Universidad del Desarrollo
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# PARTICIPATION OF MOTHERS AND PRESCHOOL CHILDREN IN JOINT USE OF MOBILE DEVICES

BY:

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*To my life partner Karem and our children Emilia and Manuel, who are my beacon and my constant source of joy. Through games and laughter, you have woven my inspiration and strength.*

*To my parents and all those who have chosen to play alongside me, you are proof that we are committed to playing together.*

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## Introduction

Research on preschool children's use of media has sought to illustrate the repercussions on their development, considering both positive and negative consequences. A particular practice that has demonstrated positive outcomes from its use is Joint Media Engagement (JME, Stevens & Penuel, 2010; Takeuchi & stevens, 2011), which refers to individuals sharing and participating jointly in the use of media. Specifically, JME encompasses a wide range of experiences, from a rudimentary level where the adult merely accompanies the child in media use without generating dialogue or interactions, to more enriching activities, termed productive, which involve the adult providing cognitive, affective, and technical support, as well as facilitating active mediation that enables the child to understand the content and relate it to their own life, thus promoting a meaningful learning experience (Dore & Zimmermann, 2020). It is well documented that JME holds benefits for child development through the fostering of communication, social interaction, collaborative learning, and problem-solving. These potentially contribute to healthy cognitive and socio-emotional development in children (Archer et al., 2021; Dore & Zimmermann, 2020; Lauricella et al., 2014).

Given the high penetration of mobile devices (MDs) in households (Economic Commission for Latin America and the Caribbean, 2020; Rideout & Robb, 2017; Wood et al., 2016), the lack of knowledge around the use of these media, specifically in the interaction between adults and infants, as well as the factors that may influence their promotion or discouragement by parents, is intriguing. International experiences indicate that JME tends to occur more often with traditional media, such as television, rather than mobile devices. Additionally, it is observed that JME is more frequent with young children and decreases as the child grows.

Preliminary literature has identified some factors that contribute to the development of this joint practice with media. In the case of parents, a higher level of education, more personal time dedicated to the use of mobile devices, and greater experience with them are tied to more JME (Connell et al., 2015). Also been found to parents' beliefs have an impact on the development, participation, and commitment manifested in JME sessions with MDs (Cingel & Krcmar, 2013a). Therefore, it is crucial to understand how instances of JME-MD can be beneficial or productive for the greater cognitive, social, and emotional development of infants and children, considering both the design and content of mobile media (applications) as well as the portability and mobility of the MDs do not always favor JME (Hiniker et al., 2018; Vaala & Bleakley, 2015).

The purpose of this study is to characterize the variables that affect the instances of co-use between infants and adults, known as Joint Engagement with Mobile Devices (JME-MD), addressing the framework of parents' beliefs and the content of the media during their joint use. To meet this objective, two studies have been carried out. The first was aimed at understanding the framework of maternal beliefs that stimulate or inhibit the emerging of the JME-MD practice. The second explores how the dyad can take advantage of the joint session by interacting with the media content (app) on a mobile device to achieve a productive and beneficial JME session for both participants.

Together, both studies aim to expand knowledge about how media content (app) and context (beliefs and characteristics of the mother) relate to JME with MDs. From these results, recommendations can be derived for parents and creators of children's content to promote productive co-use in dyads in these joint media use instances.

## Theoretical Framework

### Joint Media Engagement (JME) as a Media Use Context

In the dynamic landscape of child development, the interaction with digital media has taken a leading role over the past decade. Joint Media Engagement (JME) emerges as a significant area of interest in current research. Although initially focused on the influence of television and its content (Lauricella et al., 2014; Wartella & Jennings, 2000), the transition to the digital era has reconfigured the landscape and has drawn attention to mobile devices (MDs), such as smartphones and tablets, which act as a window to the vast universe of multimedia content available. However, such focus on content constitutes a unidimensional view that does not reflect the complexity inherent to the phenomenon. Current research advocates for a perspective that integrates other critical variables such as the child's age and the context in which media use unfolds; dimensions that intertwine with child development and vary substantially among different environments (Guernsey, 2013).

JME involves more than just simultaneity in media use between adults and children. It also encompasses the quality of these interactions and their influence on the cognitive, social, and emotional development of children and acts as parental mediation in relation to media (Livingstone & Helsper, 2008; Nathanson, 1999). Parental mediation, which promotes dialogue and interaction around media content, can mitigate negative effects and strengthen child development, as evidenced by studies that show benefits for children who engage in such conversations (Nathanson, 2001). Furthermore, it has been observed that parents employ specific strategies to boost learning during shared media use, providing verbal, physical, and emotional support, as well as cognitive scaffolding that enriches the child’s understanding and learning of media content (Reich et al., 2013; Valkenburg et al., 1999).

The concept of Joint Media Engagement (JME), developed by researchers at the Joan Ganz Cooney Center, encompasses all shared experiences, whether digital or analog, in which interactions focus on a common medium. These experiences can include games, searches, reading, and creation, with either traditional or digital media (Stevens & Penuel, 2010; Takeuchi et al., 2011). Takeuchi and Stevens (2011) establish that for JME to be effective, several essential conditions must be met. These include all participants sharing a common space and the possibility of direct communication among them while paying attention to the medium. Moreover, individuals must be able to divide their attention between the primary medium and other secondary activities. This encourages a dynamic and varied exchange of responses, covering forms of verbal, non-verbal, and physical interaction, through a mutual engagement.

In summary, current research highlights the vital role of JME in the digital age, underlining how it strengthens emotional bonds and improves interaction between parents and offspring. This approach not only fosters affective ties but is fundamental in acquiring skills at early stages of childhood (Dore et al., 2018; Ewin, Reupert, McLean, et al., 2021; Takeuchi et al., 2011). The relevance of this phenomenon is even more pronounced during the preschool years, a critical phase in which parents play a crucial role in the introduction to and guidance in the use of digital tools (Kucirkova & Sakr, 2015; Plowman et al., 2008). It is also a period when young children show a preference for accompanied technological interaction, highlighting the importance of active parental presence in these processes (Chiong & Shuler, 2010; Connell et al., 2015).

### Joint Media Engagement with Mobile Devices (JME-MD)

Currently, families have witnessed the emergence and proliferation of mobile devices (MDs), revolutionizing the family media environment. These devices, distinguished from previous technologies like television and desktop

computers by their portability, interactivity, and ease of use (Christakis, 2014), have qualities that simplify and encourage their use by children (Cingel & Krcmar, 2013). In some cases, the device can even provide support tailored to the child's developmental level directly (Hirsh-Pasek et al., 2015). This trend is supported by data indicating a notable increase in MD use among children: in the United States, usage went from 52% in 2011 to 98% in 2020 (Rideout & Robb, 2020), demonstrating the growing integration of these media into children's daily lives.

In Chile, specifying access to mobile devices by preschool children is challenging. Nonetheless, certain indicators regarding their possession offer an approximation.

The 2015 CASEN survey[1] data reveals that 13% of 5-year-old children and 17% of 6-year-old children have a mobile phone in use (Ministerio de Desarrollo Social y Familia, 2017). Furthermore, the Kids Online Chile study shows that the average age of receiving the first mobile phone has decreased from 11 years in 2016 to 8.9 years in 2022, with 87% of respondents indicating possession of a MD (UNICEF et al., 2024). Although these data do not specifically refer to the preschool segment, they allow us to infer that possession of personal devices will occur at increasingly younger ages in future generations (Ministerio de Desarrollo Social y Familia, 2017).

[1] The Encuesta Casen, or National Socioeconomic Characterization Survey, is a nationwide survey conducted by the Ministry of Social Development and Family of Chile. Its objective is to measure and understand the socioeconomic conditions of households and the country's population, in relation to demographic, education, health, housing, employment, and income aspects. (Ministerio de Desarrollo Social y Familia, 2017).

The increasing presence of MDs in households suggests that the interaction between parents and children through media use is becoming a common practice for educational or leisure purposes. However, we are still in the early stages of research on JME-MD, and empirical evidence is limited to fully understand its impact (Zippert et al., 2019). A brief review of the literature focused on JME-MD is presented.

Among the research that has explored the incorporation of MDs into family life, the work of Wartella et al. (2014) stands out, showing that these devices have become a constant presence in U.S. households with children under the age of 9. Sixty-nine percent of families own a smartphone, 40% have a tablet, and 34% have both. Regarding Joint Media Engagement with Mobile Devices (JME-MD), it is reported that 63% of parents participate in shared activities with their children using these media. Although JME-MD is a widespread practice, its frequency is lower compared to media such as television, whose joint use reaches 88%. Moreover, the study highlights that JME-MD is more common with younger children, with a decrease in frequency as children grow (Wartella et al., 2014).

A year after the research by Wartella et al, Connell and collaborators (2015) provided complementary findings using a representative sample of US parents with children up to 8 years of age. They reported that JME-MD was less frequent compared to the co-use of more traditional media, such as books or television, but it still constituted a notable practice. The data indicated that 29% of parents always or almost always co-used smartphones with their children, and 21% did the same with tablets, but these numbers increased to 31% when it involved television. About 8% of parents claimed they never co-used mobile devices with their children, a significantly higher proportion than the nearly 1% who never co-used television. Frequent co-use of television or computers was reported by a third of parents, while only one in five indicated equivalent co-use with tablets. The study also reported that JME decreases with the age of children, especially

in the use of mobile devices, suggesting a significant shift in media co-use preferences as children move out of the preschool stage.

Furthermore, among the parental demographic variables, it was found that older parents and those who spend more hours per day using tablets were more likely to engage in JME-MD. However, the relationship between the age of parents and co-use is negative when considering smartphones. A marginal correlation with the level of education was also discovered; observing that parents with secondary education or less are more prone to JME-MD compared to those who have a bachelor's degree or higher education level (Wartella et al., 2014). Finally, Ochoa and Reich (2022) examined parental beliefs regarding the use of mobile devices (MDs) and their impact on child development among a group of 40 Latinx parents residing in the US with 4-year-old children. Their findings underscore that nearly all parents reported beliefs consistent with both potential benefits and obstacles associated with these devices in children’s learning. Specifically, about JME-MD, approximately 20% of the sample, representing various socioeconomic levels, identified this as one of the top five parental mediation strategies. Caregivers of both genders with higher educational attainment emphasized the importance of co-use as a means of assisting in device use and content comprehension.

It is essential to consider that, in the rapidly growing literature on joint device use, the challenge of estimating usage time, both individually and collectively, persists. A common strategy in the reviewed studies is to use retrospective estimates based on self-reports. However, various indicators suggest that people tend to underestimate the time they spend on these devices. For example, Rosenberg et al. (2022) offer insights on how adolescents perceive time when deprived of mobile phone use, highlighting the complexity of measuring this time in real-life situations. Likewise, Kim (2013) notes that mobile devices are often used for longer periods than users perceive, which could lead to an

underestimation of the actual time invested in them. Furthermore, regarding the Joint Media Engagement variable, it is essential for researchers to balance factors such as the type of technological device, content, duration and frequency of exposure, and the interactions that occur during JME (Arundell et al., 2020; Medawar et al., 2023).

In summary, the relationship between the time parents spends on technology and their willingness to use these devices together with their children is significant. Research suggests that parents who spend more time using technology not only feel more comfortable with it but also tend to have a more positive attitude towards its use. Thus, parental perceptions, beliefs, and support play an essential role in how children approach and learn about technology, influencing their willingness to use it in a shared context (Barron et al., 2009; Cingel & Krcmar, 2013). Finally, estimating individual and joint usage time retrospectively is complex not only because of time underestimation but also because it must address content and context, and therefore future measures of this phenomenon must encompass not just an estimation of “screen time” but also incorporate other measurements that allow a more accurate approach to this complex phenomenon.

