



Family Negotiation in Joint Media Engagement with Creative Computing

Junnan Yu
School of Design
The Hong Kong Polytechnic University
Hong Kong, China
junnan.yu@polyu.edu.hk

Sari Widman
School of Education
University of Colorado Boulder
Boulder, CO, USA
sari.widman@colorado.edu

Ricarose Roque
Department of Information Science
University of Colorado Boulder
Boulder, CO, USA
ricarose@colorado.edu

ABSTRACT

HCI researchers have been investigating family dynamics with new and emerging technologies during joint media engagement (JME) experiences. However, most studies describe family dynamics from parents' perspectives, such as their roles and mediation practices, while the roles and agency of other family members are less understood. In this paper, we examine family dynamics through the lens of negotiation between family members. Our study is located within an informal learning program called Family Creative Learning, where families from non-dominant groups were invited to participate in a series of workshops to create with a programming app called ScratchJr. Through analysis of data that included process, artifact, and reflective data, we identify negotiation practices of family members as they advocate for device and creative control. We further discuss how the lens of negotiation expands the meaning of productive JME in family contexts and highlight design considerations to facilitate engaging joint family experiences with educational technologies.

CCS CONCEPTS

- Human-centered computing → Empirical studies in collaborative and social computing; Empirical studies in HCI;
- Social and professional topics → Children; • Applied computing → Collaborative learning.

KEYWORDS

negotiation, family, joint media engagement, creative making

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1 INTRODUCTION

Media and HCI scholars often describe and assess families' shared engagement with technologies through a framework called "Joint

Media Engagement" (JME) [16, 66], which is "*spontaneous and designed experiences of people using media together*" [66, P9]. Understanding family JME with technologies is essential to fostering "productive" shared experiences through designs of new technologies. By "productive," Takeuchi and Stevens [66] mean joint technology-mediated experiences that "*can result in deeper understanding, inspiration, greater fluency, and physical, emotional, or mental wellbeing*" (P43). Therefore, much research has focused on exploring family JME with various types of technologies and media, e.g., parent-child shared engagement with television [67], Internet use [15, 38], video games [27, 64], and social media [72, 74], or siblings co-playing games [21]. Notably, multiple studies have examined family JME with learning technologies, such as computational toys and kits [78], media for AI literacy [13], and e-books [54]. The family context provides a vital learning ecology for all family members, who are also important learning resources for each other. For example, parents may scaffold children's creating with technologies and join children's learning tasks as a project collaborator [5, 77], while children may also act as a helper and teacher for their parents, such as providing technical assistance for parents' everyday technology use and brokering online information for them [30, 52].

Although an increasing body of research has focused on investigating family JME experiences in learning contexts, most studies examine family JME from the perspective of parents and focus on the roles of parents as they support and mediate their children's learning with technologies (e.g., [5, 13, 23, 77]). In other words, current studies mainly highlight the agency and power of parents, while children's voices during family interactions are less explored and understood, especially in relation to other family members' participation. Moreover, existing family JME studies are predominantly either lab-based (e.g., [2, 7, 10, 21, 75]) or interview-based (e.g., [5, 39, 44, 78]), which might miss emergent dynamics and roles in more natural contexts. Relatively few studies were done in richer real-world contexts, such as designing AI activities for families to engage in [13] or observing families' information-searching in the home [52]. Also, fewer studies focus on families from non-dominant groups who have been systematically disconnected from opportunity by reasons of race, ethnicity, immigrant status, and socioeconomic status (e.g., [29, 37, 52, 73]). In short, current studies have limited perspectives of family dynamics during JME with educational media. More observational studies in real-world contexts with families of different demographics are needed to advance our understanding of family dynamics during JME with technologies beyond parents' roles or mediation strategies.



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In this work, we investigate family dynamics in an informal learning program called Family Creative Learning (FCL) [59, 60]. In FCL, families (including parents, children, and siblings) historically marginalized in computing are invited to participate in a series of workshops (typically 4 - 5 meetings across one month) in community-based organizations, such as public libraries and community centers, during which they jointly create projects with creative computing technologies like Scratch¹ and Makey Makey². We approach family dynamics in FCL through the lens of **negotiation**, a concept grounded in the sociocultural learning perspectives underpinning the design of FCL. Sociocultural perspectives of learning, rooted in the work of Lev Vygotsky, argues that culture is a system of meaning carried across generations that is also being continuously created and recreated in local contexts [34, 45]. Human activities and thoughts are mediated by the social and cultural processes where they are situated [35]. Accordingly, learning occurs through shifts in social relationships and participation [45], “*how people develop is a function of transforming roles and understanding in the activities in which they participate*” [58, P209]. Learning is a dynamic process in cultural spaces where individuals form and reform themselves and their relationships within and across communities, and consistently negotiate their roles and manage their participation in relationships with others[45]. FCL is such a sociocultural learning environment where families can tinker with and negotiate their relationships with each other, the environment, and learning tools (Author, 2016). In order to better understand these negotiations, we ask: **How do family members engage in negotiation during joint creation with computing?**

We collected and reported qualitative data on families’ joint engagement in the form of field notes, pictures, and screen recordings in one FCL implementation with five Hispanic/Latino³ families. With the collected data, we examined family members’ negotiation practices. Aligning with the sociocultural learning perspective [45], we define negotiation as family members’ practices for co-creating their roles and modes of participation with family members. We identified a number of negotiation practices employed by parents and children and classified them into two large categories, including *negotiating device control* (i.e., who operates the device) and *negotiating creative control* (i.e., what and whose ideas will be implemented). Under each category, family members practiced various negotiation strategies, e.g., pulling the tablet out of reach of another family member, policing each other’s creative input, and redirecting attention from conflict points to making. We also examined family members’ negotiation processes throughout the workshops and revealed new insights into families’ JME practices, e.g., family members might especially insist on their ideas when the activity is related to representing their identities. Based on these findings, we further reflect on the roles and agency of all family members in

¹<https://scratch.mit.edu/>

²<https://makeymakey.com/>

³The authors want to acknowledge that terms like “Hispanic” and “Latino” have a complicated history in the US in relation to the collection of Census data, and the flattening of a wide range of national, racial, and ethnic identities. Further complicating this is the more recent evolution of language to represent a range of non-binary gender identities more fully, like Latine and Latinx. When families registered to participate in FCL, they were asked to indicate what ethnicity/race they identified as. “Hispanic/Latino” was the language used in that paperwork at the time the study was conducted. For this reason, we use Hispanic/Latino in this paper.

this joint-making experience, discuss tensions and negotiations as valuable learning experiences, and expand on what a “productive” JME might look like.

This work makes the following three contributions to the HCI and CSCW communities. First, our empirical findings regarding family negotiation enhance the understanding of family JME dynamics (i.e., parent-child and sibling interactions) and reveal family members’ agency during co-making. JME, especially co-creating, is a generative and improvisational interaction between the makers, the materials, and the activity [25, 62]. Our data collection approach enables us to capture the complexity and richness of family interactions in a real-world setting that could be missed in interviews and lab-based observations. Second, the negotiation framing and summarized negotiation patterns provide a lens for other researchers to examine family interaction dynamics that emphasize the agency of all participating members in different JME contexts, like co-playing video games. Third, we enrich the understanding of learning opportunities embedded in families’ negotiation practices, what a “productive” JME experience can be, and contribute to implications for supporting such learning experiences.

2 RELATED WORK

The current work builds on and adds to the framework of Joint Media Engagement (JME) and the application of JME in family joint experiences with educational media. Therefore, this section first introduces the JME framework, then related work within HCI reporting family JME with learning technologies.

