# Computer vs. Non-Computer Mediated Parental Interactions

Lu Xiao, University of Western Ontario, London, ON
Tingting Cai, Sun Yat-sen University, Guangzhou, China
Vanessa Eastmure, University of Western Ontario, London, ON

**Abstract**
The importance of parent-child dialogues in child development has been widely recognized. Also acknowledged in the literature is that an artifact in an activity mediates and influences the activity's objective. Yet previous studies have not examined the relationships between the types of the parent-child activities and their behavior with respect to engaging in a dialogue and controlling the artifact. Addressing this research gap, we analyzed the videos of five math and design activities that eight parent-child groups participated over one month period of time. Our results reveal that the type of activities did not influence the frequency of group members' having a dialogue in an activity, but affected the length of a dialogue. Specifically, the length of a group's dialogue was much longer in the math activities Also, each member controlled artifact(s) more often in math activities. While the children controlled the artifact(s) longer in the design activities than in the math activities, it was the opposite pattern in the parents' case.
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**Contact**: lxiao24@uwo.ca, tingting492224745@qq.com, veastmur@uwo.ca

## 1 Introduction

Various research studies have been conducted to understand the effects of parental interactions and parental involvement on child development, e.g., the types of parent-child interactions in assigned math activities (Anderson, 1997), the comparison of father-child and mother-child interactions (MacDonald & Parke, 1984), or the parents' metacognitive knowledge (Thomas & Anderson, 2013). Similar to other group activities, parent-child activities are often mediated by artifactss, e.g., pens, papers, and computers. Recognizing the importance of parental interactions in child development (e.g., Eccles & Harold, 1993; Desforges, & Abouchaar, 2003; Vandermaas-Peeler & Pittard, 2014), CSCW researchers have argued for the consideration of parental role in the design of educational technologies (Xiao & Martin, 2012). Computer technologies are developed to foster parental involvement, mainly focused on improving parent-child communication (e.g., Brown et al., 2007; Yarosh, Cuzzort, Müller, & Abowd, 2009; Zhao et al., 2013). With the increasing number of computer tools that support parent-child activities, the effects of these artifacts on the parental interactions are getting more and more research attention. For example, Sumi and Nagata (2011) examined the effects of using visualizations in facilitating communication between parents and children, and Barendregt (2012) investigated how specific game design elements structure the cooperative interaction between parents and children. Despite of the fact that parents and their children engage in different kinds of activities and use different mediating artifacts, it remains unknown that whether and how the types of the activities and artifacts affect the parent-child activities. For example, analysis of parent-child dialogues in the activities has been a main research method in educational studies that examine the influence of parental interactions (e.g., Anderson, 1997; Anderson, Anderson, & Shapiro, 2004; Thomas & Anderson, 2013; Pino-Pasternak, Whitebread, & Tolmie, 2010). Yet previous studies have not examined whether the type of activities affects the dialogue behavior, e.g., how often they engage in a dialogue, and how long the dialogue is. Also, it is not answered whether or not parents' and children's behavior of controlling the artifact(s) is affected by the type of the artifacts, e.g., computers vs. traditional paper and pens. Answering these questions contributes to the development of better educational technologies for parent-child activities.

As a starting point to address these research gaps, we analyzed the videos of parent-child activities focusing on the frequency and duration aspects of the parent-child dialogues, as well as their behavior of controlling the artifact(s). These videos are about the five math workshops that eight groups of parents and their children (grade 4-6) participated in May 2014 in a Southwestern Ontario city. In this paper, our analysis focused on understanding the participants' behavior of controlling the artifact(s) and engaging in the dialogues in different types of activities. In the section below, we describe the video data

in more details, and then present our coding schema and the coding process. Followed by the analysis results, we conclude with suggestions on future research.