**JME and parental beliefs**

Parental beliefs are highly relevant when seeking to understand the behavior they display in various contexts. The literature has shown that these beliefs act as a cognitive framework that guides how they think and automatically react to their children's actions and activities, how they interpret their behaviors (Bornstein, 2012, 2013; Johnston et al., 2018), and even the degree of parental involvement in essential activities such as play (Bornstein & Tamis-LeMonda, 1989).

As a construct, parental beliefs range from perceptions around the child's ideal or optimal emotional and behavioral functioning to an assessment of their own role in dyadic interactions, thus playing a determining role in both parenting and child development (Bornstein, 2012; Johnston et al., 2018).

Parental beliefs have been described as stable after being formed through their own contextual and historical experiences, experiences with their family of origin, and broader frameworks such as the surrounding culture (Bronfenbrenner & Morris, 2007). Thus, parental beliefs operate as a backdrop for schematic cognitive processing whose influence on parental behavior is rather automatic and/or heuristic, has been generally assessed through self-report, thus capturing those more explicit elements of such beliefs (Johnston et al., 2018).

Linked to JME, parents' beliefs may be at a crossroads of contrasting beliefs. Some find that parents value the potential benefits that technology can bring to the learning and growth of children (Ortiz et al., 2011; Radesky et al., 2016; Sanders et al., 2016; Ochoa & Reich, 2020). Others find significant concerns among parents about excessive use of screens and potential detrimental effects on child development and children’s achievement (Genc, 2014; McCloskey et al., 2018; Radesky et al., 2016; Ochoa & Reich, 2020).

It is interesting to note that personal beliefs influence the degree of parental participation in their children's media consumption This participation can vary widely, from a shared and active experience, seen as a valuable opportunity to strengthen family bonds as suggested by Barron et al. (2009), to the act of providing mobile devices to children for entertainment or emotional regulation as a form of distraction, known as the "pass-back effect" or “pacifiers” or “shut-up toys” (Chiong & Shuler, 2010; Holloway et al., 2014; Kabali et al., 2015; Wartella et al., 2014). These concepts refers to when parents, hand over a MD to children to keep them occupied, calm them down, as a reward, or as a disciplinary

measure. Although more than 50% of parents claim to lend their mobile devices to their children when they are busy, research from Northwestern University indicates that only 36% feel completely comfortable with such practice (Wartella et al., 2014).

The task of parents to balance their positive and negative views regarding the use of MDs is complicated due to the belief that children, as 'digital natives' (Prensky, 2001a, 2001b, 2009), possess a natural ability to handle technology. This belief can undermine parents' confidence in their own technological competence and their ability to guide the use of digital media. However, studies like that of Barron et al. (2009), refute this idea, highlighting that parental support is crucial, beyond the technological knowledge of the parents. In this context, two studies provide significant evidence on the matter. On the one hand, the research by Wood et al. (2016) showed that parents who considered their children to be advanced users of MDs tended to offer less support during joint digital play activities. This results in a reduction of physical interactions such as helping the child make a gesture on the screen; verbal interactions, such as asking questions or reading aloud instructions shown on the screen, and emotional interactions exemplified in actions like celebrating with a high five or verbally expressing enthusiasm for achievements. On the other hand, the study led by Reich et al. (2013), from a sociocultural perspective, revealed that, contrary to the popular concern that digital media might supplant quality family time, shared play dynamics on digital platforms promote interaction and strengthen social bonds, not only among siblings but also with parents and other relatives.

The impact of the 'digital native' concept on parents might also lead them to erroneously assume that the skill observed in their children's operation of mobile devices (MDs) equally extends to a competence in understanding media content. Various studies have highlighted how the unique properties of modern MDs, such as their intuitive touch interface and the ability to offer digital

interactions that act as a sort of digital scaffolding, adaptively responding to the child's actions (Ewin, Reupert, McLean, et al., 2021), not only promote independent use from an early age (Cabello et al., 2021; Christakis, 2014) but also can discourage parental participation in joint digital activities, as the adults perceive a lack of necessary skills to integrate into these play dynamics offered by their children (Reich et al., 2013). This phenomenon highlights the importance of delving into the study of parental beliefs and how they influence active and conscious involvement by parents in their children's technological experiences.

Thus, despite the challenge for parents to balance their positive and negative beliefs about the use of MDs, the conviction that mobile technology represents a gateway to future opportunities for learning, social connection, and employability remains strong among parents (Radesky et al., 2016, Ochoa & Reich, 2020). This ambivalence reflects the inherent challenge of parenting in the digital age: balancing the opportunities and risks associated with technological use. While some mothers may feel less competent in technology compared to fathers (Wood et al., 2016), the widespread belief is that early exposure to technologies favors the development of essential skills for the future (Plowman & McPake, 2013).

In conclusion, parental beliefs about technology and its use play a fundamental role in shaping parenting practices that seek to balance the promotion of child development with the mitigation of potential risks. This balance, often laden with tensions and contradictions, highlights the complexity of contemporary parenthood and underlines the need for continuous reflection on how to guide children in navigating the digital world.

Collectively, international literature indicates that there are some sociodemographic variables that can affect the development of joint use practices with their children. These include the age of the children, parental education,

media use by the parents and parental beliefs linked to media use (for example, the children's benefit derived from such use, the level of skill necessary to use MDs by the parents and their children, and the dispensability of adult support in activities with MDs.) While these results are valuable for contributing to the understanding of the JME-MD phenomenon, they are linked to an Anglo-Saxon social and cultural context (Scotland, the United States, and Canada). In Chile, however, there could be cultural specificities, since parental beliefs are unique and specific in terms of time and ecological context (Lin & Li, 2019; Sigel & McGillicuddy-De Lisi, 2002). For example, studies developed with Latino parents residing in the U.S. indicate that they spent more time on JME than English-speaking Latino parents (Lee & Barron, 2015), and that more educated parents recognize the important role they play in mediating their children's use of MD through co-use (Ochoa & Reich, 2020). Therefore, it is necessary to assess whether these findings are applicable to the national reality.

Therefore, it is pertinent to ask:

Q1: Do mothers and preschool children in Chile use Joint Media Engagement instances with mobile devices (JME-MD)?

Q2: Do maternal demographic variables, media use, and beliefs relate to the reporting of JME-MD instances with preschool children?

**JME, the content has returned.**

The concept of Joint Media Engagement on Mobile Devices (JME-MD) encompasses a variety of interactions between parents and children that could influence their development in diverse ways. These interactions can range from shared the viewing streaming platforms to participating together in playful activities such as family video calls or augmented reality games outdoors (Sobel et al., 2017). Although these activities may seem similar in their execution, they

do not necessarily have the same effects on child development. In this context, Takeuchi and Stevens (2011) introduce a distinction by defining a "productive JME" as those contexts of interactions that foster a deep understanding of the shared content and contribute to the physical, emotional, and mental well-being of the participants, an aspect that has been supported by subsequent research (Ewin, Reupert, & McLean, 2021; Kuhl et al., 2019; Sheehan et al., 2019; Sobel et al., 2017; Zack & Barr, 2016). Thus, an interaction within the framework of Joint Media Engagement (JME) is considered productive when at least one of the participants gains benefits for their development and learning from the shared media event. The effectiveness of these interactions lies in the dyadic dynamics, essential to generate valuable connections, interests, and experiences, for current and future interactional context.

Under this definition, to foster a productive JME environment between parents and preschool-aged children, it is fundamental to assess two components: first, the behavior, the nature of the interaction, and the degree of involvement and commitment of both (child and adult); and second, the nature of the media content and its potential to promote or limit the development of constructive interactions. Regarding the first element, studies agree that, despite differences in methods and conceptual approaches, there is a consensus on the positive effect of parental participation characterized by warmth, sensitivity, and responsiveness, positively impacting children's cognitive and linguistic development. Conversely, hostile, controlling, or negligent attitudes during these interactions can have adverse consequences for the child (Padilla-Walker et al., 2020; Tamis-LeMonda et al., 2004), and therefore can be considered as "non-productive."

Other studies have emphasized the importance of the support that one participant offers to the other in fostering the development of the activity, following Vygotsky's (1967) theory of socio-cultural learning. In this sense, Pempek and

collaborators (2011) have shown how parental scaffolding, especially through open-ended questions and sensitive and contingent comments, can significantly enhance the child's understanding and engagement with the media activity. Adults play a crucial role in providing motivation and emotional support, whether through verbal praise (e.g. "you did very well") or affectionate gestures (e.g. like gently caressing the child's head), contributing to the intensification of the shared positive experience (Wood et al., 2016). In addition, parents can offer help in managing and supporting the device, thus providing essential physical and technical support for the interaction (Yen et al., 2018).

This review also highlights the way in which negative and frustrating interactions during shared media use can trigger a non-productive experience. These situations present themselves in various forms, including the monopolization of the device by one of the users, thus excluding the other from the shared experience (Hiniker et al., 2018; Yen et al., 2018), along with reactions of annoyance, frustration, or anger during the interaction. Such behaviors not only reduce the quality of shared time but can negatively and lastingly affect the relationship between the participants.

Moreover, research on JME indicates that patterns of parental scaffolding vary according to the purpose of the media activity. Yen et al. (2018) observed that parents from different cultures (U.S., China, and Taiwan) tend to offer differing levels of emotional support, such as hugs, high-fives, and praise, during joint MD's activities using educational and structured applications, compared to activities without specific objectives.

In summary, it is crucial to recognize that not all media interactions between parents and children have the same characteristics nor exert the same impact on children and their parents. Productive Joint Media Engagement (pJME) is distinguished by a detailed understanding of the content and achieves a positive

effect on the physical, emotional, and mental well-being of at least one of the participants (Sobel et al., 2017; Takeuchi & Stevens, 2011). This productivity is manifested in the active and committed participation of those involved, achieving intersubjectivity marked by an environment of warmth, sensitivity, and receptiveness, where the needs of both are attended to, providing affective, physical, and/or cognitive support during shared media use, without resorting to invasive or hostile interactions (Takeuchi & Stevens, 2011).

Although Joint Media Engagement on Mobile Devices (JME-MD) between parents and children holds considerable potential, research indicates that most applications and hardware are not optimally designed to promote social interaction in digital environments, complicating their joint use. For example, the study by Hiniker et al. (2018) that compared interactions between parents and children with traditional toys versus mobile devices found that dyads interacted less when using tablets compared to using toys. This study highlighted three main differences between experiences with analog media (toys, books, and television) and digital media: the portability and interaction modalities of mobile devices facilitate more individualized use by children; many applications are not designed to be used by two people, often relegating the adult to a secondary role; and applications tend to capture the child's attention exclusively, limiting their ability to interact with parents. This contrasts with traditional toys, which facilitate a more integrated and simultaneous interaction.

This scenario suggests that not all JME-MD experiences provide the same advantages, resulting in diverse experiences and, consequently, different effects on children. Therefore, it is crucial to analyze how dyads can maximize the strengths and overcome the challenges presented by applications to achieve media interaction that is enriching for both. The specific characteristics of the applications can foster or limit certain interactional dynamics, underlining the need to investigate how users can optimally utilize these tools (Stevens et al., 2008). In

this context, the need to study the impact of application features on facilitating productive JME-MD interaction arises. Therefore, an additional pilot study is proposed to determine whether JME-MD and productive JME-MD vary when using an application with design features that promote co-use versus one that does not, posing specific questions for each case study.