2.1 Joint Media Engagement

Joint Media Engagement is defined as “*spontaneous and designed experiences of people using media together*” [66, P9] and can happen anywhere and anytime as long as multiple people interact with media together [16, 66]. JME can occur in many forms, including viewing, playing, searching, reading, contributing, and creating with digital or traditional media [66]. JME originates from the coviewing dimension of parental mediation theory that describes parents’ mediation of their children’s media use [11, 27, 67, 78]. Coviewing initially refers to the condition that parents watch television with their children without engaging in conversations [67] and has been alternatively rephrased as “co-playing” or “co-using” to capture co-engagement with other media like video games [44, 63] and digital books [10, 66]. As the landscape of media expands rapidly from television to new formats like social media, mobile devices, and learning tools, HCI and media scholars accordingly expand coviewing to JME to include various forms of shared media engagement, such as co-engagement over distance, learning together with media, peer and sibling shared technology use, not just coviewing or co-playing [66].

To support productive JME, i.e., joint experiences that can lead to “*deeper understanding, inspiration, greater fluency, and physical, emotional, or mental wellbeing*” (P43), Takeuchi and Stevens [66] proposed six design principles: (1) mutual engagement, i.e., all partners are motivated to participate and the experience can sustain their engagement throughout the process, regardless of their ages, expertise, and ways of participation; (2) dialogic inquiry, i.e., activity should inspire collaboration with others like communicative

interactions and conversations to make meaning of situations; (3) co-creation, i.e., the activity supports partners to build things or shared understandings together using media; (4) boundary crossing, i.e., activity happens and spans across time and settings like connecting to partners' past experiences and inspiring future activities; (5) intention to develop, i.e., at least one partner intends for themselves or other partners to grow in the activity; and (6) focus on content, not control, i.e., both technical features and partners minimize the distraction or hindering the interactions between partners or with content. However, these principles are not exhaustive and should not be treated as dogmas when applied. There are other important considerations for productive JME. For example, one's cultural background can shape their perception of what is productive [75], and Martinez et al. [39] identified additional conditions that support productive JME from joint family engagement with the Animal Crossing game, including supporting variety and flexibility in play style, supporting indirect jointness and disentrainment, and scaffolding affective interactions. In sum, JME is a big-umbrella concept that broadly covers people's joint media experiences. More research will be needed to understand the interaction nuances in specific media contexts.

2.2 Family Joint Media Engagement with Learning Technologies

In the past decade, HCI scholars have been employing JME to examine family joint activity with various media in different settings, e.g., smart voice assistants in the home [6, 9], digital and analog toys in a lab [23], location-based video games in the field [64], and family online information search practices [52]. Given that the current study focuses on family negotiations during JME with an educational coding platform, this section focuses on family JME with learning technologies.

Most relevant studies about family JME focus on parent-child interactions around learning technologies and highlight the different approaches that parents engage in children's learning activities. Specifically, some researchers frame parental involvement based on the different roles parents take on. For example, Barron and colleagues [5] summarized seven parent roles in their children's development of technology fluency, including teacher (teaching children new skills and knowledge), project collaborator (working on the same project as children), learning broker (seeking learning opportunities for children), resources provider (providing resources to support children's learning), and nontechnical consultant (providing suggestions on children's project). Yu and colleagues [77] examined parental involvement in young children's use of computational toys and kits and summarized ten different roles parents took on, e.g., scaffolder, bystander, executor, and dominator, most of which are also seen in family learning with other coding tools [46, 53, 57, 61]. They further framed these participation roles into creative, preparative, and administrative mediation [78]. Druga et al. [13] designed four categories of AI learning activities for families and employed already identified parent roles [5, 77] to examine how parents helped their children develop AI literacy in these activities. Their findings show that parents played various roles in those learning activities, such as being a teacher, mediator, student, and tinkerer. At the same time, parents and children supported each

other in understanding AI, such as observing each other's tinkering and discussing hypotheses with each other.

On the other hand, some scholars directly describe parental involvement practices rather than through the lens of roles. For example, Banerjee et al. [3] designed a text-free, visually concrete programming tool named BlockStudio for English-language-learning families and identified multiple forms of family JME with the tool, e.g., parents and children co-creating artifacts, dynamically taking on different roles, and celebrating shared successes. Bindman et al. [7] explored family joint engagement with artistic tablet apps for painting and coloring and found that parents would co-create with their children, coach them by making suggestions and providing guidance, spectate children's play without being actively involved, or simply play side-by-side next to each other. Similar parental engagement practices can also be found in family's shared use of other learning technologies, such as mobile apps for play [75], nature exploration [31], executive function training [65], and codable robots [55]. Taking together the literature on parent roles and practices, there is already a deep and thorough understanding of parental involvement patterns in children's engagement with technologies. However, such understanding is mainly focused on parents' agency, i.e., from the perspective of parent roles and their mediation. The current study, from a negotiation perspective, complements these identified parent-child interactions by highlighting family members' (mainly parent-child and sibling interactions) agency and the nuances of their back-and-forth interactions during family joint experiences.

Compared to the studies about parent-child JME, only a few studies examined sibling co-engagement with technologies. Ballagas and colleagues [2] developed a virtual-reality-based handheld prototype named Electric Agents for interacting with educational television content and deployed it with siblings. They found that siblings used various strategies to scaffold each other's play, such as directing the play for each other, explaining and prompting content, and reporting their own activities to each other. Go et al. [21] observed the play with digital and physical games between siblings and identified different play dynamics, e.g., competing against each other, collaborating on the same task, and providing help when the other encountered difficulties. These two studies show that, like parent-child dyads, there are also rich and multifaceted interactions between siblings. Finally, some tensions and conflicts may arise during family JME with technologies. For example, parents faced tensions about screen time and were concerned about children's safety and privacy issues while using a nature exploration app [31]; and older siblings might become impatient and refuse to collaborate with their younger siblings, or older siblings seized the control and dominated the play [2, 21]. Although such tensions are identified, how family members address such tensions and negotiate for participation during JME remains unclear. Understanding their negotiation is essential to promote productive JME for families, especially with learning technologies. This work aims to bridge this gap by providing insights into how family members negotiate with each other for engagement during a family co-making activity with creative computing. Note that conflict and negotiation are not a new topic within HCI, researchers have surfaced tensions and negotiation around people's technology-mediated interactions in various contexts [8, 14, 17, 42, 43, 76], such as couples' discussions

on topics that they disagree with over the phone and instant messaging [8, 76], the tension around communication between parents and their adult children who have left home and how to mediate the tension through design [42, 43], as well as parents' and their teenage children's negotiation around photo displays in the family home [14]. Our work adds to this body of HCI literature around negotiation by examining family dynamics in a less explored context: co-making with learning technologies.

3 METHODS

The research team collected data from families' participation in an informal learning program. The exact program implementation this study is built on is a series of workshops at an elementary school in a Mountain West region state in the USA during the fall of 2018, where young children and their families were invited to create story projects using a coding kit for young people named ScratchJr. This section presents the implementation details of the FCL program (i.e., workshop structure, tools, participants, and facilitators) as well as the data collection and analysis processes.

3.1 The Current FCL Workshop Implementation

FCL is a family learning program whose design has been informed by community-based partners, feedback from families, and influenced by constructionist and sociocultural perspectives on learning [36, 45, 47]. The current implementation included a series of four workshops across one month at an elementary school in the Fall of 2018, where young children (ages five and above) and their families (e.g., parents and/or siblings) created story projects using the coding kit ScratchJr⁴.