## 2 Video Data of the Study

The workshops took place in a classroom of the Faculty of Education at the local university. In the first four of the five workshops, the parent-child teams were encouraged to work together on a math problem, then after a break, they designed user interfaces for an imaginary computer game to help them re-conceptualize how to visually present the worked math problem. They were provided iPad as the technology for designing the user interfaces. In the last workshop, the children were given the math problems that reflected the concepts covered in the previous four math activities, and were encouraged to solve the problems by them. This served the purpose of checking whether or not the children have mastered the concepts from previous activities. A professor of the local university who specializes in math education designed the math problems and these problems were considered at a similar level of difficulty. The design problems were also at the same level of difficulty as no additional requirement was provided in different workshops.

A total number of 11 child-parent groups were involved in the workshops. The children were enrolled between Grade 4-6 at public schools of the city. The groups' attendance of each workshop is shown in the table below. Currently, our analysis has focused on the eight groups that attended the workshops at least three times (the shaded groups in Table 1). Some videos were not analyzed because they did not fully capture the groups' behavior due to the constraint of the classroom setting (see the footnote below for details). In the end, we had 27 design sessions and 35 math sessions in the analysis.

| Group Names | Workshop 1 | Workshop 2 | Workshop 3 | Workshop 4 | Workshop 5 |
|---|---|---|---|---|---|
| Amazing Sunset | Y | | Y | | |
| Cheeta | Y | | | | |
| Team Awesome | Y | | | | |
| Math Busters | Y | Y | Y | Y | Y |
| Parrot | Y | Y | Y | Y | Y |
| Poro | Y | Y | Y | Y | Y |
| Random People | Y[1] | Y | Y | Y | Y |
| Super Tiger | Y | Y | Y | Y | Y |
| One Pound Fish | Y[2] | Y | | Y | Y |
| Unicorn | Y | Y | Y[3] | Y | Y |
| Lion | | Y | Y | Y | |

Table 1 Family groups' attendance in the workshops

## 3 The Behavior Coding Schema and Coding Process

To help compare whether and how the behavior differs in different types of activities – math, design, and other, we first divided the recorded session into these three parts. We differentiated a dialogue situation from a non-dialogue situation by using the code 'dialogue'. The dialogue coding family has several codes to code what happened between the parent and child while they spoke with one another. This included 'who initiated (with a statement or question)', 'who ended the dialogue' and 'who was controlling the tool'. Then in a non-dialogue situation, we had multiple codes to code what the parent and child were doing individually when the two were not engaged in a dialogue. This included 'talking to other parents', 'talking to other children', 'talking to researchers' or 'working alone'. We also coded the cases when they spoke to the other person but the dialogue did not start, e.g., the parent said something without verbal respond from child, including giving orders or reminders. Our non-dialogue coding family also considered the case when the parent and the child were working together but no dialogue occurred. Besides these codes, the parent's behavior had additional ones such as 'looking at the child' and 'non-workshop activity (e.g., reading a book or using a mobile phone)'.

The second and third co-authors were also the coders in the study. They coded the videos using the schema. To ensure the inter-coder reliability, they first coded one family's videos from two workshops independently. All co-authors then discussed the coded results and agreed on several technical issues

[1] The video of Random People in workshop 1 cannot be analyzed, for the parent and the child were not totally captured.
[2] It was the same as workshop 1 of One Pound Fish, in which case the child was not captured.
[3] In workshop 3 of Unicorns, the video of design activity is missing.

such as how to define when one dialogue ended and another began. Then the two coders re-coded three of the videos, and met with the first co-author and finalized the coding schema together. They then coded the rest videos separately and met about once a week to discuss any coding issue as they arose.

# 4 Results

## 4.1 Does the type of activity affect how often that parents and children engaged in a dialogue in the activity? What about the duration of their dialogue?

Our data show that whether the activity was about a math problem or a design problem did not affect how frequently the family group engaged in a dialogue. However, the dialogue's length in these two types of activities suggested differently. While almost every group had a dialogue length over 60% in math activities indicating that they were talking more than 60% of the time in a math activity, only two groups kept this level in the design activities (see Figure 1 for this comparison). In fact two family groups only had 10% of the time talking to the parent/the child. These results suggest that parents and children were more interactive in the math activities than the design activities.