Thus, the following research question is posed: Q3) Are there significant differences between JME-MD and productive JME-MD when using an application that includes design features promoting co-use, compared to another that lacks these features?

## Aims

### General aims

To explore the level of use and co-use of Mobile Devices (MD) by mothers of preschool children, examining their beliefs about joint use, and analyzing how differences in the design of mobile applications (content) used in the media session affect the participation of mothers and children in Joint Media Engagement sessions on mobile devices (JME-MD).

### Specific aims

1. To describe the frequency of JME-MD instances reported by mothers of children aged 4 to 6 years.

2. To explore mothers' beliefs about the impact of MDs on their children's development and their opinions on co-use.

3. To relate maternal beliefs about the consequences of using mobile devices on child development with sociodemographic variables such as age, educational level, and individual MD use by mothers.

4. To relate maternal beliefs about joint MD use between mothers and children to sociodemographic variables such as age, educational level, and individual MD use by mothers.

5. To compare the occurrence of productive JME in joint use sessions with content that promotes JME versus an application that does not promote such use.

6. To explore how mother-child dyads optimize joint use sessions to enhance the productivity of these encounters.

## Hypothesis

1. The frequency of JME-MD sessions between mothers and preschool children will be related to the demographic variables of the mother, including her age, educational level, and personal use of MDs.
    a. The age of the mothers will be significantly related to self-reported joint use, however, the evidence reviewed does not allow for establishing a directional hypothesis.
    b. There is a positive correlation between the educational level of mothers and the likelihood of using MDs jointly with their children, such that a highest educational level of mothers corresponds to a higher frequency of joint use.
2. Maternal beliefs related to the use of MDs, the impact of this use on child development, and the joint use of these devices, will be related to the use of MDs by the children.
    a. It is expected that mothers who hold beliefs about a positive impact of MD use on child development will report a higher frequency of JME-MD.
3. It is expected that dyads using an application whose content promotes JME-MD will more frequently experience joint use events and for more extended periods of time than when using an application that does not have such design properties.

## Study 1

### Participants

The present study adopted a convenience sampling strategy, focusing exclusively on women over 18 years old, who are mothers of at least one child within the age range of 4 to 6 years. For those participants who reported having more than one child in this age range, the selection criterion established was to choose the child whose name came first alphabetically.

From an initial set of 634 potential participants, the effective participation of 405 mothers was achieved, whose cases were considered valid for subsequent analysis. The variation observed between the initial number of mothers contacted and the effective participants is attributed to differences in the recruitment sources used, as well as the specific inclusion criteria of the study.

The inclusion criteria require that the mothers be over 18 years old, with at least one child aged between 4 and 6 years, who have previously used an MD. As an exclusion criterion, a diagnosis of special educational needs in the case of the child was considered.

*Demographic Profile of the Sample*

The participating mothers have an average age of 35.26 years (SD = 5.52 years). Concerning marital status, the majority (76.0%) of the participants were in a committed relationship, either through marriage, civil union, or cohabitation, followed by 19.0% who identified as single. A smaller proportion was distributed among divorced (4.4%) and widowed (0.2%) participants. From an educational perspective, it was observed that 44.7% of the participants had not completed university studies, while 12.2% had obtained a university degree, and 17.6% had reached master's or doctoral levels. Additionally, 4.2% of the mothers did not complete mandatory education, and 11.9% had full technical training.

*Availability and Use of Mobile Devices*

More than half of the participating mothers (52.6%) had only a smartphone, while a close 47.4% owned both a smartphone and a tablet. Additionally, a large majority (75.6%) indicated that they had downloaded applications designed for their children's use.

*Characteristics of the Children*

The sample is composed of 49% girls. The average age is 5.20 years (SD = 0.80 years). According to the information provided, the age distribution is mainly concentrated on 6-year-olds (44.2%), followed by those aged 5 (32.1%) and 4 years (23.7%).

**Procedure**

*Recruitment sources and data collection*

The recruitment and data collection process in this study was characterized by its diversity of sources and methods. The dissemination strategy ranged from social media advertisements to active community engagement associated with the Children's Library at the Public Library of Santiago (Biblioteca de Santiago), which contributed 54.6% of the participants. For data collection via social networks and other digital platforms, online questionnaires were administered, which were conducted between August 2019 and April 2021 through SurveyMonkey, representing 20% of the sample. Additionally, the company NETQUEST facilitated the distribution of the survey through its user panel, using its own server during April and May of 2021, which accounted for 25.4% of the total sample.

Before participating in the study, all mothers digitally provided their informed consent. It took each participant approximately 20 minutes to complete

the questionnaire. It is important to emphasize that the entire data collection process was previously evaluated and approved by the Ethics Committee of the Universidad del Desarrollo, thus ensuring adherence to current ethical standards. A copy of this consent is available in Annex A.

**Data Analysis**

For the processing and analysis of the information collected in this research, a combination of advanced statistical programs was used: IBM SPSS (version 22.0.0), JAMOVI (version 1.6.23), R (version 4.3.3), and MPLUS (version 8.10). Before proceeding with the specific analyses aimed at testing the hypotheses raised, exploratory factor analyses (EFA) were conducted on the items of two scales designed ad hoc for the study, named "Beliefs about the Use of Mobile Devices in Child Development (BMD-CD)" and "Beliefs about Joint Media engagement on mobile devices (BJME-MD)."

The methodology for the factor analysis included the application of the Kaiser-Meyer-Olkin (KMO) criteria and Bartlett's Test of Sphericity. The choice of the optimal number of factors was based on the analysis of the scree plot and the Minimum Average Partial (MAP) Test, opting for the WLSMV estimation method due to the non-normal nature of the item distribution. The guidelines proposed by Netemeyer, Bearden, and Sharma (2003) for factor selection were followed, requiring that each factor be defined by at least two items and discarding those items that showed significant loadings on multiple factors. Factor loadings were considered relevant starting from a threshold of 0.4, in line with the recommendations by Pett et al. (2003).

The analysis process explored various factorial configurations by applying oblique rotation techniques, aiming to achieve a solution that was both parsimonious and conceptually coherent, following the guidelines set by Sass and Schmitt (2010).

The percentage of missing data across the various variables ranges from 0 to 30%. In total, 257 out of 405 records (63.46%) were incomplete. The analysis of dropout patterns indicated that younger mothers and those who use MDs individually for less time had a higher likelihood of missing data in the belief items, while those who use MDs individually for longer periods and those who co-use MDs with their children for extended periods had a higher probability of omitting the “child’s sex” variable.

Given the high number of missing responses, the multiple imputation procedure was used to address the study's objectives. One hundred complete data sets were imputed using the default model of the SPSS software (Yuan, 2011). Descriptive analyses of the data (in percentages) were conducted, bivariate correlations were estimated, and multiple regression models were calculated.

In the case of multiple regression, a stepwise regression model was used to account for the predictors of joint usage time. In the first step, control variables were entered; in the second step, beliefs about the consequences for child development of using mobile devices (BMDCD) were included; and in the third and final step, beliefs related to joint use (BJME-MD) were added. This last model was used to account for the predictors of the frequency of joint use in different types of activities (content). The results of the combined model are presented, which include a) the unstandardized coefficients provided by the SPSS software, b) the combined R2 values, obtained as an average of the values from each imputed sample. No transformations were made given that the sample size was larger than N=200 (Enders, 2010), and c) the combined F value was estimated using the *“micombine.F”* command from the *“miceadds library”* (v.3,1744) for the R statistical package.

## Instruments

To examine the temporal patterns and frequency of mobile device use both individually by mothers and in shared activities with their children, as well as mothers' beliefs about the use of MDs and child development, and beliefs related to dyadic use, four questionnaires were specifically designed for this research.

*Sociodemographic Data*

The questionnaire consists of 10 questions focused on obtaining information about the age, marital status, and educational level of the participating mother, as well as the first name and date of birth of her child. It also inquires whether the child has used mobile devices (MD) or has a diagnosis of Exceptional Needs (EN), with the aim of meeting the inclusion criteria of our sample. This questionnaire is available in Annex B.

*Use of MDs within the Family Context (MDFC)*

To assess the use of MD within the family context, a set of specific questions aimed at mothers was designed. This approach aimed to gather detailed information about three different variables: the individual use by the mothers, the individual use by their children, and the joint use of MD. Mothers were asked to provide estimates of the time spent daily on each of these usage modalities, expressing their answers in minutes. From these daily estimates, a weighted weekly average for each mode of use was calculated. The calculation was based on the sum of the average minutes spent during weekdays, multiplied by five, plus the average minutes used during weekends, multiplied by two, following the methodology previously implemented by Rideout and Hamel (2006) and Arundell et al. (2020).

Additionally, to gain a more detailed perspective on usage patterns, mothers were asked to indicate the predominant time slots for their use of devices,

as well as for their children's use and for joint use. For this purpose, six time slots were offered, ranging from "before 09:00 hours" to "after 21:00 hours," adapting the methodological approach established by Marsh et al. (2015).

Another dimension addressed in the joint use was the specific activity carried out. For this purpose, nine items were created with the goal of identifying the most frequent media use practices among mothers and children. These activities included listening to music, watching videos, reading digital content, managing, and reviewing photographs, using both entertainment and educational apps, browsing social networks, and making video calls and phone calls. Using a five-point Likert scale, where the value 1 means 'Never' and 5 'Frequently', mothers assessed the frequency of each of these activities performed in the company of their children.

The MDFC questionnaire can be viewed in detail in Annex C.

*Beliefs regarding the implications of mobile device usage on child development (BMD-CD)*

To understand maternal beliefs regarding the impact of MD on children, participants were asked to express their opinions on how they believe the use of mobile phones and tablets affects their children's development. This approach is inspired by the study of Rideout and Robb (2017), covering a wide range of child development domains, with the goal of exploring maternal perceptions related both to the potential benefits and the possible harms arising from the use of these technologies (See MD-CD questionnaire in Appendix D). The development domains considered include a variety of aspects such as gross motor skills, literacy, mathematical competencies, language, scientific and social skills, emotional regulation, attention, hand-eye coordination, problem-solving, and artistic abilities. Mothers assessed the impact of mobile devices on these domains

using a Likert scale ranging from 1 (Very Negative) to 5 (Very Positive). The descriptive results of each item are presented in Table 1.