Workshop Structure. Each workshop included four parts: Eat (i.e., families and facilitators ate food together to kick off the workshop), Meet (i.e., parents and children separately met with facilitators to talk about their participation experiences), Make (i.e., parents and children created projects using ScratchJr), and Share (i.e., families showcased their projects to other families and received feedback). Families met once a week for two hours in the evening so parents could participate after work. Here are the major activities in the four workshops:

- Workshop 1: Parents learned to use ScratchJr during Meet, then introduced ScratchJr to their children and explored the tool together.
- Workshop 2: Families were prompted to create a story project based on one of their favorite family stories, e.g., a family trip or an imaginary family trip they would like to do together. Families first created their story on a paper-based storyboard and then implemented their design on ScratchJr.
- Families continued to work on their story project on ScratchJr.
- Families wrapped up their projects and shared them with other families, school staff, and local community members.

Tools. ScratchJr is a visual, block-based programming environment on mobile devices designed for young children between 5-7 years old [18]. Figure 1(a) shows a screenshot of ScratchJr's coding interface. ScratchJr was chosen because we hoped to engage

children as young as grades K - 2 while still being able to support their old siblings and parents in the making. Children can create interactive stories and animations using ScratchJr's programming features and digital assets. The digital assets (Figure 1(b), referred to as sprites) include characters, backgrounds, and objects. Children can also create their own digital assets using a paint editor. The programming features consist of visual coding blocks that represent different commands, such as motion, flow control, and events, which children can drag and connect to create a sequence of commands for their sprites. Each family got at least one iPad, and families with three or more people were offered the option of getting an extra one to help manage family participation.

Participants. The participating families were recruited with the assistance of a teacher from the hosting elementary school. The teacher helped advertise the FCL program to 1st and 2nd graders from their "English Language Learners" program which consisted of children whose families immigrated to the USA recently and were primarily from Mexico. Nine families who identified as Hispanic/Latino signed up and participated in at least one workshop. The nine families included 25 participants, among whom 14 were children (5-10 years old, 7 males and females, respectively) and 11 adult guardians (4 males and 7 females). Some families dropped out for reasons such as work conflicts and emergent family conditions. Five families attended at least three workshops and participated in post-program interviews. Therefore, the analysis of the current paper was based on these five families' participation data. Table 1 shows the participation information of the five families. Note that participants' names are pseudonymized.

Facilitators. Four undergraduate students, three graduate students, and one university professor facilitated the workshops. The facilitators had multiple meetings before the first workshop to get familiar with the tools, activities, and facilitation techniques. During the workshops, the facilitators welcomed families and supported families' making activities, including helping families get started with the technologies, encouraging families' experimentation, eliciting their interests and ideas, and forming a comfortable relationship with the participating families. Right after each workshop, the facilitators discussed what went well, what was challenging, and what could be improved. Two facilitators who were Spanish speakers also acted as interpreters during interviews and helped translate families' screen recordings.

3.2 Data Collection and Analysis

To capture emergent social interactions between family members around the materials/technologies, the facilitators collected various forms of qualitative data throughout the workshop process, including:

- **Process data**, consisting of field notes and photo documentation that focused on the interactions between families, facilitators, materials, and the space, and screen recordings of families' iPads that captured audio from the iPad microphone and speaker (i.e., families' conversations during making and project sounds from the device). All the collected screen recordings were transcribed into texts with supplementary pictures and organized by family unit following the four-workshop order of the workshops. The facilitators produced

⁴<https://www.scratchjr.org/>

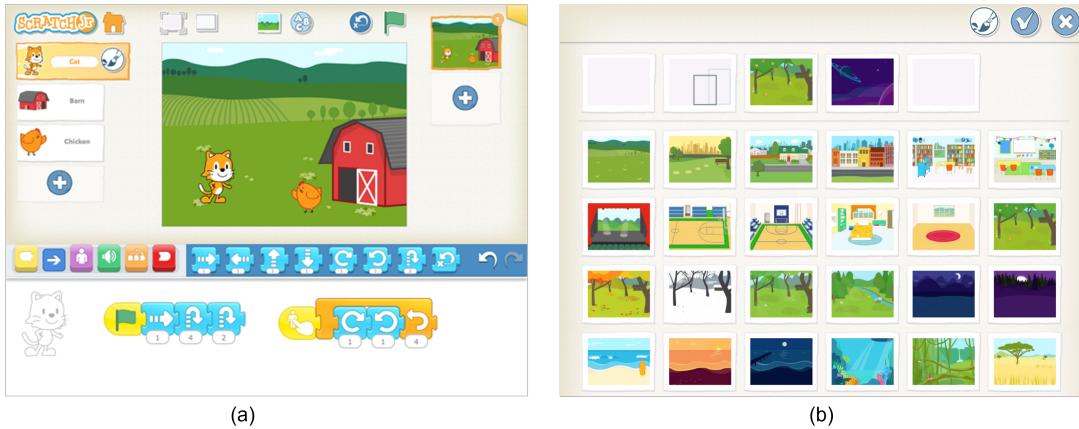


Figure 1: (a) The coding interface of ScratchJr, and (b) examples of ScratchJr’s digital assets – the backgrounds

Table 1: Demographic Information of the Five Families Included for Analysis

Families	Family members involved
Family 1	Parents: Celso (father, age 51), Ana (mother, age 47); Child: Camila (girl, age 6)
Family 2	Parent: Julia (mother, 41); Children: Cal (boy, older brother), Hamid (boy, 10), Kiara (girl, 6)
Family 3	Parent: Lucia (mother); Children: Jessica (girl, age 10), Marcelo (boy, age 7), Jasmine (girl, youngest sister)
Family 4	Parent: Marta (mother, age 35); Children: Roberto (boy, age 9), Daniel (boy, age 8)
Family 5	Parent: Nina (mother, age 41); Children: Mia (girl, age 6), Lorena (girl, age 5)

25 pieces of field notes from the four workshops, representing approximately a hundred hours of interactions (if simply adding the hours reflected by each field note together). Additionally, the four workshops generated 36 screen recordings, and the total length was about 19 hours. These detailed process data enabled us to examine the granular interactions between family members and the environment.

- **Artifact data**, i.e., storyboards created by families, descriptions of their projects from facilitators' field notes and photo documentation, and the saved final projects on iPads. The five families generated 5 storyboards and 9 projects.
 - **Reflective data**. We conducted 30–90-minute interviews with each family member after the fourth workshop to get more feedback on the workshop activities and their reflections on their experiences, e.g., "what inspired you to create this story?" and "what was it like using ScratchJr?" The interviews were audio-recorded. We generated 17 interviews in total from the five families.

This work builds on our initial analysis of families' tensions and negotiations [Authors, 2022]. To examine families' dynamics during the making, we began by creating analytical memos for each family to develop a summary of their interactions across the workshops based on the collected process, artifact, and reflective data. We then examined screen recordings which included families' moment-to-moment interactions with conversations around the ScratchJr app.

We also used other collected data (i.e., field notes, photos, and interviews) to triangulate the dynamics reflected in the screen recording data. The analysis was centered on individual families as an interaction unit, i.e., negotiation practices between members within a family, including parent(s)-child(ren) and siblings' interactions.