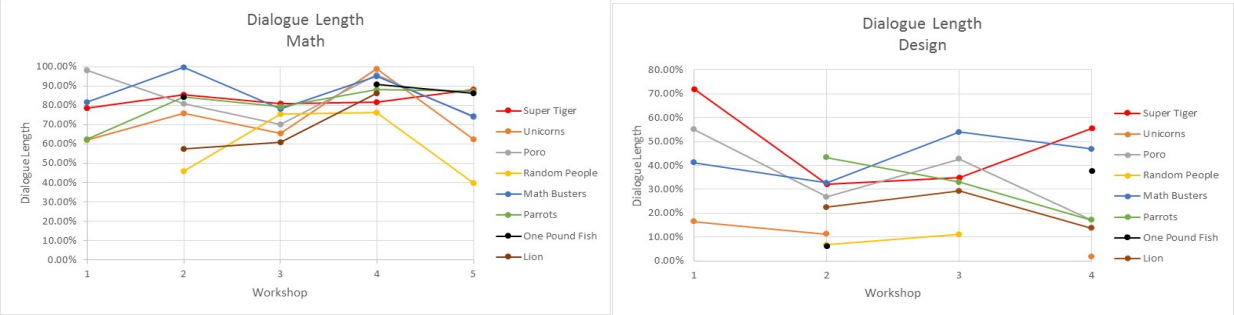


Figure 1 Family groups' dialogue length in the math and design activities

## 4.2 Does the type of activity affect how often that parents and children control an artifact in the activity? What about the duration of the artifact control?

We examined how often family members controlled an artifact in the math and design activities (i.e., 'parent controls the tool', 'child controls the tool', or 'both control the tool'). In the math activities, the tool could be pencils, papers, and the math artifacts for the activities such as building blocks and strings. In the design activities, the artifact was the iPad that the group used to design the user interfaces. Table 2 shows the descriptive statistics of the artifact control frequency data. Interestingly, we found that the situation of one member controlled the artifact occurred more often in the math activities than the design activities, but this pattern did not exist in the case when both members controlled the artifact. Unfortunately we could not conduct more powerful statistical analysis such as t-test to confirm the result statistically, due to the limitation of the data – it violated the independence assumption for two-sample t-test, and had insufficient sample size for one-sample t-test.

| | Child controls the artifact (number of times per dialogue) | | Parent controls the artifact (number of times per dialogue) | | Both control the artifact (number of times per dialogue) | |
|---|---|---|---|---|---|---|
| | **Math** | **Design** | **Math** | **Design** | **Math** | **Design** |
| **Maximum** | 10.5 | 3.1 | 6.3 | 1.9 | 1.3 | 1 |
| **Mode** | 1 | 1 | 1 | 0 | 0 | 0 |
| **Median** | 1.6 | 0.9 | 1 | 0.2 | 0 | 0 |

Table 2 Member(s)' frequency of controlling an artifact in a dialogue in the activity

Table 3 shows how long one or two members controlled the artifact in a dialogue in the activities. It suggests that how long both members controlled the artifact in a dialogue did not seem to be affected by the type of the activity. However, child seemed to control the artifact longer in the design activities than the math activities, whereas this was the opposite case when the parent controlled the artifact. Figure 2 and 3 also illustrated this finding.

| | Child controls the artifact | Parent controls the | Both control the artifact |
|---|---|---|---|

| | (percentage of dialogue duration) | | artifact (percentage of dialogue duration) | | (percentage of dialogue duration) | |
|---|---|---|---|---|---|---|
| | **Math** | **Design** | **Math** | **Design** | **Math** | **Design** |
| **Maximum** | 100% | 100% | 92.5% | 23.5% | 24.0% | 47.2% |
| **Mode** | 0 | 0 | N/A | 0 | 0 | 0 |
| **Median** | 38.9% | 67.7% | 18.3% | 5.3% | 0 | 0 |

Table 3 The percentage of a dialogue's time that had one or two members controlling the tool in the activity