*Table 1. Descriptive Measures and Central Tendency, BMD-CD questionnaire*

| Development domain | M | SD | Min | Max | Skewness | Kurtosis |
|---|---|---|---|---|---|---|
| 41 - Gross Motor | 2.1 | 1.062 | 1 | 5 | 0.630 | -0.306 |
| 42 - Reading skills | 3.4 | 1.114 | 1 | 5 | -0.573 | -0.341 |
| 43 - Mathematical skills | 3.44 | 1.094 | 1 | 5 | -0.637 | -0.105 |
| 44 - Language skills | 3.54 | 1.097 | 1 | 5 | -0.833 | 0.098 |
| 45 - Scientific skills | 3.53 | 1.125 | 1 | 5 | -0.773 | -0.023 |
| 46 – Social skills | 2.36 | 1.212 | 1 | 5 | 0.382 | -0.94 |
| 47 - Emotional Regulation skills | 1.98 | 1.073 | 1 | 5 | 0.782 | -0.46 |
| 48 - Attention | 2.44 | 1.145 | 1 | 5 | 0.333 | -0.80 |
| 49 - Hand-eye coordination | 3.36 | 1.248 | 1 | 5 | -0.601 | -0.615 |
| 50 - Problem-solving skills | 3.06 | 1.146 | 1 | 5 | -0.295 | -0.712 |
| 51 - Artistic Skills | 2.61 | 1.276 | 1 | 5 | 0.254 | -1.056 |

*Note. N = 405*

An exploratory factor analysis (EFA) was conducted on the items. Initially. statistics supporting the suitability of factor analysis were calculated. The Kaiser-Meyer-Olkin index reached a value of 0.899. considered excellent by Hair et al. (2005) and Pardo and Ruiz (2002). Bartlett's test of sphericity indicated significant correlations between the items ($\chi^2$ (55) = 1869.25, $p$ < .001). To define the appropriate number of factors, the screetest and MAP methods recommended by O'Connor (2000) were applied, yielding values that suggest a two-factor structure. Based on these findings, a two-factor configuration allowing correlations between them was estimated, using a CF-QUARTIMAX rotation. The estimation method used was Principal Axis Factoring. During the first iteration, items 49, 50, and 51 (hand-eye coordination, problem-solving, and artistic skills) were excluded as they showed factorial loadings on multiple factors.

The final factor structure, illustrated in Table 2, consists of two factors. The first factor, comprising four items and labeled as "Academic Development Domain" accounts for maternal beliefs about the impact that the use of mobile devices has on the advancement of fundamental academic skills, such as literacy, and mathematical and scientific competencies. The second factor, consisting of five items and labeled as "Life Skills Development Domain," groups maternal beliefs about how these devices affect the development of essential day-to-day capabilities, including emotional regulation and social skills, attention, and the promotion of artistic and motor skills. A significant correlation was recorded between the two factors ($r = 0.676$, $p < .05$).

Additionally, the internal consistency of the items belonging to each factor was measured, revealing a Cronbach's alpha coefficient of 0.904 for the first factor and 0.844 for the second, with a sample of 405 participants in both cases. These coefficients reflect "very good" and "excellent" reliability for the first and second factors respectively, according to the criteria established by Hair et al. (2005).

*Table 2. Factor Loadings from the EFA*
*"Beliefs about the use of MD in Child Development (BMD-CD)*

| Items | Academic development | Life Skills Development |
|---|---|---|
| 43 – Mathematical skills | .981 | |
| 42 – Reading skills | .893 | |
| 44 – Language skills | .812 | |
| 45 – Scientific skills | .737 | |
| 47 – Emotional Regulation skills | | .962 |
| 46 – Social skills | | .809 |
| 48 – Attention | | .666 |
| 51 – Artistic Skills | | .633 |
| 41 – Gross Motor | | .543 |

*Note. N=405*

*Beliefs about JME on mobile devices (BJME- MD)*

The "Beliefs about JME on mobile devices (BJME-MD)" questionnaire was developed with the aim of deeply exploring maternal beliefs regarding the shared use of mobile devices with their children. Designed exclusively for this study, it originally consisted of a set of 47 items, organized around eight key domains that addressed various aspects of joint use of mobile devices: (1) *Mobile Device Characteristics*, which contemplate technical aspects and usability; (2) *Media Co-Use Competencies and Familiarity*, which refers to the skills necessary for effective and safe use; (3) *Negative consequences of child use*, referring to the risk of addiction, perceived innate children's digital skills and unintentional parental promotion of excessive screen use. (4) J*oint Digital Proficiency*, which evaluates beliefs about familiarity with mobile devices by mothers and children; (5) *Devices and parenting*, addressing how these devices affect family and educational dynamics; (6) *Joint media space*, investigating perceptions about the benefits of digital dyadic play in the mother-child relationship; (7) *Technological Future*, exploring the relevance of children's early familiarization with technology for their long-term success; and (8) *Maternal mediation*, deepening perceptions related to fostering learning, entertainment and parental supervision through the mother's involvement. (see Table 3). The response questionnaire measures the degree of agreement or disagreement of the participants with each statement on a 5-point Likert scale, where 1 means "Disagree" and 5 "Agree."

To ensure the content validity of the items, a panel of experts was assembled, consisting of five psychologists specializing in child development, play, media use in childhood, and research methodology. These professionals proposed modifications to the wording of the items to clarify their understanding, such as replacing the expression "they are used so easily" with "they are so easy to use," and deleting redundant items, for example, "I believe that my child is more skilled at using a mobile device, compared to other children of their age" and "I

believe that my child has a greater ability to use a mobile device than other children of their age." In addition, five cognitive interviews were conducted, applying "thinking aloud" and "verbal exploration" techniques (Sánchez et al., 2024). This approach facilitated the identification of potential obstacles in the presentation of the items and allowed the average response time to be estimated.

*Table 3. Original domains of the questionnaire Parental Beliefs on Joint Media Engagement on mobile devices*

| N | Domain | Description | Items | Example |
|---|---|---|---|---|
| 1 | Mobile Device Characteristics (8 items) | Technical aspects and ease of use. | 64, 65, 70, 71, 75, 79, 89 and 95 | 64. Mobile devices are so attractive to children that when they use them, they don't pay attention to what's happening around them. |
| 2 | Media Co-Use Competencies and Familiarity (6 items) | Competencies required for effective and safe joint media engagement. | 52, 61, 62, 80 and 82 | 62. I believe [Q04] is more skilled at using a mobile device compared to other children his/her age |
| 3 | Negative Consequences of Child Use (9 items) | Device addiction, children's innate digital skills, and parental concerns about device consumption. | 68, 76, 81 and 85 | 76. I believe children can become addicted to using mobile devices. |
| 4 | Joint Digital Proficiency (6 items) | Perceptions of mothers' and children's familiarity with devices. | 54, 58, 77, 78, 93 and 96 | 54. Children the age of [Q04] learn to use mobile devices on their own (they don't need someone like me to teach them). |
| 5 | Devices and Parenting (10 items) | Influence of devices on family dynamics. | 53, 55, 56, 57, 59, 60, 67, 69, 72 and 73 | 73. I believe mobile devices are a good option for entertaining [Q04] when I'm busy. |
| 6 | Joint Media Space (7 items) | Impact of digital dyadic play on the parents-child relationship. | 83, 88, 90, 91, 92, 94 and 98 | 83. When mothers and children use a mobile device together, it fosters a better relationship between them |
| 7 | Technological Future (3 items) | Early familiarization of children with digital technologies for long-term success. | 63, 66 and 74 | 63. Tomorrow everything will be digital and technological, so mothers should encourage their children to learn to use technologies like mobile devices. |
| 8 | Maternal Mediation (4 items) | Fostering learning, entertainment, and parental supervision through active maternal involvement. | 84, 86, 87 and 97 | 86. Children learn better when they use a mobile device together with their mother than when they use it alone. |

Note. The full list of items is presented in Appendix E.

The descriptive analyses corresponding to the 47 items, which include measures of central tendency and dispersion, are presented in Table 4.

The Kaiser-Meyer-Olkin (KMO) index, with a value of 0.983, and Bartlett's Test of Sphericity, which yielded a $\chi^2$ (1035) = 88197 with $p < .001$, confirm the suitability for conducting an Exploratory Factor Analysis (EFA). To determine the number of factors to examine, the screetest and Parallel Analysis methods were used, both of which indicated the presence of three factors. Considering the skewness and kurtosis values in various items, a marked deviation from normality was noted, as well as the identification of items with floor and ceiling effects, and bimodal distributions, the Weighted Least Squares Mean and Variance adjusted (WLSMV) estimation method was chosen for the factor analysis, with oblique rotation (CF-QUARTIMAX) being performed.

During the first iteration, 2 items were eliminated due to problems of cross-loading (items 59 and 72) and 12 items for having factor loadings below .4 (items 53, 60, 64, 64, 65, 67, 69, 71, 78, 86, 87, 93 and 94). The second iteration eliminated 10 items (2 for cross-loading 58 and 85; 8 for low loadings 61, 76, 80, 81, 82, 83, 84 and 97). The third iteration eliminated items 52 and 92 due to low loadings. As a result of this purification process, the definitive factor solution emerged with 3 factors, composed of 21 items, whose factor loadings ranged between .429 and .855, as shown in Table 5. Factors 1 and 2 are significantly related ($r = .37$, $p < .05$), as are factors 1 and 3 ($r = .12$, $p < .05$) although to a lesser magnitude. Factors 1 and 3 do not present a statistically significant relationship ($r = .05$, $p > .05$).

*Table 4. Descriptive analyses and measures of central tendency Parental Beliefs about Joint Media Engagement on MD (BJME-MD)*

| Item | Statement | N | Min | Max | Mean | Sd | Skew. | Kurt. |
|---|---|---|---|---|---|---|---|---|
| 52 | I think [Q04][2] feels comfortable and confident using a mobile device. | 400 | 1 | 5 | 3.91 | 1.08 | -0.92 | 0.41 |
| 53 | One way to punish children when they behave inappropriately is to suspend their use of mobile devices. | 401 | 1 | 5 | 3.34 | 1.47 | -0.41 | -1.16 |
| 54 | Children the age of [Q04] learn to use mobile devices on their own (they don't need someone like me to teach them). | 401 | 1 | 5 | 2.99 | 1.54 | -0.06 | -1.49 |
| 55 | Mobile devices allow me to easily entertain my child. | 401 | 1 | 5 | 3.62 | 1.30 | -0.82 | -0.37 |
| 56 | I believe we mothers can have time to do other activities while our children use mobile devices. | 401 | 1 | 5 | 3.35 | 1.43 | -0.49 | -1.08 |
| 57 | Mobile devices are useful for mothers because they contain educational activities and content for [Q04]. | 401 | 1 | 5 | 3.29 | 1.25 | -0.53 | -0.70 |
| 58 | I believe children benefit from their mother's (or another adult's) support when using (or learning to use) an app on a mobile device for the first time | 401 | 1 | 5 | 3.74 | 1.19 | -0.74 | -0.23 |
| 59 | Mobile devices allow me to calm [Q04] when he/she is agitated or upset. | 401 | 1 | 5 | 1.93 | 1.27 | 1.02 | -0.32 |
| 60 | A problem with mobile devices is limiting the amount of time children use them | 401 | 1 | 5 | 3.55 | 1.46 | -0.64 | -0.95 |
| 61 | I feel comfortable and confident using smartphones and tablets. | 401 | 1 | 5 | 3.37 | 1.35 | -0.42 | -0.92 |
| 62 | I believe [Q04] is more skilled at using a mobile device compared to other children his/her age | 400 | 1 | 5 | 2.69 | 1.19 | 0.01 | -0.77 |
| 63 | Tomorrow everything will be digital and technological, so mothers should encourage their children to learn to use technologies like mobile devices. | 401 | 1 | 5 | 2.79 | 1.28 | -0.06 | -1.10 |

[2] [Q04] represents the name of the child referred to by the mother.