As specified in the introduction, the sociocultural perspectives on learning that guided the design of the FCL program [35] inspired our analysis of negotiation. We employ sociocultural perspectives in our analysis to understand how families learned together from a relational perspective. In practice, we followed an iterative thematic analysis of families' making processes to identify the interactions between family members. All three authors went through the five families' analytical memos and screen recordings multiple times on their own to get a deep understanding of the dynamics in each family. We especially paid attention to the moments of negotiation between family members to demonstrate how family members utilized negotiation strategies and how those strategies were responded to. The first two authors each summarized relevant themes (e.g., *pulling the device*, *gatekeeping ideas*), then all authors met regularly during the data analysis process to share, discuss, and refine the identified negotiation practices (Table 2) – ensuring all authors have a shared understanding of how specific interactions should be interpreted. These identified themes capture family members' negotiation actions in specific moments and are presented in section 4.1. *Negotiation in Action*. As we examined the negotiation practices of each family, we also paid attention to the change in

family members' negotiation practices across the four workshops and revealed patterns, which are presented in section 4.2. *Negotiation Patterns across Families*. We did not perform an inter-rater reliability check because the analysis aimed to identify the range of dynamics, practices, and strategies utilized by family members during co-making, not to quantify the frequency of these strategies across families. The agreement on the interpretations of families' interactions was achieved through synchronous or asynchronous discussions [40].

3.3 Author Positionalities

The first author is an Asian male currently working as a university professor in China. The second author is a non-binary Ph.D. candidate in educational research and the learning sciences who identifies as White. The third author, who directs the FCL project, is a female university professor with a Computer Science background. She identifies as Filipino-American and an immigrant. The 2nd and 3rd authors are both US citizens, and the 1st author was an international Ph.D. student studying HCI in the United States when the workshop took place. All authors had experiences with FCL program implementations as facilitators, supporting families in creating projects. All authors wrote field notes after each workshop and participated in data collection and analysis. The authors' diverse cultural and educational backgrounds provide different expertise and perspectives on the data analysis and enable us to notice nuanced details in family interactions from both HCI and learning sciences perspectives. Other members of the research team were bilingual fluent Spanish speakers who provided translation during the FCL workshops, translated transcripts of interviews and screen recordings, and participated in data analysis and writing for other related studies. However, it is worth noting that the three authors of this paper had limited proficiency in Spanish. This, along with the authors' cultural positionality, should be noted as potentially impacting our interpretations and analysis.

4 FINDINGS

This section presents findings of families' negotiation practices during joint making with ScratchJr. We first describe an overview of the negotiation practices family members employed (i.e., negotiation in action), then share findings of family members' negotiation patterns over the four workshops (i.e., negotiation patterns across families).

4.1 Negotiation in Action

We saw families taking up verbal and physical actions (often simultaneously) to negotiate with each other around technology tools to physically execute the programming of projects, or drive the creative direction or logistics of production for their projects. Family members used a range of verbal and physical strategies or practices to advocate for themselves or other family members, or to moderate the broader collaborative structures of family members working together. We classified these negotiation practices into two broad themes – *negotiating device operation* and *negotiating creative control*. Table 2 shows the three negotiation themes and families' specific negotiation practices. Note that negotiating device control and negotiating creative control are often interwoven. For

example, parents or siblings sometimes stepped back from device operation but still sought to influence project ideas and content. In our discussion, we tie these strategies and responses to roles previously identified in the literature, to show how this type of analysis can deepen our understanding of these roles, particularly in collaborative engagement between larger families. The following subsections introduce the details of these types of negotiation practices.

4.1.1 Negotiating Device Control. A common negotiation theme among family members is centered around device control, i.e., negotiating who gets to operate the device. We summarize three types of practices families employed to negotiate operating the device: *requesting device access*, *stepping up or back*, and *seeking and offering help*.

Requesting Device Access. Family members verbally ask for or request access to device operation. Specifically, some family members would **ask permission** to operate the device, typically used by children when working with their parents and siblings. For example, Kiara, after her mother Julia showed the work she had done, asked, “*Mom, can I help you?*” in order to access the device, although Julia did not respond. In another family, Mia asked her mother Nina if she could operate the device to change the background of their project, then Nina let Mia take complete control of the device. Sometimes children went beyond asking for permission and **demanded the device access** more assertively. For example, when Cal [older brother] was adding coding blocks, Hamid [younger brother] kept requesting the device control:

Hamid: “You are not letting me do anything, give it [iPad] to me.”

Cal: “No.”

Hamid: “Give me it. Give me it. Give me it!” [Shouting]

Older siblings would also ask permission from their younger siblings. For instance, Marcelo [younger brother] added a sprite that both he and his older sister Jessica did not like, then Jessica told him to draw one instead. Jessica asked if she could draw it, but Marcelo did not respond and went ahead with drawing one just by himself. Children were also seen **reminding each other to take turns** among family members – Mia reminded her mother Nina that it was her turn when Nina tried to add more sprites to their project:

Nina: “Now, another one [sprite].” [Nina opened the sprite selecting page and was about to select one]

Mia: “It’s my turn.”

Nina: “Oh yeah.” [Nina handed over the device to Mia]

Sometimes children **asked their parents for an extra device** when they failed to get the opportunity to operate the device. This practice was seen being used by the youngest child across three families. For example, when Hamid [older brother] was operating the device, Kiara [younger sister] asked Julia [mother] if she could get her own device – “*mom, can I have one [device]?*” Jasmine even cried to her mother Lucia and said she wanted an iPad in workshop 4. Finally, some children sought device control by **asking parental intervention**, which happened between siblings and was employed by the younger child. For instance, Cal mostly dominated the device when working with Hamid, who had tried to claim the

Table 2: The Negotiation Practices Family Members Took

Negotiation Category	Description	Negotiation Practices	Description
Negotiating Device Control	Family members negotiate about who gets to operate the device	<i>Requesting device access</i>	Family members verbally request access to device operation, such as asking for an extra device or reminding turn-taking
		<i>Stepping up for device control</i>	Family members step up for device control through direct physical actions, such as pulling the device to their side and inputting directly on the device
		<i>Stepping back from device control</i>	Family members voluntarily stepped back from device control and let others input on the device
Negotiating Creative Control	Family members negotiate what and whose ideas to be implemented	<i>Inviting creative input</i>	Family members invite ideas from each other for input, e.g., encouraging others to pick a sprite
		<i>Suggesting creative input</i>	Family members propose ideas for each other's consideration, e.g., suggesting a color or background
		<i>Directing creative input</i>	Family members enforce their ideas into the project or gatekeep other members' input
		<i>Remixing creative input</i>	Family members discuss ideas with each other and build on each other's input

device. Hamid then sought his mother Julia's help multiple times (e.g., “Mama, Cal is not letting me do anything!”) Overall, children would ask permission to operate the device, get an extra device, announce their turn, or seek parental intervention in order to access the device.

Stepping up for Device Control. In addition to verbally requesting access, family members negotiate through physical actions by directly stepping up or back from device control. Siblings were sometimes seen *pulling the device* to their side for making, often accompanied by verbal requests. For example, Hamid [younger brother] and Cal [older brother] were consistently pulling the device to the side for making, although Cal mostly obtained the device control. As they were pulling, Hamid also said, “Let me do it!” While Cal argued back and shouted, “Stop!” Family members also negotiate for device operation by *directly operating the device* without seeking verbal permission from other family members. Parents usually took this strategy when they wanted to add things to the project. Some kids also operated the device directly during sibling or parent-child pairs. For instance, when Jessica [older sister] and Marcelo [younger brother] joined their mother Lucia after participating in independent activities in the workshop, Marcelo directly started moving the sprites on the device that Lucia had already added without asking Lucia or Jessica. In another case, Mia [younger sister] just moved forward with adding new coding blocks for their animation, during which Lorena [older sister] was trying to add one at the same time and became upset by Mia’s action. However, direct operating would not always work as desired – when Jasmine, who worked with her mother Lucia as a group, went to her siblings’ iPad and tried to interact with it, her siblings [Marcelo and Jessica] told her to go to her iPad (Jessica: “No, Jasmine!” Marcelo: “You should not even be over here!”). In short, family members would physically advocate their device operation by pulling it to their side (mainly used by children) and directly operating the device (used by both children and parents).

