroom social structures to make explicit the various elements that impact the design of classroom learning environments.

1. **Cultural beliefs** refer to the mindset that shapes the way of life in the classroom. Design considerations here include the ways in which learning are conceptualized, **students’ and teachers’ social identities**, and **how technology-based tools are perceived**.
2. **Practices** concern the ways in which **teachers and students engage in both online and offline learning activities related to technology-based tools.**
3. **Socio-techno-spatial relations** refer to the organization of physical space and cyberspace as they relate to the teacher’s and students’ interactions with technology-based tools.
4. **Interaction with the outside world** refers to the ways in which students interact, online and offline, with people outside of their immediate classroom context.

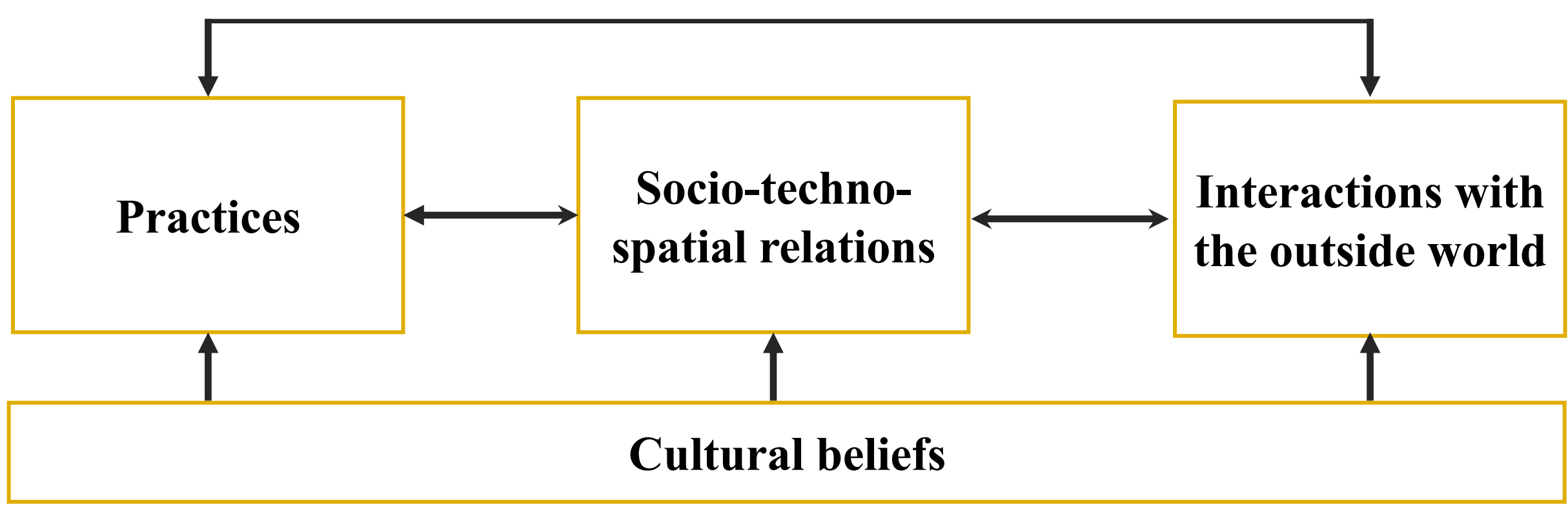


Fig. 1: The social infrastructure framework as a system of interactions (Bielaczyc, Kapur, & Collins, 2013)

## Methods

### Participants

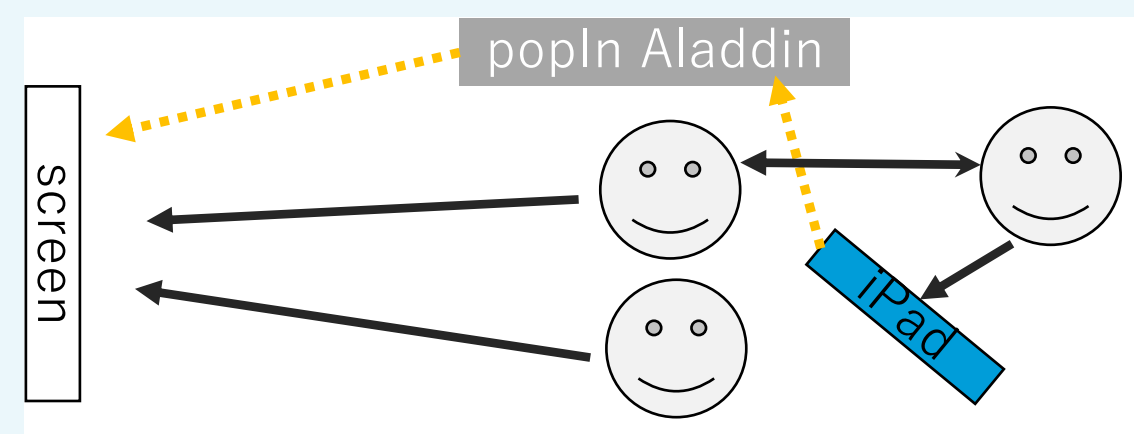
- ◆ Participants: Four classes of four- and six-year-old children at two daycare centers
- ◆ Term: **Twice a week** for a duration of **six months** (July 2018–December 2018)

### Ethical Considerations

- ◆ The Research Ethics Committee at the University of Tokyo approved this study.