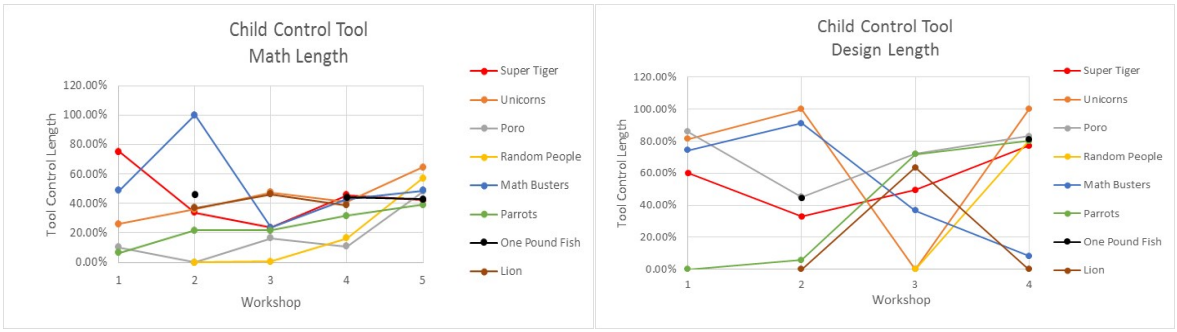


Figure 2 The percentage of a dialogue's time that had child controlling the artifact in the activity

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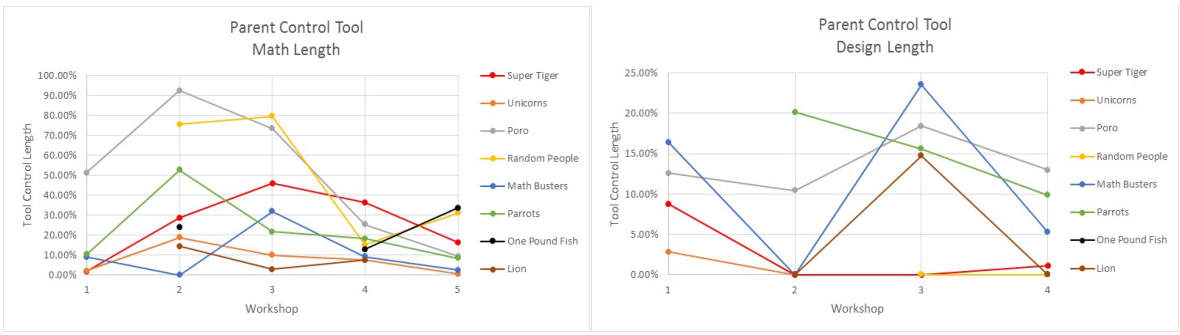


Figure 3 The percentage of a dialogue's time that had parent controlling the artifact in the activity

## Conclusion

The importance of parent-child dialogues in child development has been widely recognized. Also acknowledged in the literature is that an artifact in an activity mediates and influences the activity's objective. Yet previous studies have not examined the relationships between the types of the parent-child activities and their behavior with respect to engaging in a dialogue and controlling the artifact. Addressing this research gap, we analyzed the videos of five math and design activities that eight parent-child groups participated over one month period of time. Our results show that the type of activities did not influence the frequency of group members' having a dialogue in an activity. However, the length of a group's dialogue was much longer in the math activities. Parents and children controlled artifact(s) more often in the math activities than the design activities. Additionally, while the children controlled the artifact(s) longer in the design activities than in the math activities, it was the opposite pattern in the parents' case.

Our study of the parents' and children's control of the technologies is a starting point toward a better understanding of the technologies' mediating influences in parental interactions. On one hand, the different control patterns by parents and their children imply their different roles in the activity. On the other, different design may invoke different control patterns thus affecting the roles that parents and children play in the activities. Education literature has demonstrated that parental roles in these activities

affect the development of the child. Thus it is expected that studying these control patterns contribute to better design of technologies to support parent-child activities and to foster child development. We call for more work that looks into various aspects of parental interactions in computer-mediated activities so as to better design the technologies that afford these interactions.

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