Stepping back from Device Control. Family members sometimes voluntarily step back from the device control and invite participation from other members. Parents often stepped back from device control to encourage more hands-on participation from their children. For example, Ana [mother] completely gave the device operation to her daughter Camila throughout the workshops and mostly contributed project ideas. When noticing that their children were not paying attention, parents would *invite their children for input*, e.g., Lucia [mother] noticed Jasmine [daughter] was distracted and engaged her again by inviting her input into the project and said, “Look, Jasmine! Look, Jasmine! We are going to look here [ScratchJr sprite library] for your grandma.” The practice of inviting co-making was also identified in children during parent-child and sibling interactions. After Hamid added some sprites and codes to a birthday card project started by Julia [mother], he handed the device over to Julia and asked her to build on the project, saying, “Look, mom, you work on this one [scene].”

Children would also step back from device control for their siblings because of *mediated turn-taking* from their parents or the workshop facilitators. For example, Nina [mother] assigned roles to her girls [Mia and Lorena] in each workshop to ensure both girls contributed and consistently monitored the girls’ turn-taking. In one instance of changing the color of a bat sprite, Mia and Lorena argued over picking the colors, then Nina guided them to take turns:

Nina: “Take turns. Lorena, you put one color.” [Lorena clicked and added one color]
 Nina: “Mia, now you put one.” [Mia picked and added another color]

Finally, family members would give away device control when *seeking help* from each other. Children and parents both sought help from each other, a moment they would voluntarily step back from their control of the device. For example, Marcelo [son] asked

Lucia [mother] how he could add a girl sprite, then Lucia started clicking on the interface even though she did not remember how:

Marcelo: "Mom, how did you get the girl?"

Lucia: "The girl?" [Lucia clicked on the undo button, then on the flag button]

Lucia: "Umm, I don't remember." [Lucia continued to click around until she figured it out]

This type of device control negotiation through seeking and offering help was also often seen between sibling pairs, e.g., Jasmine [younger sister] accidentally turned a sprite's skin color green, then her older sister Jessica tried to help her by directly clicking on the interface and said, "wait, I will help you...." Interestingly, some children used offering help as a strategy to get the opportunity to access the device. For instance, Cal [older brother] tried to delete the sprite he had just added but could not figure it out. Hamid [younger brother] said he knew how, "give me it [iPad], I know how to do it," then took over the device control, trying to delete the sprite but was not able to delete it, either.

In sum, family members would also step back from the device control, either voluntarily (children and parents) or mediated by their parents (children), to make space for other family members' input. Family members who invited help would voluntarily share the device control with those who provided help, while family members who offered help on their initiatives might receive resistance from those they tried to help.

4.1.2 Negotiating Creative Control. Beyond device control, family members frequently negotiated creativity for their project, i.e., what and whose ideas were to be included and implemented in the project. We identified four negotiation strategies around creativity, including *inviting creative input*, *suggesting creative input*, *directing creative input*, and *remixing creative input*.

Inviting Creative Input. Family members often invited creative input from each other. We primarily observed this practice among parents to encourage ideas from their children. For example, when Mia [daughter] opened the page of characters, Nina [mother] asked, "Which one do you want, Mia?"; or asked, "What animals are in the snow?" when Mia was trying to add sprites to a snow background. Parents also structured the creating process for children to provide their ideas. For instance, Ana [mother] and Celso [father] restarted the entire project when Camila [daughter] joined them to make space for Camila's input; and Nina [mother] told her daughter Lorena which stage they were in and asked her to share her ideas, e.g., "Lorena, you are going to choose a background." On the other hand, children would sometimes invite ideas from their parents and siblings. For example, Marcelo [son] asked Lucia [mother] if she wanted to take a picture for the sprite representing her or use an existing character. Also, when hearing his younger sister Jasmine crying for an iPad, Marcelo invited Jasmine to work with him and asked for ideas from her (e.g., "Hey Jasmine, what color do you want?"). **Suggesting Creative Input.** Family members suggested their own making ideas for each other's consideration, which is different from facilitating others' input in *Inviting Creative Input* above. All parents frequently suggested creative ideas for their children. For example, Lucia encouraged Jasmine [daughter] to select specific sprites (e.g., "This one! This one!"). At the same time, children sometimes would suggest ideas for their parents'

consideration. For instance, Hamid [son] told Julia [mother] that he believed eight was too much for a Repeat block to control their animation and suggested three instead, to which Julia replied, "good idea." Children were also often seen to ask for permission from their parents to add their ideas, e.g., "Mom, can I put a cat?" [Mia to Nina. In addition to parent-child interactions, siblings also suggested ideas for each other, e.g., Jessica [older sister] discovered the customization function of adding one's pictures to certain sprites and suggested Marcelo [younger brother] incorporate his picture into the project (i.e., "Want to take pictures?"). Family members generally followed each other's suggestions but might also resist or ignore some suggestions. For example, Celso and Ana [parents] suggested to Camila [daughter], who was operating the device, to add a sound for a cat sprite (Figure 2):

[Celso and Ana were excited to hear the audio play out.

Celso then suggested letting Camila record an audio block for the cat sprite, which Ana agreed to while Camilia told them that she did not want to add sound to the cat]

Celso (father): "Now, now, make her [Camila] do the other one! [i.e., recording audio] Go to the cat!"

Ana (mother): "Okay, now we are going to do another cartoon."

Camila (daughter): "No, not on the cat."

Directing Creative Input. Family members enforced the incorporation of their own ideas, directed project directions, or gatekept others' input. For example, parents sometimes **assigned ideas** for children to implement, e.g., Lucia told her kids to create different scenes at the beginning of a workshop – "[Lorena], you make the Disneyland one, and then Marcelo can do the Water World one." Children would also occasionally direct ideas for their parents and siblings. For example, as Lucia scrolled through the sprite page of ScratchJr, Jasmine told her that she wanted to add a flower ("A flower, mom, a flower! I want a flower"), and Lucia added a flower as requested. Similarly, Marcelo [younger brother] pointed out a castle sprite and excitedly asked his older sister Jessica to pick the sprite when Jessica was browsing the sprites – "Jessica! The castle!" In addition, family members would **defend their contributions** from being changed by other members. For example, Cal [older brother] shouted to Hamid ("It looks good! Just leave it like that!") when Hamid (younger brother) tried to color the castle sprite chosen by Cal; Julia [mother] questioned Hamid [son] when Hamid used a "disappear" coding block for a sprite added by Julia (i.e., "why did you take her [a dancer sprite] off? Uggh") and complained to a facilitator, "He [Hamid] took off my dancer... He does not know what he is doing"; And Jessica [daughter] thought Lucia [mother] erased all her inputs when Lucia accidentally exited the making page and asked with an upset voice, "What are you doing? You erased it now!" Besides advocating their own ideas and inputs, family members often **gatekept others' input**. This practice was used by parents in all five families to monitor their children's ideas, such as if an idea made sense or aligned with their preferences. When Kiara [daughter] customized the color of the door in a castle sprite to pink, Julia [mother] did not like it and asked Kiara to change it – "No, with the pink doors, it [castle] does not look good. Change them." At other times, parents made sure their children's inputs aligned with the