*Table 4. (continue) Descriptive analyses and measures of central tendency Parental Beliefs about Joint Media Engagement on MD (BJME-MD)*

| Item | Statement | N | Min | Max | Mean | Sd | Skew, | Kurt. |
|---|---|---|---|---|---|---|---|---|
| 64 | Mobile devices are so attractive to children that when they use them, they don't pay attention to what's happening around them. | 396 | 1 | 5 | 4.21 | 1.10 | -1.46 | 1.41 |
| 65 | Mobile devices teach children things without moms having to intervene. | 396 | 1 | 5 | 2.23 | 1.28 | 0.62 | -0.87 |
| 66 | I believe children of [Q04]'s age should use mobile devices because that experience will help them get better jobs in the future. | 395 | 1 | 5 | 1.87 | 1.07 | 0.90 | -0.13 |
| 67 | When [Q04] uses a smartphone/tablet, he/she doesn't pay attention when I talk to him/her. | 396 | 1 | 5 | 3.42 | 1.33 | -0.44 | -0.96 |
| 68 | I believe children the age of [Q04] have a good balance between the time they spend using mobile devices and doing other activities. | 396 | 1 | 5 | 2.30 | 1.35 | 0.63 | -0.88 |
| 69 | Controlling the time children use mobile devices is a tool for making them behave appropriately. | 396 | 1 | 5 | 3.55 | 1.40 | -0.65 | -0.77 |
| 70 | A benefit of mobile devices is that they correct or reward [Q04] according to what he/she does on the screen. | 396 | 1 | 5 | 2.12 | 1.19 | 0.57 | -0.86 |
| 71 | When a child doesn't know how to do something on a mobile device, the app itself provides help and shows how it's done. | 395 | 1 | 5 | 2.84 | 1.21 | -0.17 | -0.91 |
| 72 | At the end of the day, mobile devices are just another problem in the mother-child relationship | 395 | 1 | 5 | 3.17 | 1.35 | -0.25 | -1.03 |
| 73 | I believe mobile devices are a good option for entertaining [Q04] when I'm busy. | 396 | 1 | 5 | 3.15 | 1.39 | -0.37 | -1.16 |
| 74 | Nowadays, a child who knows how to use mobile devices will have better grades in the future than those who don't know how to use them | 396 | 1 | 5 | 1.93 | 1.09 | 0.78 | -0.50 |
| 75 | Mobile devices are so easy to use that children don't need their mothers' help to use them. | 396 | 1 | 5 | 2.74 | 1.41 | 0.19 | -1.30 |
| 76 | I believe children can become addicted to using mobile devices. | 396 | 1 | 5 | 4.70 | 0.66 | -2.74 | 8.78 |

*Table 4. (continue) Descriptive analyses and measures of central tendency Parental Beliefs about Joint Media Engagement on MD (BJME-MD)*

| Item | Statement | N | Min | Max | Mean | Sd | Skew. | Kurt. |
|---|---|---|---|---|---|---|---|---|
| 77 | Children of [Q04]'s age know how to use mobile devices much better than their mothers | 396 | 1 | 5 | 3.00 | 1.35 | -0.13 | -1.14 |
| 78 | I find it easier to use a mobile device than other mothers my age. | 396 | 1 | 5 | 3.31 | 1.24 | -0.28 | -0.67 |
| 79 | I believe [Q04] knows more or has greater skills than I do in using a mobile device. | 286 | 1 | 5 | 2.82 | 1.40 | 0.12 | -1.24 |
| 80 | I believe children stop engaging in other more beneficial activities for their development because they are using mobile devices | 396 | 1 | 5 | 2.85 | 1.57 | 0.11 | -1.49 |
| 81 | Children the age of [Q04] know how to use mobile devices because they have grown up surrounded by this technology. | 396 | 1 | 5 | 3.64 | 1.22 | -0.66 | 2.27 |
| 82 | I believe that mobile devices are designed to be used by only one person at a time. | 396 | 1 | 5 | 3.64 | 1.22 | -0.66 | -0.42 |
| 83 | When mothers and children use a mobile device together, it fosters a better relationship between them | 279 | 1 | 5 | 3.06 | 1.26 | -0.30 | -0.85 |
| 84 | While mother and child use a mobile device together, mothers can be attentive to the child not damaging the device. | 281 | 1 | 5 | 3.54 | 1.23 | -0.66 | -0.36 |
| 85 | I believe that when mother and child use a mobile device together, it's as if the mother is encouraging the child to spend more time in front of the device. | 281 | 1 | 5 | 3.12 | 0.13 | -0.30 | -1.09 |
| 86 | Children learn better when they use a mobile device together with their mother than when they use it alone. | 281 | 1 | 5 | 3.75 | 1.11 | -0.66 | 0.14 |
| 87 | Children are more entertained when they use a mobile device with their mothers than when they use it alone. | 281 | 1 | 5 | 3.21 | 1.19 | -0.08 | -0.54 |
| 88 | I wouldn't know what to do if [Q04] asked me to use a mobile device together with him/her. | 281 | 1 | 5 | 1.69 | 0.99 | 1.34 | 1.04 |
| 89 | I believe there are no attractive apps for mothers and children to use together. | 281 | 1 | 5 | 2.52 | 1.35 | 0.33 | -1.10 |

*Table 4. (continue) Descriptive analyses and measures of central tendency Parental Beliefs about Joint Media Engagement on MD (BJME-MD)*

| Item | Statement | N | Min | Max | Mean | Sd | Skew. | Kurt. |
|---|---|---|---|---|---|---|---|---|
| 90 | I prefer that [Q04] share other activities with me rather than using mobile devices together. | 281 | 1 | 5 | 4.38 | 0.96 | -1.66 | 2.45 |
| 91 | I think [Q04] prefers to use a mobile device alone rather than using it with me. | 281 | 1 | 5 | 2.95 | 1.37 | 0.03 | -1.14 |
| 92 | When [Q04] asks me to use a mobile device together, it's because he/she wants to share something with me. | 281 | 1 | 5 | 3.93 | 1.19 | -1.04 | 0.31 |
| 93 | I would not feel comfortable if [Q04] taught me 'how to do something' on a mobile device. | 281 | 1 | 5 | 1.90 | 1.23 | 1.18 | 0.31 |
| 94 | I find it boring to use a mobile device together with [Q04]. | 281 | 1 | 5 | 2.44 | 1.37 | 0.50 | -0.93 |
| 95 | The way mobile devices are used makes it difficult for two people to see what is happening on the screen at the same time. | 281 | 1 | 5 | 3.03 | 1.35 | -0.13 | -1.09 |
| 96 | Mothers should be much more familiar with mobile devices, so they can use them together with their children. | 281 | 1 | 5 | 3.35 | 1.29 | -0.36 | -0.80 |
| 97 | A positive aspect of using a mobile device together with [Q04] is that it allows me to supervise that he/she does not access inappropriate content. | 281 | 1 | 5 | 4.63 | 0.75 | -2.50 | 7.10 |
| 98 | One way to share a moment with our children is to use mobile devices together. | 281 | 1 | 5 | 2.91 | 1.47 | 0.02 | -1.36 |

The analysis identified three key factors in maternal beliefs about shared use of mobile devices with their children (Table 5). The first factor, called "*I believe mobile devices are useful to me when I need to distract my child*", encompasses maternal beliefs about the usefulness of devices to provide entertainment for children, allowing mothers to have time for other activities. The following items make up this factor: (55) Mobile devices allow me to easily entertain my child, (56) I believe we mothers can have time to do other activities while our children use mobile devices, (73) I believe mobile devices are a good option for entertaining [Q04] when I'm busy.

The second factor, "*I believe that my child and I are part of a digital future*" (Table 5), captures maternal beliefs about the benefits of technology use for children's future employment prospects, (66. I believe children of [Q04]'s age should use mobile devices because that experience will help them get better jobs in the future"), and how mobile devices can be tools to strengthen the interaction and bond between mothers and children (90, Reverse-coded item, "I prefer that [Q04] share other activities with me instead of using mobile devices together[3]"; and 98, "One way to share a moment with our children is to use mobile devices together"). Additionally, it includes maternal views of children as competent in managing technology. In addition, includes mothers' views of children as competent in their use of technology (62, I believe [Q04] is more skilled at using a mobile device compared to other children his/her age; 68, I believe children the age of [Q04] have a good balance between the time they spend using mobile devices and doing other activities)

[3] Item 90 loads negatively, so the semantic interpretation would be "I prefer my child to share mobile devices with me, rather than engaging in other activities together.

The third and final factor, labeled "*I believe the digital gap is so wide that I feel excluded from this experience*", reflects the perceived difficulties in engaging in co-use media, such as the belief that it would be a boring and unnecessary activity given the assumed higher level of mastery children have over adults in digital use (e.g., “75. Mobile devices are so easy to use that children don't need their mothers' help to use them.”, and “79. “I believe [Q04] knows more or has greater skills than I do in using a mobile device.”), that children do not require assistance to use the devices, and children's preference for using the devices independently (e.g., “91, I think [Q04] prefers to use a mobile device alone rather than using it with me”). Additionally, beliefs about the physical or software characteristics that complicate co-use are included here (e.g., “95. The way mobile devices are used makes it difficult for two people to see what is happening on the screen at the same time; and 89. I believe there are no attractive apps for mothers and children to use together.).

The internal consistency of the factors, assessed using Cronbach's alpha, shows good internal cohesion: the first factor records an α = .797, the second an α = .769, and the third an α = .744 (N= 193).

*Table 5. Factor Loadings from the EFA for the Parental Beliefs about Joint Media Engagement on MD (BJME-MD)*

| N | Statement | Domain | F1 | F2 | F3 |
|---|---|---|---|---|---|
| 55 | Mobile devices allow me to easily entertain my child | Devices and Parenting | 0.855* | | |
| 56 | I believe we mothers can have time to do other activities while our children use mobile devices | Devices and Parenting | 0.786* | | |
| 73 | I believe mobile devices are a good option for entertaining [Q04] when I'm busy | Devices and Parenting | 0.653* | | |

*Table 5. (continue) Factor Loadings from the EFA for the Parental Beliefs about Joint Media Engagement on MD (BJME-MD)*

| N | Statement | Domain | F1 | F2 | F3 |
|---|---|---|---|---|---|
| 66 | I believe children of [Q04]'s age should use mobile devices because that experience will help them get better jobs in the future. | Technological Future | | 0.888* | |
| 74 | Nowadays, a child who knows how to use mobile devices will have better grades in the future than those who don't know how to use them | Technological Future | | 0.808* | |
| 63 | Tomorrow everything will be digital and technological, so mothers should encourage their children to learn to use technologies like mobile devices | Technological Future | | 0.754* | |
| 70 | A benefit of mobile devices is that they correct or reward [Q04] according to what he/she does on the screen | Mobile Device Characteristics | | 0.607* | |
| 62 | I believe [Q04] is more skilled at using a mobile device compared to other children his/her age | Media Co-Use Competencies and Familiarity | | 0.588* | |
| 57 | Mobile devices are useful for mothers because they contain educational activities and content for [Q04] | Devices and Parenting | | 0.530* | |
| 68 | I believe children the age of [Q04] have a good balance between the time they spend using mobile devices and doing other activities. | Media Co-Use Competencies and Familiarity | | 0.524* | |
| 90 | I prefer that [Q04] share other activities with me rather than using mobile devices together | Joint Digital Proficiency | | -0.487* | |
| 98 | One way to share a moment with our children is to use mobile devices together. | Joint Digital Proficiency | | 0.449* | |

*Table 5. (continue) Factor Loadings from the EFA for the Parental Beliefs about Joint Media Engagement on MD (BJME-MD)*

| N | Statement | Domain | F1 | F2 | F3 |
|---|---|---|---|---|---|
| 95 | The way mobile devices are used makes it difficult for two people to see what is happening on the screen at the same time. | Mobile Device Characteristics | | | 0.785* |
| 96 | Mothers should be much more familiar with mobile devices, so they can use them together with their children. | Media Co-Use Competencies and Familiarity | | | 0.676* |
| 54 | Children the age of [Q04] learn to use mobile devices on their own (they don't need someone like me to teach them) | Joint Digital Proficiency | | | 0.660* |
| 75 | Mobile devices are so easy to use that children don't need their mothers' help to use them | Mobile Device Characteristics | | | 0.618* |
| 79 | I believe [Q04] knows more or has greater skills than I do in using a mobile device. | Mobile Device Characteristics | | | 0.521* |
| 89 | I believe there are no attractive apps for mothers and children to use together. | Mobile Device Characteristics | | | 0.497* |
| 77 | Children of [Q04]'s age know how to use mobile devices much better than their mothers | Joint Digital Proficiency | | | 0.464* |
| 88 | I wouldn't know what to do if [Q04] asked me to use a mobile device together with him/her | Joint Media Space | | | 0.434* |
| 91 | I think [Q04] prefers to use a mobile device alone rather than using it with me | Joint Media Space | | | 0.429* |

*Note. N = 405. Factor loadings < .40 were omitted.*
*Note: [P04] is the name of the child inserted for the time of each participating mother's response*

## Results

### *Mobile Device Use in the Family Environment*

The distribution of mobile device use by mothers and children reveals interesting patterns throughout the day. According to the data collected (see Table 9), 42.5% of mothers are already using their devices before 09:00 hours, a marked

contrast to only 6.9% of children doing the same. This trend changes as the day progresses, especially in the afternoon between 15:00 and 18:00 hours, where 64.2% of mothers and 46.7% of children are active on their devices. Usage decreases in the later hours but remains significant, especially among mothers, whose use exceeds 50% until after 21:00 hours.