### Procedure

- ◆ The main data collection tools were the children’s drawings and narratives, the daycare staff’s narratives, and video-recorded observations of the drawings. Episodes were analyzed qualitatively.
- ◆ Our implementation procedure involved the incorporation of digital tools into the drawing activity at the following stages: **introduction, drawing activity, and appreciation.**
- ◆ “Digital tools” include an iPad and a “**popIn Aladdin**,” an IoT device equipped with ceiling lighting, which was used to project children’s drawings onto a wall.



- By mirroring the iPad display on the screen through popIn Aladdin, children can see the iPad drawing on the screen in real time.

## Results

### Result 1. Practices

**Episode: “Star Festival” (June 27–July 4, two classes of five- and six-year-old children)**

- ① On June 27, twenty-four children watched the scenery of the Milky Way on the screen (Fig. 1-1). As children watched the Milky Way, **various utterances were triggered.**
  - ② The next day, they depicted the stars of the world by **finger painting** while imagining the Milky Way (Fig. 1-2). The **nursery teacher decorated the ceiling with their work** (Fig. 1-3).
  - ③ The children watched an animation made from their work on July 4 (Fig. 1-4). By incorporating music, light, and movement into the children’s work, they found new expression in them. They voluntarily sang the Tanabata song, holding hands, shoulder-to-shoulder, and feeling proud of themselves.
- The digital scenery enriched the off-screen version of the drawing activities. Watching the digital scenery along with the animation of their drawings might encourage children to discover fun drawing activities. **The more children can make a connection between the content in the digital world and their own lives, the more they will express their creativity freely.**



Fig. 1-1. Watching the landscape. Fig. 1-2. Depicting stars of the world. Fig. 1-3. Displaying their work. Fig. 1-4. Appreciating the scenery.

### Result 2. Socio-techno-spatial relations

- ① During free time, 2–5 children drew with the Notes app for iOS. They were allowed to choose whether or not to use a digital pen.
  - ② Mirroring the iPad display on the screen through popIn Aladdin, they could simultaneously watch the drawing on the iPad (Figs. 2-1, 2-3) and on the screen (Figs. 2-2, 2-4).
  - ③ Children played, danced, and sang while reacting spontaneously to drawings shown on both the iPad display and the screen.
- By projecting the drawing on the screen, other children verbalized the drawing, made suggestions, and praised the child who was drawing.
  - These episodes suggest that **the relationship between observing and being observed may be transformed during children’s interaction with digital tools.**



Fig. 2-1. Suggesting ideas. Fig. 2-2. Playing with the drawing. Fig. 2-3. Praising another’s drawing. Fig. 2-4. Dancing in the scenery.

### Result 3. Interactions with the outside world

**Episode: “Fish Swimming in the Sea” (July 17–August 18, two classes of four- and six-year-old children)**

- ① In the summer, some children went to the sea and to the aquarium. They began to show interest in fish in the sea. Therefore, children watched the landscape of the deep sea together (Fig. 3-1).
  - ② Next, each child drew fish (Fig. 3-3). Some children drew **while researching** the type, color, and shape of fish in books with and without pictures (Fig. 3-2).
  - ③ After nine days, the children watched an animation in which their fish moved. Some children touched the screen or spoke (e.g., “I was moved to tears”) in response to others’ fish (Fig. 3-4).
  - ④ In mid August, children watched the animation **with their parents**. The children talked happily throughout the animation, teaching their fish to others. The parents also gave **positive feedback.**
- Through digital tools, children were able to explore the world where fish live and share with parents and peers. They seemed to expand images and developed expression while deepening their dialogue in relation to various external worlds.



Fig. 3-1. Watching the landscape. Fig. 3-2. Checking picture books. Fig. 3-3. Drawing fish with watercolor paints. Fig. 3-4. Watching the scenery with friends and parents.

## General Discussion

We discovered the following four factors in relation to the **emergence of expressive activities** in a daily childcare setting based on the **social infrastructure framework**:

1. **Practices:** This study suggests **how to share and harmonize analogue works, such as paper media and digital tools, to enriched expression.**
2. **Socio-techno-spatial relations:** By combining the iPad’s ability to create diverse expressions with popIn Aladdin’s facility to immediately share expression with others, we showed that drawing activities are **not simply expressions of aesthetic enjoyment and individual thought but collaborations producing new images with others.**
3. **Interactions with the outside world:** Digital tools **mediate the external world, deepen children’s exploration, and enable children to share feelings with others.**
4. **Cultural Beliefs:** In support of the previous ideas, nursery teachers need to bear in mind and share their ideas about what they want children to experience and learn from digital activities.

### Directions for future research

- ◆ Future studies will examine interconnections among the elements based on longitudinal participation observations.