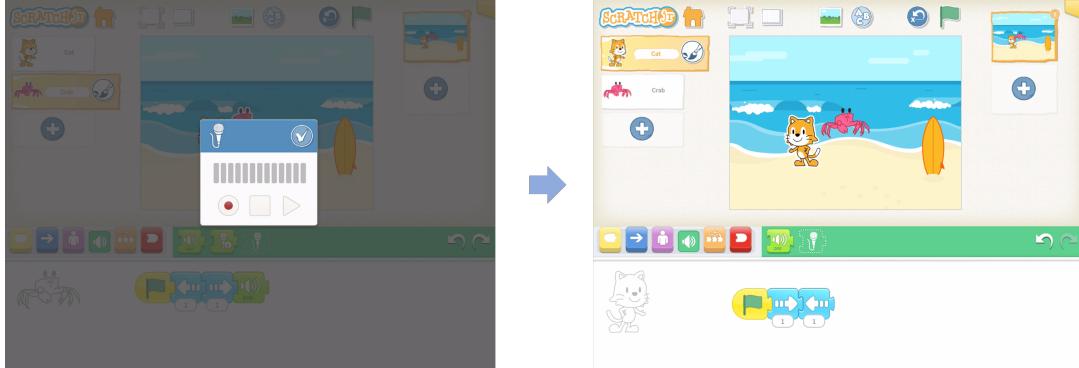


Figure 2: This figure shows the process of Ana family's negotiation practices around suggesting creative input for each other: Ana and Celso added a sound block to a sprite (left) and suggested their daughter Camila record a sound for the cat sprite (right), but Camila said no

project theme, e.g., Ana [mother] asked Camila [daughter] if she wanted to add another character to their beach background but also reminded her to pick something that was related to the beach like a frog. Additionally, children sometimes also acted as the gatekeepers of their parents' or siblings' input. For example, Camila [daughter] told her mother Ana to erase the audio recording that captured her voice (Ana: "Haha, you can hear your voice." Camila: "No! Erase it, erase it, erase it, erase it!"); and when Cal opened the custom background page and started to draw, his younger brother Hamid disagreed and kept questioning his input – "What are you drawing? What are you drawing then?... What is that? That looks horrible." In most cases, family members just followed others' directions. There were also instances where family members pushed back against such gatekeeping actions. For example, Jasmine [daughter] argued with her mother Lucia, who disagreed with Jasmine's idea of adding an extra cake sprite to their project, and the group ended up adding the sprite (Figure 3):

Jasmine: "What about my cake?"
 Lucia: "We already put it over there."
 Jasmine: "But I want it here."
 Lucia: "No, you said you wanted it at school [background]."
 Jasmine: "But I want another one." [Jasmine proceeded with adding a new cake sprite anyway]

When gatekeeping would not work, children might **seek parental intervention**, which happened multiple times between the sibling pair of Cal [older brother] and Hamid [younger brother]. For example, Hamid disagreed with Cal's drawing of a sprite that represented him and asked for Julia's [mother] intervention,

Cal: "Haha, look Hamid. I am so sorry. I would never try to make you look that ugly, haha."
 Hamid: "Mom, look what Cal did to me!"
 Julia: "Cal!" (Shouting)
 Cal: "I'm sorry, mom."
 [Cal then deleted the sprite and added a new one that Hamid did not complain about]

To sum up, family members [parents and children] would advocate their own ideas by directing other members to implement

their ideas and defending their inputs from being changed by others. Simultaneously, they would gatekeep other members' ideas, although they might receive some resistance.

Remixing Creative Input. Family members discussed ideas with each other, incorporated each other's ideas, and built on each other's contributions. As the practices of "*suggesting creative input*" and "*directing creative input*" show, family members often offered and incorporated making ideas from each other. Adding to that, family members would follow a more equitable and collaborative approach by **exchanging ideas** with each other. For example, when deciding which background to pick for a Mexico scene, Ana [mother] and Camila [daughter] discussed with each other and considered each other's ideas:

Ana: "This one?"
 Camila: "No, Mexico looks..." [not finished yet]
 Ana: "Or like this one?"
 [Camila also proposed a choice]
 Camila: "This one?"
 Ana: "No. Or this one? No, because this one looks like more..." [Ana rejected her own idea]
 [The two kept looking for and proposing ideas until they both agreed on one]

This kind of exchange of ideas was also identified among siblings. For instance, the brothers Cal and Hamid noticed the sprite they added for their younger sister Kiara was not moving, even though they programmed some animation for it. Then they discussed and worked on how to address this issue together. Finally, family members sometimes **became inspired by others' projects**, such as when Daniel decided to add a new scene about a dog running away for his project after seeing Roberto's [older brother] animation effects. Lastly, family members **built on** each other's contributions in their shared project. For example, Nina [mother] chose where to place the tree sprite that Lorena [daughter] added; Hamid [son] added new animation codes to the birthday card project started by Julia [mother]; Lorena [older sister] and Mia [younger sister] took turns inputting to their project. Overall, although with differences in ages and expertise, family members could build on each other's ideas,



Figure 3: Project screenshots from a family gatekeeping each other’s creative input: Lucia pushed back her daughter Jasmine’s idea of adding a cake sprite, but Jasmine did not listen and added a cake sprite anyway (right)

such as discussing and exchanging ideas and adding to each other’s contributions.

4.2 Negotiation Patterns Across Families

The above section details the negotiation strategies employed by family members during their co-making experiences. We further examined and compared family members’ negotiation process throughout the four workshops and described patterns in their interactions.

Families Have Different Negotiation Dynamics. While parents typically stepped back from device control when their children joined them, parents in the five families varied how much direction or scaffolding they provided. For example, Ana [mother] often directed her daughter Camila’s selections of sprites, backgrounds, and colors; in Julia’s family, all family members (parents, children, and siblings) were seen negotiating with each other to add their ideas and defend their contributions; while Marta [mother] primarily observed her kids’ (Daniel and Roberto) project making, and she occasionally commenting on their projects. Additionally, some parents let their children figure out their own dynamics without prescribing how to work together, e.g., Julia and Marta. In contrast, other parents strictly enforced turn-taking to make sure their children each got a chance to create and represent their ideas, such as Lucia and Nina. These variations in interaction dynamics were also reflected between siblings, e.g., Cal and Hamid struggled with device control by physically pulling the device and verbally requesting device access, whereas Marcelo and Jessica often voluntarily stepped back from the device control for each other.

Negotiating as An Evolving and Changing Process. Family members were often seen adjusting their negotiation strategies over time. For example, in Workshop 1, Kiara [daughter] wanted to operate the device after Julia [mother] showed what she did and asked Julia, “*Mom, can I help you?*” Julia, however, did not respond because Hamid [older brother] took over the device control and Julia was observing Hamid’s interaction. Kiara asked Julia again after about 3 minutes, but for an extra device this time, “*Mom, can I have one [device]?*” Julia replied, “*No, because everyone is with their parents.*” Then Kiara continued staying with her brother and mother but left the working table 4 minutes later, which finally caused Hamid and Julia to step back from the device control for

her: Julia and Hamid yelled back Kiara and invited her to operate the device – “*We want you to do it*” (Julia to Kiara), the first time Kiara got to interact with the device. Kiara, in this vignette, changed her negotiating strategies from asking permission to operate the device to requesting her own device and leaving the working group. In workshop 3, Kiara also defended her device control by saying “*Nooooo, ah ah ah*” when Hamid wanted to join her in her project. Overall, one’s negotiating strategies were not fixed, but might be adjusted to respond to the situation and to achieve their desired participation goals.