*Table 6. Percentage of individual DP use by mothers and their children*

| Time range | Mother | Child |
|---|---|---|
| Before 9:00 a.m. | 42.5% | 6.9% |
| Between 9:00 a.m. and 12:00 p.m. | 60.2% | 24.0% |
| Between 12:00 p.m. and 3:00 p.m. | 45.4% | 18.5% |
| Between 3:00 p.m. and 6:00 p.m. | 64.2% | 46.7% |
| Between 6:00 p.m. and 9:00 p.m. | 54.1% | 30.1% |
| After 9:00 p.m. | 59.5% | 10.1% |

*Note: N mothers = 405; N children = 398*

Also recorded was an estimate of individual use by the mother, the child, and JME-MD, presented in Table 7. The data are organized into categories ranging from "Does not use/do not use" to "More than 6 hours," offering estimates for weekdays and weekends for each group. Variability in usage is observed, with trends indicating a greater propensity for children to use devices for shorter periods, primarily over the weekend. Likewise, in families where mothers report lower usage (about 1 hour or less), there is a tendency to share this activity more with their children jointly. Conversely, in families where mothers report higher usage (close to or more than 3 hours), they tend to use it more individually than jointly with their children, and the individual use of both (mother and child separately) is greater than the time they spend on that activity together.

Considering the average hours of MD usage, as an indicator summarizing both weekdays and weekends for mother, child, and joint use, the results indicate that mothers use the devices independently for more hours per day (M= 3.08,

SD=1.63) than their children (M= 1.83, SD=1.51, *t*=8.30, df= 241, *p* < .001). Additionally, both mothers (*t*=10.40, df= 249, *p* < .001) and children (*t*=3.29, df= 1092, *p* < .001) use MDs independently for longer periods than those dedicated to joint use (M=1.53, SD=1.30).

*Table 7 Activities developed in JME-MD between mothers and children, expressed in percentages.*

| Estimate of Usage Hours | Mother | | Child | | JME-MD | |
|---|---|---|---|---|---|---|
| | Weekdays | Weekends | Weekdays | Weekends | Weekdays | Weekends |
| No use / do not use | 9.06% | 5.22% | 12.84% | 16.79% | 3.23% | 3.71% |
| Less than 1 hour | 6.50% | 10.73% | 22.47% | 18.52% | 36.03% | 39.93% |
| About 1 hour | 6.28% | 8.79% | 14.81% | 12.59% | 25.23% | 22.61% |
| About 2 hours | 12.60% | 18.50% | 20.49% | 20.74% | 16.08% | 15.06% |
| About 3 hours | 19.29% | 20.51% | 11.85% | 13.33% | 7.03% | 8.37% |
| About 4 hours | 19.23% | 16.61% | 9.63% | 10.12% | 5.78% | 3.82% |
| About 5 hours | 14.75% | 11.16% | 6.17% | 5.19% | 3.90% | 3.71% |
| More than 6 hours | 12.27% | 8.48% | 1.73% | 2.72% | 2.71% | 2.80% |

Regarding the activities developed by mother-child dyads in JME-MD sessions, as shown in Table 8, mothers reported a varied distribution in the frequency of joint use of different digital activities. Watching videos (42.2%) and listening to music (33.8%) together are the most popular activities, followed by making video calls. On the other hand, joint participation in activities like reading on digital supports and playing in game apps is less frequent, with 38.4% and

38.9% of participants indicating that they never participate in these activities, respectively. This trend extends to learning apps and the use of social networks, where a significant proportion of respondents also indicates sporadic participation.

*Table 8. Activities developed in JME-MD between mothers and children, expressed in percentages.*

| Activities | Never | Rarely | Sometimes | Often | Frequently |
|---|---|---|---|---|---|
| Listen to music | 9.4% | 25.3% | 31.5% | 23.1% | 10.7% |
| Watch videos | 8.4% | 18.0% | 31.4% | 27.9% | 14.3% |
| Read on digital support | 38.4% | 20.5% | 21.3% | 12.6% | 7.2% |
| Use or take photos | 17.8% | 32.6% | 25.7% | 15.6% | 8.4% |
| Play in a game app | 38.9% | 22.8% | 21.5% | 12.6% | 4.2% |
| Play in a learning app | 27.9% | 23.1% | 24.9% | 14.9% | 9.2% |
| Use social networks | 27.9% | 24.2% | 24.7% | 14.8% | 8.4% |
| Make video calls | 11.2% | 26.4% | 30.3% | 20.1% | 11.9% |
| Make phone calls | 15.3% | 31.2% | 30.7% | 14.6% | 8.2% |

*Note: N mothers = 405*

*Parental Beliefs about Device Use.*

Mothers believe that MDs have more positive consequences for academic development than for cultivating life skills. Additionally, they are more inclined to believe that MDs are useful for distracting their children than to consider their use as relevant given the projection of a technological future (Table 9).

*Table 9. Means and standard deviations for the MD-CD and JMEB questionaries.*

| | Mean | SD |
|---|---|---|
| **Beliefs about the consequences of mobile devices** | | |
| Academic Development Domain | 3.48[a1] | .98 |
| Life Skills Development Domain | 2.30[b1] | .91 |
| | | |
| **Beliefs About Joint Use** | | |
| I believe mobile devices are useful to me when I need to distract my child | 3.37[a2] | 1,16 |
| I believe that my child and I are part of a digital future | 2.69[b2] | 0,70 |
| I believe the digital gap is so wide that I feel excluded from this experience | 2.80[c2] | 0,76 |

*Note*. Different superscripts indicate significant differences $p < .05$

*Predictors of Joint Media Engagement on Mobile Devices (JME-MD)*

To progress towards the second objective of the study, correlation analyses and regression models were implemented.

The correlations (see Table 10) indicate that younger mothers tend to make more intensive use of these devices, both individually and dyadically (JME-MD). Additionally, there is a moderate positive relationship between the use of mobile devices by mothers and their use by their children, indicating that greater maternal use is associated with an increase in use by the children, as well as more joint use. However, the age of the mother is not associated with maternal beliefs.

The correlations indicate that younger mothers tend to make more intensive use of these devices, both individually and dyadically (JME-MD). Additionally, there is a moderate positive relationship between mothers' use of MDs and their children's use, indicating that greater maternal MD use is associated with increased use by children, as well as increased joint use. In contrast, mothers' ages are not associated with maternal beliefs (contrasted with 12 or fewer years of maternal education).

*Table 10. Correlations of variables related to joint engagement with mobile devices (JME-MD)*

| N | Variables | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Mother's age | 0.03 | .124* | -0.03 | 0.04 | -.147* | -.131*** | -.148*** | -0.01 | -0.08 | -0.05 | -0.09 | 0.02 |
| 2 | Child's gender | 1 | -0.07 | 0.06 | -0.02 | 0.04 | -0.1 | -0.08 | -0.08 | 0.02 | 0.05 | -0.01 | 0.02 |
| 3 | Child's age | | 1 | 0.07 | -0.06 | -0.02 | .193*** | -0.03 | 0.09 | 0.04 | 0.04 | .123* | 0.12 |
| 4 | Technical maternal education | | | 1 | -.898** | -0.02 | 0.02 | 0.06 | 0.04 | 0.07 | 0.04 | 0.1 | .134* |
| 5 | University or higher maternal education | | | | 1 | 0.02 | -0.06 | -0.09 | -0.09 | -.121* | -0.02 | -.124* | -.150** |
| 6 | Mothers' MD use | | | | | 1 | .311** | .215** | .197** | .174** | 0.1 | .194** | 0.12 |
| 7 | Children's' MD use | | | | | | 1 | .403** | .398** | .345** | .358** | .445** | .157** |
| 8 | JME-MD mother-child use | | | | | | | 1 | .169* | .264** | 0.07 | .211** | 0.07 |
| 9 | BMD-CD Academic Development Domain | | | | | | | | 1 | .617** | .358** | .544** | 0.02 |
| 10 | BMD-CD Life Skills Development Domain | | | | | | | | | 1 | .229** | .603** | 0.07 |
| 11 | BJME-MD I believe mobile devices are useful to me when I need to distract my child | | | | | | | | | | 1 | .473** | .153** |
| 12 | BJME-MD I believe that my child and I are part of a digital future | | | | | | | | | | | 1 | .231** |
| 13 | BJME-MD I believe the digital gap is so wide that I feel excluded from this experience | | | | | | | | | | | | 1 |

[a] Contrasted with 12 or fewer years of maternal education

Mothers' education is associated with maternal beliefs. Participants with a university or higher education level hold more negative beliefs regarding the development of life skills, the notion that "I believe that my child and I are part of a digital future," and a lesser belief in a digital gap, compared to mothers with compulsory or lower education levels. In contrast, mothers with some form of technical education more frequently adhere to the belief in the existence of a digital gap that excludes them from joint media experiences, compared to mothers with compulsory or lower education levels.

Regarding the children, only their age is associated with greater independent use of MD. Furthermore, as children get older, mothers are more inclined to believe that they, together with their child are part of a digital future.

For their part, the frequency of individual use of MD by mothers and children, as well as joint use, is positively related to beliefs about the consequences of using MD on child development. The more MD are used, the more mothers believe this translates into positive consequences for academic development and skills for daily life.

Greater specificity is present between individual and joint use and the dimensions of the Beliefs about Joint Media Engagement on mobile devices (BJME-MD) questionnaire. Thus, both mothers who individually use MD more frequently and mother-child dyads who co-use them more frequently report more positive beliefs about the joint use necessary for the future. The more frequent individual use of MD by children is positively related to maternal beliefs linked to joint use. Specifically, with a higher score, mothers believe that MD are useful for distracting their child, that both are part of a digital future and, at the same time, that there is such a large digital gap that it distances them from the joint media experience.

Finally, it is important to mention that beliefs about the consequences of device use are positively related to each other (.23 < $r$ < .62), except for beliefs about consequences for academic and daily life development, and the belief in a digital gap; emphasizing the need to jointly analyze their relationship with JME-MD.