Younger Ones Tend to be Disadvantaged in Negotiation. When examining who often was able to get the device or creative control, age tended to matter. Older children, if without parental regulation, mostly dominated the device control and project creativity, marginalizing their younger sibling’s opportunities to contribute. For instance, Kiara’s desire to make was ignored by her older brother Hamid in workshop 1, while Hamid himself did not have much success in negotiating for device control during workshop 2 and workshop 4 when working with his older brother Cal. Particularly, some parents enforced turn-taking by frequently reminding the children to take turns or assigning tasks for each child, which had shown to be effective in balancing siblings’ participation. For example, two sibling groups (i.e., Jessica & Marcelo, Mia & Lorena) did not struggle with device control or idea negotiation much because their parents closely regulated their turn-taking. Their overall dynamics were cooperative and friendly compared to the sibling pair of Cal and Hamid. They even voluntarily stepped back for each other when their parts were completed, e.g., “*Here, it’s your turn*” (Jessica to Marcelo).

Identity Matters. While family members experienced give and take throughout their co-making processes, family members, especially children, exerted themselves the most when it came to representations of their identities, e.g., self-representations in the project and incorporating personal traits. For example, Camila rejected her parents’ request to record her voices for sprites and refused to have her picture taken for a girl sprite representing her; Kiara changed the hair color of the sprite representing herself to blue and said “*No*” in a confident voice when Julia [mother] wanted pink (Julia: “*No, I like the pink one more*”); and when Cal [older

brother] used a pig sprite to represent Hamid [younger brother] and later drew an unflattering face for Hamid' sprite, Hamid became annoyed and sought intervention from their mother Julia to make Cal change them. In contrast, we did not notice much of children's resistance regarding identity-irrelevant suggestions from their family members, such as changing backgrounds, adding new sprites, and removing certain coding blocks.

5 DISCUSSION

The above findings provide nuanced and detailed insights into family members' negotiation strategies during joint creating with computing. Family members demonstrated various negotiation practices around the control of device and project creativity. Notably, families' negotiation practices around device control are often embodied through their physical actions [71], i.e., direct embodiment [41] where family members literally act out their desire for device control, such as pulling the device to their side or directly inputting on the device. Future work can further examine how family members negotiate with each other through the lens of embodiment to enrich our understanding of the physical manifestation of negotiation, such as other forms of embodiment like *metaphorical embodiment* [20] and *manipulated embodiment* [41] that are missed in our data due to lacking video recordings of participants' making processes. At the same time, families' negotiation practices around creative control demonstrate rich forms of collaboration during JME among family members, including inviting ideas from each other, suggesting ideas for each other, dictating ideas for each other, and remixing each other's ideas. Research on computer-supported cooperative learning (CSCL) typically focuses on the macro-level of collaborative learning [26], namely, productive modes of collaborative learning (e.g., how learners should be grouped [28], how to regulate learners' behaviors [33], and activity structures [12, 24]) and supportive learning tools (e.g., [68, 69]). Our identified family negotiation practices around creativity control provide empirical insights into family as a micro-unit where family members (parents, children, and siblings) collaborate with each other, expanding the current understanding of CSCL in family contexts. Additionally, these different negotiation practices enrich the framing of parents as a teacher and project collaborator reported in JME literature (e.g., [5, 13, 77]) by supplementing nuanced details of how these collaborative roles are enacted in relation to other family members, which will be further articulated in later sections. In the remaining sections, we connect the findings to the literature about parent roles and sibling dynamics within HCI, reflect on the learning opportunities embedded in family members' negotiation practices, and share implications for designing productive JME learning experiences.

5.1 Roles and Agency of Family Members

Aligning with previous research reporting parent roles in children's interaction with learning technologies, the negotiation strategies parents took reinforce many of the previously identified parent roles [5, 13, 23, 77]. For example, children's negotiation practices of requesting device access reflect parents' roles as *gatekeeper* [77] (i.e., granting or not granting children's access to the device), as well as *enforcer* and *mediator* [13] (i.e., reminding or enforcing children's turn-taking with the device). In other words, a negotiation

practice often demonstrates the dynamic interaction process between family members and reflects a range of parent roles. It is also worth pointing out that not all parents' interactions are captured by existing roles in literature [5, 13, 23, 77], e.g., parents' actions of stepping back from device control shown in the negotiation action of "*stepping back from device control*" or the mediation practice of "*respecting independence*" in [78]. Together with the roles parents enact, their negotiation practices showcase parents' agency in families' joint making.

At the same time, most of the negotiation practices employed by parents were also identified in children. For example, children would gatekeep the inputs from their siblings and parents, just as parents gatekept their children's ideas. That being said, children also enact rich and various roles during the joint making, such as being a *student*, *teacher*, *collaborator*, and *scaffolder*. However, the role framing for parents from JME literature can only cover partial children's interactions and some remain unnamed, such as children asking permission for device access or adding their ideas (as a *permission seeker*), or being regulated by their parents or older siblings to focus on making (as a *regulatee*). The lack of framing about children's roles indicates the inadequate attention to children's perspectives and agency in family JME literature within HCI. To this end, our negotiation lens captures the dynamics between family members in the joint-making with technologies and highlights children's agency. For example, they would step up for device control, suggest making ideas for their family members, defend their inputs, and gatekeep other family members' inputs, rather than simply following their parents' or older siblings' instructions.

However, how much actual control children can gain over their families' shared project through negotiation seems to mainly depends on two factors: (1) *The unique dynamics of their family*, i.e., how those in a more dominant position (typically older family members like parents and older siblings) would manage or direct the joint experience, which can vary from family to family. For example, Cal [older brother] dominated the joint making with his younger brother Hamid and seldom stepped back for Hamid, Nina managed turn-taking between her girls Mia and Loren to make sure both of them got the opportunity to contribute, and Ana closely monitored which of Camila's ideas could be incorporated even though she let Camila operate the device; (2) *The extent to which they are willing to advocate for their ideas in negotiation*. Our findings show that children and parents strongly insisted on their ideas when the ideas were related to their identity, even when other family members tried to dictate or control these representations. Therefore, *to encourage children's agency and sense of ownership during shared-making, future designs of learning experiences and technologies can incorporate such identity-related features and activities*. For example, a JME learning activity can connect to children's life experiences, e.g., a play, a trip, a friend, and a family member. The tool could support children to incorporate these personalized experiences, such as allowing space for adding experience-related customizations like ScratchJr's features of adding one's own pictures and drawing their project elements [18].

5.2 Tensions and Negotiations as Important Joint Learning Experiences

Our findings of family negotiation practices reveal tensions during JME between family members. For example, siblings might struggle with device control by pulling the device to their side and directly adding their ideas to the device, negotiate ideas by verbally disparaging each other's contributions, or even misrepresent each other's identities in the shared project. Parents and older siblings were generally more successful than their younger co-makers in navigating through these tensions and negotiating what they wanted, resonating with previous findings that older children might not be willing to collaborate with their younger siblings in joint play and dominate the play [2, 21]. Some may argue that the tensions around device control and project creativity will lead to an intense and aggressive atmosphere between family members. However, tensions, disruptions, or breakdowns provide a fertile ground for learning and have been studied as an effective lens to understand people's collaboration and joint work in learning sciences [1, 49, 50]. Remarkably, the sociocultural learning perspective frames learning as a dynamic process in cultural spaces where learners form and reform themselves and their relationships in the space and consistently negotiate their participation [45]. Therefore, we see family members' negotiation practices in the workshops as important learning opportunities, in addition to learning how to code and create on ScratchJr. Specifically, parents were seen to fluidly adjust their roles in managing and supporting their children's making. For example, Nina acted as a *teacher* for her kids at the beginning of workshop 1 by teaching them the basics of ScratchJr, then stepped back from device control for the kids' making and became an *observer, cheerleader, gatekeeper, and mediator* [5, 13, 77] for the kids. Such role changes show parents' flexibility in responding to the different participation needs of their children.

Similar role flexibility and responsiveness were also found in children's negotiation practices, such as from being a *learner* at the beginning of workshop 1 to project *dominator* [77] who took control of the device and project creativity, *executor* [77] for the ideas of their family members, and *teacher* who provided technical support for family members as they explored and understood more in later workshops. Importantly, children's negotiation strategies showcase their *repertoire in advocating for themselves and their ideas* within their families. Kiara, the youngest child in Julia's family, for example, she practiced three negotiation strategies for device control in workshop 1, from asking permission to operate the device to getting an extra device and leaving the worktable, which eventually caused the attention of Julia and Hamid, who stepped back and invited her to operate the device. Throughout the workshops, Kiara, intentionally or unintentionally, experimented with different negotiation strategies to get the device access and finally succeeded after some non-working attempts. Although younger children tend to be disadvantaged in family negotiation practices, their negotiation experiences are a valuable learning opportunity for young children like Kiara to practice relationship management and demonstrate their agency. Moreover, such relationship- and role-negotiation practices provide a fertile ground to better understand family collaboration and joint work in informal learning contexts, which can inform the redesign of activity structures and learning tools

[49, 50, 70]. For example, previous HCI literature often views tensions and negotiation as factors leading to unproductive JME and therefore suggests designing technologies and interactions that can avoid conflicts, e.g., “*everyone should have their own controller, their own role, and equal view into the system*” [21, P746]. Our findings enable us to argue that *the designs of JME learning experiences and technologies do not necessarily have to avoid all potential conflicts but can instead embrace mechanisms that may give rise to tensions between family members*, which can provide opportunities for them to experiment with managing each other's participation and advocating for themselves. For instance, a JME experience can encourage families to discuss the different roles they can play instead of assigning roles to family members, which can be something to consider in both the design of educational technologies for JME.

5.3 Negotiation as Productive JME

In addition to highlighting the learning opportunities embedded in family negotiation, we further connect family negotiation practices to the principles of productive JME and share implications of our findings on facilitating productive JME for families in this section. Takeuchi and Stevens [66] summarized six design principles for productive JME, including *mutual engagement, dialogic inquiry, co-creation, boundary crossing, intention to develop, and focus on content, not control*. Family members' negotiation practices align well with these productive principles. For example, all negotiation practices involved multiple family members, mainly through direct interactions with each other (*mutual engagement*); the majority of negotiation practices happened through or were accompanied by conversations, such as asking for permission, inviting and suggesting ideas, and defending contributions, which is *dialogic inquiry*; and when family members made story projects in our workshop, they connected to their past experiences and negotiated with each other about how they wanted to be represented in the projects, which crossed the boundaries of time and settings (*boundary crossing*). In other words, tensions and negotiations are already embedded in Takeuchi and Stevens' [66] productive JME guidelines but were not specified. Our work takes a step further by surfacing and detailing negotiation practices in a specific JME context and highlighting that *negotiation is a form of productive JME*. In brief, the negotiation lens grounded in family members' moment-to-moment interactions highlights the features of productive JME and reveals how productive JME can actually happen when family members advocate for themselves. We encourage more researchers and educators to consider examining JME experiences through the negotiation perspective.

Our findings also shed light on strategies to facilitate productive JME. Yen and colleagues [75], after examining JME between parents and preschoolers from different regions, argue that cultural backgrounds impact how families perceive what a productive JME is. Our lens of negotiation extends this argument by showing that being productive and engaging may have different meanings even for individuals within the same family. For example, some parents might feel engaged throughout the process simply by observing or managing their children's inputs and occasionally contributing their own ideas. Some kids, like Marcelo and Kiara, wanted to frequently

get the opportunity to operate the device and include their ideas (e.g., Kiara, Marcelo, Jessica). Given each family may have its ways of working together and unique understandings of what is “productive” and is not “engaging,” there are no one-size-fits-all models that all families should follow during JME. According to culturally responsive teaching and learning [19, 56], teaching and learning should happen in culturally supported, learner-centered contexts where students’ cultural assets and characteristics should be identified, nurtured, and employed to support and promote their effective learning. We argue that family’s existing interactions and dynamics are an important part of learners’ cultural assets. Allowing family members to adapt their own interaction styles that reflect more closely those of their everyday life may particularly contribute to an engaging and productive JME experience. As activity designers and facilitators, ***we need to recognize their unique family dynamics as important cultural assets for learning and respect their expectations of what is meaningful and productive for themselves.*** Educators and researchers should consider the range of cultural practices families may be bringing with them, and examine their own assumptions about what productive collaborations and interactions look like. For example, some Chinese parents tend to hold their children’s hands during JME with tablet games, while US parents may be less likely to use physical intervention [75]. Even within particular identity groups, each family has their own unique cultural and relational practices [32] based on a range of family member’s held identities and lived experiences in action with each other [22]. Learning technologies for JME should be designed with the input of families from diverse backgrounds and cultural traditions, while learning programs should be codesigned or adapted in conversation with families from the communities being directly served. Families who participate in JME in institutional settings, especially those who hold identities that have been historically marginalized, may also perceive implicit norms and expectations for their interactions, and modify their behavior accordingly. Educators and researchers should be aware of this, and make efforts to help families feel comfortable and explicitly welcome them to bring their home dynamics into the learning space.

5.4 Limitations & Future Work

Our participating adult caregivers were primarily mothers, although we did encourage all family members to join the program. Therefore, certain family members’ voices were missing in the current study, such as the dynamics between fathers and children or grandparents and children. We note that a father did participate in certain workshops (e.g., Celso) whose interactions were included in the analysis. In our other FCL implementations, we have had some grandparents, extended relatives like uncles, and fathers participate, whose interactions we will continue to examine in the future. Additionally, our data only included five families from a mountain west area in the US. The negotiation practices employed by the five families are by no means comprehensive. While we’ve contributed to understanding the range of what negotiation between family members looks like in JME from a sociocultural perspective, we acknowledge a need for more critical analyses of JME. Specifically, it is important to study what culturally sustaining [48] JME (i.e. designs for JME that explicitly promote families’ use of their cultural

home practices) can look like for families whose cultural practices may be marginalized by mainstream institutions, and what family negotiations would look like in such a learning environment. It has also long been acknowledged that white and middle-class cultural norms are infused in the design of digital technologies and STEAM learning environments in the US [4, 51]. We believe it would be fruitful to further study the impact of these white cultural norms on the design of various elements of JME experiences, and how they may impact families’ ability to more fully bring home practices into their negotiation strategies, particularly families from historically-marginalized backgrounds. Finally, our data does feature family members’ interactions and reflections across a series of workshops in real-world settings, which is not common in current JME literature in HCI. Our findings can serve as a starting point to encourage further explorations into families’ negotiations, such as how family members learn through their negotiations and how materials and technologies can influence the kinds of negotiations that emerge.

6 CONCLUSION

In this paper, we report how family members negotiated with each other in joint media engagement with a creative computing tool named ScratchJr in an informal learning workshop series. Family members practiced various negotiation strategies during the joint making, which we classified into two broad categories – negotiating device and creative control. We also share patterns in family members’ negotiation practices across the workshops. Based on these findings, we reflect on the agency of family members, including children, in negotiating for device and creative control, how the tensions and their negotiation practices can contribute to meaningful and productive JME learning experiences for all, as well as design implications to facilitate family-based, productive JME experiences. Ultimately, we hope this work can advance the current understanding of family dynamics with educational technologies within HCI and inspire the design of engaging technology-mediated learning experiences for families.

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