Next, the regression model used to analyze the dependent variable "weekly joint use" of MD is presented. In the first step, demographic variables (such as the mother's age and educational level) are incorporated, along with individual usage time of MD by both the mother and the child. In the second step, beliefs about the impact of MD on child development (Belief about the use of MD in child development – BMD-CD) are incorporated. In the final step, the " Beliefs about Joint Media Engagement on mobile devices questionnaire (BJME-MD) is incorporated.

The results of the first step [$F$(5,288)=17.40, $p$ < 0.001, $R^2$=.18] indicate that the child's MD usage time is the only significant predictor, indicating that greater MD use by children is associated with an increase in joint use. The next step [$F$(7,293) = 6.03, $p$ < 0.001, $R^2$ = .20] indicates a significant relationship of joint use with the variables of MD use by the child, and beliefs regarding the impact on daily life skills development domain. In the last step, specific maternal beliefs related to dyadic use between mothers and children (JME-MD) did not show a significant impact on the model. Thus, it is confirmed that the initial variables, the children's MD usage time and the maternal belief in the benefits of MD for developing life skills, are the only significant predictors of joint use [$F$(10,284) = 4.162, $p$ < 0.001, $R^2$ = .20], maintaining the same direction and significance previously indicated.

Additionally, a multiple linear regression model was employed to analyze predictors of joint use of mobile devices, differentiated by the type of media content consumed. The evaluated types of content were a) listening to or watching musical content, b) viewing videos and TV content, c) joint reading on devices, d) creation or viewing of photographs and videos, e) use of recreational apps, f) use of educational apps, g) use of social networks, h) participation in video calls, and i) making phone calls.

The results indicated that mother's age and belief in the academic benefits of devices are significant predictors of joint use of musical content, with more frequent participation of younger mothers and those convinced of the academic value of these devices [$F(10,242862) = 6.549$, $p < 0.001$, $R^2 = 0.123$]. Regarding the creation or viewing of videos, it was observed that younger mothers and children who use the devices more independently are more involved in this joint activity [$F(10, 270507) = 8.351$, $p < 0.001$, $R^2 = 0.16$].

For joint reading in digital format, mothers who report higher beliefs about the positive influence of devices on academic development, lower beliefs linked to the use of MD as a distraction for the child, and greater beliefs in a shared digital future were significantly associated with this practice [$F(10, 67929) = 5.905$, $p < 0.001$, $R^2 = 0.18$]. In joint use with photographs and videos, maternal beliefs about the use of MD having consequences for the development of life skills predicted a higher frequency of joint use in this activity [$F(10, 2737654) = 4.615$, $p < 0.001$, $R^2 = 0.82$].

*Table 11. Stepwise Multiple Regression Table Predicting JME-MD Child-Mother*

| | Variables | β | SD | *t* | *p* |
|---|---|---|---|---|---|
| 1 | Constant | 1.59 | 0.55 | 2.90 | 0.00 |
| | Mother's age | -0.02 | 0.01 | -1.72 | 0.09 |
| | Technical maternal education | -0.10 | 0.31 | -0.31 | 0.76 |
| | University or higher maternal education[a] | -0.28 | 0.32 | -0.88 | 0.38 |
| | Mothers' MD use | 0.07 | 0.05 | 1.38 | 0.17 |
| | Childrens' MD use | 0.31 | 0.05 | 6.28 | 0.00 |
| 2 | Constant | 1.40 | 0.62 | 2.26 | 0.02 |
| | Mother's age | -0.02 | 0.01 | -1.53 | 0.13 |
| | Technical maternal education | -0.07 | 0.31 | -0.21 | 0.83 |
| | University or higher maternal education[a] | -0.22 | 0.32 | -0.69 | 0.49 |
| | Mothers' MD use | 0.07 | 0.05 | 1.34 | 0.18 |
| | Childrens' MD use | 0.29 | 0.05 | 5.90 | 0.00 |
| | BMD-CD Academic Development Domain | -0.14 | 0.10 | -1.32 | 0.19 |
| | BMD-CD Life Skills Development Domain | 0.26 | 0.09 | 2.80 | 0.01 |
| 3 | Constant | 1.56 | 0.66 | 2.36 | 0.02 |
| | Mother's age | -0.02 | 0.01 | -1.57 | 0.12 |
| | Technical maternal education | -0.01 | 0.31 | -0.04 | 0.97 |
| | University or higher maternal education[a] | -0.17 | 0.32 | -0.53 | 0.60 |
| | Mothers' MD use | 0.07 | 0.05 | 1.27 | 0.21 |
| | Childrens' MD use | 0.31 | 0.05 | 5.98 | 0.00 |
| | BMD-CD Academic Development Domain | -0.10 | 0.11 | -0.94 | 0.35 |
| | BMD-CD Life Skills Development Domain | 0.26 | 0.10 | 2.56 | 0.01 |
| | BJME-MD - F1 MD as a distractor | -0.10 | 0.07 | -1.45 | 0.15 |
| | BJME-MD - F2 - Digital future | -0.02 | 0.14 | -0.18 | 0.86 |
| | BJME-MD - F3 - Digital gap | 0.01 | 0.10 | 0.08 | 0.94 |

Note [a] Contrasted with 12 or fewer years of maternal education

In the use of recreational apps, younger mothers with strong beliefs in the educational value and digital future of devices showed a greater tendency to participate jointly in these activities [$F(10, 72184) = 16.444$, $p < 0.001$, $R^2 = 0.287$]. Similarly, other variables that influence a higher frequency of joint use with recreational apps are those who have lower beliefs in MD as a distractor and those who less adhere to the belief that MDs are a kind of gap that promotes exclusion by adults. Similarly, for educational apps, a longer individual usage time by children and positive maternal beliefs about academic and life skills development were associated with higher joint use [$F(10, 197424) = 17.791$, $p < 0.001$, $R^2 = 0.303$]. Likewise, a variable that influences a higher frequency of joint

use with educational apps is mothers with lower beliefs that MDs are useful for entertaining and distracting children.

In contrast, joint use of phone calls [$F(10, 53370) = 1.244$, $p < 0.26$], video calls [$F(10, 198867) = 1.653$, $p < 0.085$, $R^2 = 0.021$], and social networks [$F(10, 168234) = 3.158$, $p < 0.001$, $R^2 = 0.303$] was not associated with the variables included in the model.

*Table 12. JME-MD by content type*

| Content | Variables | β | SD | *t* | *p* |
|---|---|---|---|---|---|
| Listening to or watching musical content | Constant | 3.09 | 0.53 | 5.81 | 0.00 |
| | Mother's age | -0.02 | 0.01 | -2.06 | 0.04 |
| | Technical maternal education | -0.41 | 0.27 | -1.56 | 0.12 |
| | University or higher maternal education[a] | -0.28 | 0.28 | -1.02 | 0.31 |
| | Mothers' MD use | 0.03 | 0.04 | 0.74 | 0.46 |
| | Childrens' MD use | 0.05 | 0.04 | 1.08 | 0.28 |
| | BMD-CD Academic Development | 0.21 | 0.08 | 2.83 | 0.01 |
| | BMD-CD Life Skills Development | 0.11 | 0.08 | 1.28 | 0.20 |
| | BJME-MD - F1 MD as a distractor | -0.09 | 0.06 | -1.72 | 0.09 |
| | BJME-MD - F2 - Digital future | 0.18 | 0.11 | 1.56 | 0.12 |
| | BJME-MD - F3 - Digital gap | -0.12 | 0.08 | -1.58 | 0.11 |
| Videos and TV content | Constant | 3.18 | 0.53 | 6.01 | 0.00 |
| | Mother's age | -0.03 | 0.01 | -2.70 | 0.01 |
| | Technical maternal education | -0.07 | 0.26 | -0.26 | 0.79 |
| | University or higher maternal education[a] | 0.06 | 0.28 | 0.21 | 0.83 |
| | Mothers' MD use | 0.04 | 0.04 | 0.86 | 0.39 |
| | Childrens' MD use | 0.17 | 0.04 | 3.89 | 0.00 |
| | BMD-CD Academic Development | 0.10 | 0.08 | 1.29 | 0.20 |
| | BMD-CD Life Skills Development | 0.12 | 0.08 | 1.39 | 0.17 |
| | BJME-MD - MD as a distractor | -0.10 | 0.05 | -1.77 | 0.08 |
| | BJME-MD - Digital future | 0.20 | 0.11 | 1.80 | 0.07 |
| | BJME-MD - Digital gap | -0.09 | 0.08 | -1.10 | 0.27 |

*Table 12. (continue) JME-MD by content type*

| Content | Variable | β | DE | *t* | *p* |
|---|---|---|---|---|---|
| Joint digital reading | Constant | 1.15 | 0.61 | 1.89 | 0.06 |
| | Mother's age | 0.00 | 0.01 | -0.21 | 0.83 |
| | Technical maternal education | -0.32 | 0.30 | -1.07 | 0.28 |
| | University or higher maternal education[a] | -0.23 | 0.31 | -0.74 | 0.46 |
| | Mothers' MD use | 0.07 | 0.05 | 1.49 | 0.14 |
| | Childrens' MD use | 0.09 | 0.05 | 1.75 | 0.08 |
| | BMD-CD Academic Development | 0.18 | 0.09 | 2.03 | 0.04 |
| | BMD-CD Life Skills Development | 0.05 | 0.10 | 0.56 | 0.58 |
| | BJME-MD -MD as a distractor | -0.15 | 0.06 | -2.45 | 0.01 |
| | BJME-MD - Digital future | 0.34 | 0.13 | 2.63 | 0.01 |
| | BJME-MD - Digital gap | 0.00 | 0.09 | 0.00 | 1.00 |
| Photographs and videos | Constant | 1.78 | 0.56 | 3.16 | 0.00 |
| | Mother's age | 0.00 | 0.01 | 0.14 | 0.89 |
| | Technical maternal education | -0.24 | 0.28 | -0.87 | 0.38 |
| | University or higher maternal education[a] | -0.35 | 0.29 | -1.20 | 0.23 |
| | Mothers' MD use | 0.00 | 0.04 | -0.10 | 0.92 |
| | Childrens' MD use | 0.05 | 0.05 | 1.02 | 0.31 |
| | BMD-CD Academic Development | 0.08 | 0.08 | 0.99 | 0.33 |
| | BMD-CD Life Skills Development | 0.24 | 0.09 | 2.65 | 0.01 |
| | BJME-MD -MD as a distractor | -0.02 | 0.06 | -0.39 | 0.70 |
| | BJME-MD - Digital future | 0.15 | 0.12 | 1.19 | 0.23 |
| | BJME-MD - F3 - Digital gap | -0.05 | 0.08 | -0.57 | 0.57 |
| Recreational apps | Constant | 1.75 | 0.51 | 3.43 | 0.00 |
| | Mother's age | -0.03 | 0.01 | -2.82 | 0.01 |
| | Technical maternal education | -0.09 | 0.26 | -0.33 | 0.74 |
| | University or higher maternal education[a] | 0.04 | 0.27 | 0.14 | 0.89 |
| | Mothers' MD use | 0.00 | 0.04 | -0.02 | 0.99 |
| | Childrens' MD use | 0.19 | 0.04 | 4.57 | 0.00 |
| | BMD-CD Academic Development | 0.27 | 0.07 | 3.74 | 0.00 |
| | BMD-CD Life Skills Development | 0.09 | 0.08 | 1.13 | 0.26 |
| | BJME-MD - MD as a distractor | -0.11 | 0.05 | -2.07 | 0.04 |
| | BJME-MD - Digital future | 0.33 | 0.11 | 2.97 | 0.00 |
| | BJME-MD - Digital gap | -0.21 | 0.08 | -2.72 | 0.01 |

*Table 12. (continue) JME-MD by content type*

| Content | Variable | β | DE | *t* | *p* |
|---|---|---|---|---|---|
| Educational apps | Constant | 1.24 | 0.54 | 2.29 | 0.02 |
| | Mother's age | -0.02 | 0.01 | -1.68 | 0.09 |
| | Technical maternal education | -0.16 | 0.27 | -0.60 | 0.55 |
| | University or higher maternal education[a] | -0.06 | 0.28 | -0.20 | 0.85 |
| | Mothers' MD use | 0.04 | 0.04 | 0.93 | 0.36 |
| | Childrens' MD use | 0.10 | 0.04 | 2.35 | 0.02 |
| | BMD-CD Academic Development | 0.38 | 0.08 | 4.99 | 0.00 |
| | BMD-CD Life Skills Development | 0.21 | 0.09 | 2.45 | 0.01 |
| | BJME-MD - MD as a distractor | -0.19 | 0.06 | -3.34 | 0.00 |
| | BJME-MD - Digital future | 0.32 | 0.12 | 2.73 | 0.01 |
| | BJME-MD - Digital gap | -0.12 | 0.08 | -1.47 | 0.14 |
| Social networks | Constant | 1.43 | 0.62 | 2.31 | 0.02 |
| | Mother's age | 0.01 | 0.01 | 0.94 | 0.35 |
| | Technical maternal education | -0.41 | 0.31 | -1.35 | 0.18 |
| | University or higher maternal education[a] | -0.38 | 0.32 | -1.19 | 0.24 |
| | Mothers' MD use | 0.05 | 0.05 | 1.01 | 0.32 |
| | Childrens' MD use | 0.06 | 0.05 | 1.17 | 0.24 |
| | BMD-CD Academic Development | 0.09 | 0.09 | 1.05 | 0.29 |
| | BMD-CD Life Skills Development | 0.17 | 0.10 | 1.79 | 0.07 |
| | BJME-MD - MD as a distractor | 0.02 | 0.06 | 0.30 | 0.76 |
| | BJME-MD - Digital future | 0.05 | 0.13 | 0.37 | 0.71 |
| | BJME-MD - Digital gap | -0.03 | 0.09 | -0.31 | 0.76 |

*Table 12. (continue) JME-MD by content type*

| Content | Variables | β | DE | *t* | *p* |
|---|---|---|---|---|---|
| Video calls | Constant | 2.70 | 0.58 | 4.64 | 0.00 |
| | Mother's age | 0.00 | 0.01 | -0.06 | 0.95 |
| | Technical maternal education | -0.48 | 0.29 | -1.66 | 0.10 |
| | University or higher maternal education[a] | -0.33 | 0.30 | -1.11 | 0.27 |
| | Mothers' MD use | 0.01 | 0.05 | 0.22 | 0.82 |
| | Childrens' MD use | 0.02 | 0.05 | 0.48 | 0.63 |
| | BMD-CD Academic Development | 0.20 | 0.08 | 2.43 | 0.02 |
| | BMD-CD Life Skills Development | -0.01 | 0.09 | -0.15 | 0.88 |
| | BJME-MD - MD as a distractor | 0.07 | 0.06 | 1.11 | 0.27 |
| | BJME-MD - Digital future | -0.16 | 0.13 | -1.26 | 0.21 |
| | BJME-MD - Digital gap | 0.05 | 0.08 | 0.63 | 0.53 |
| Phone calls | Constant | 2.25 | 0.57 | 3.94 | 0.00 |
| | Mother's age | 0.02 | 0.01 | 1.66 | 0.10 |
| | Technical maternal education | -0.38 | 0.29 | -1.34 | 0.18 |
| | University or higher maternal education[a] | -0.35 | 0.30 | -1.16 | 0.25 |
| | Mothers' MD use | 0.03 | 0.04 | 0.69 | 0.49 |
| | Childrens' MD use | 0.03 | 0.05 | 0.69 | 0.49 |
| | BMD-CD Academic Development | -0.04 | 0.08 | -0.54 | 0.59 |
| | BMD-CD Life Skills Development | 0.14 | 0.09 | 1.60 | 0.11 |
| | BJME-MD - MD as a distractor | -0.03 | 0.06 | -0.50 | 0.62 |
| | BJME-MD - Digital future | 0.06 | 0.12 | 0.51 | 0.61 |
| | BJME-MD - Digital gap | -0.08 | 0.08 | -0.96 | 0.34 |

## Study 2

The second study was designed to explore the Joint Media Engagement on Mobile Devices (JME-MD) among parent-child dyads, considering that both actors must respond partially to the other participant and to the digital content on such devices. It seeks to determine whether the content, if it has productive or non-productive design features, impacts the dyad in a way that evidence differences during a moment of joint media engagement.

The participating dyads interacted with a tablet provided by the researcher (iPad, 7th generation), in two consecutive rounds that maintained a counterbalanced order to control the impact of the initial use of the first application used. In this way, each mother-child pair played with one application (app) that meets the design recommendations that promote productivity in joint use, and another app that does not incorporate these facilitating features. To discern significant variations in the promotion of productive joint use of mobile devices, the mother-child co-use sessions were video recorded for subsequent detailed analysis.

To carry out the analysis of this study, the software GridWare (Lamey et al., 2004) was used, which allows real-time analysis of interactions between participants and the content of applications on mobile devices. GridWare is a versatile tool designed for the visualization and manipulation of multivariate time series, which consist of sequential categorical data. This software is based on the work of Granic and Hollenstein (2003), who developed state space grids based on principles of dynamic systems. In our research, we use GridWare to analyze mainly two concepts: state space and state sequence. The state space comprises all the possible states through which a system can pass, represented in GridWare by two-dimensional grids. Thus, each cell in the grid symbolizes a possible state. The state sequence represents the trajectory of these states, expressing the

system's evolution over time. Thus, GridWare facilitates detailed analysis of each cell, allowing for meticulous description of the processes of change and stability in complex and open systems, specifically the complex behavioral patterns of the dyads and their joint participation, enabling them to be visualized and understood dynamically.

## Methodology

### *Participants*

The participants of this study were selected through convenience sampling, using open recruitment methods, such as advertisements on social networks and calls directed at mothers involved in the previous study. Eleven dyads participated, with the mothers' ages ranging from 27 to 42 years, where the average age of the mothers was 35 years (SD = 4.88 years). The children had an average age of 5 years (SD = 0.87; 6 males), with ages ranging from 4 to 6 years. The marital status of the participating mothers varied: four were married, two were cohabiting, three were single, and two were separated or divorced. Regarding educational level, five had a complete university education, two had incomplete university studies, three had a master's or doctoral degree, and one had completed secondary education. All mothers had a smartphone and only three of them had tablets. All acknowledged using mobile device applications with their children occasionally.

Inclusion criteria required that mothers be 18 years of age or older, with a child whose age ranged from 4 to 6 years and who had previously used mobile devices; excluding mothers who had a severe psychiatric condition or whose child had a diagnosis related to Exceptional Needs.

## Procedure

The evaluations were conducted in each child's home, where a research assistant collected informed consents and assents. The mothers completed demographic questionnaires and gave permission for the videotaped activity during the same visit, to protect the independence of the responses. A research assistant was available to answer any questions about the activity, and after their contribution, the children received a small gift. The study was approved by the Ethics Committee of the Universidad del Desarrollo, ensuring compliance with national ethical standards. A copy of the consent and child assent is available in Annex F.

### *Protocol*

Due to the contact restrictions imposed by the COVID-19 pandemic during data collection, this procedure was carried out in a single visit to the participants' home, where the dyadic play sessions were video recorded. Participants were provided with a kit of materials that included an iPad with the selected applications for the study. The recording took place in an area of the home that offered a comfortable space in the family room, suitable for conducting the session without external distractions. The participants, mother and child, were positioned in front of the mobile device, ensuring that both participants could see and interact with the app simultaneously, and the video camera was positioned in such a way that it captured a stable and high-quality image of their faces and hands during the interaction.

The experiment consisted of two successive co-use sessions, each lasting 10 minutes with a short break between them, adding up to a total of approximately 25 minutes. Participants were asked to use the applications as they normally would. The activity began with the instruction: "I invite you to spend some time together using this application," without providing further details. After the first 10

minutes, the dyads were asked to switch to the second application for an identical period, repeating the same initial instruction. After the two rounds, participants were asked about their previous experiences with the mentioned applications. Finally, the video recording and the participation of each dyad were concluded, gifting a small present to the child. It is important to note that if any of the participants withdrew or refused to participate in the activity, the recording of the dyad would be terminated.

## Measures

*Mobile applications used.*

The task faced by each dyad consisted of playing together with two mobile applications that, due to their characteristics, either facilitated or hindered productive Joint Media Engagement on Mobile Devices (JME-MD). To select the applications, the lead researcher preselected six applications from the top 50 most popular in the '4 years' subcategory on the AppStore. These applications were evaluated according to their compliance with design principles that favor productive interaction, as described by Takeuchi and Stevens (2011). The 6 design principles for apps focused on productive JME include: mutual engagement, dialogic inquiry, co-creation, boundary crossing, intention to develop y focus on content not control (which can be extensively reviewed in Table 12).

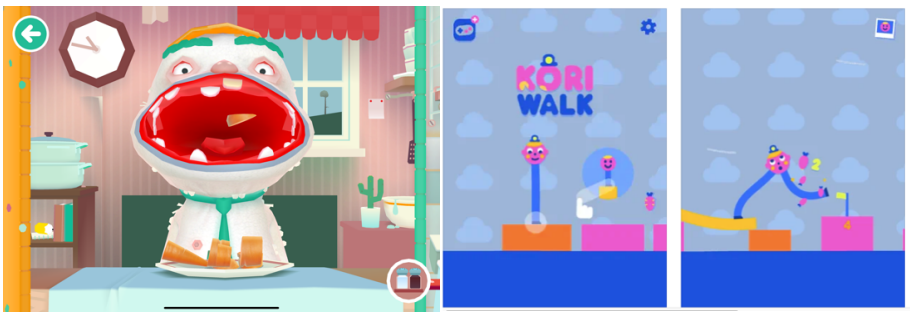
Expert professionals evaluated each application using a matrix and a three-point Likert scale (1-low; 3-high) to estimate the level of compliance with each design guideline, the details of which are in Annex G. As a result, 'Toca Kitchen 2' and 'kORi WALk' were selected for having the highest and lowest average scores, respectively. 'Toca Kitchen 2' allows users to interact with characters who react interactively to the food that is prepared and served by the participant. In contrast, 'kORi WALk' challenges users to direct a character with

extendable legs across various platforms while avoiding falling into water. These applications were used in the co-use sessions of the study to explore the dyadic dynamics. Thus, 'Toca Kitchen 2' is the app with a design that promotes productive Joint Media Engagement on Mobile Devices (JME-MD) and is subsequently identified as the ‘promoting JME app’. On the other hand, 'kORi WALk' is recognized as the ‘non-promoting JME app', given its low level of design feature compliance.

*Table 13. Principles of Application Design that Favor Productive Joint Media Engagement (pJME)*

| Design principles | Description |
|---|---|
| Mutual engagement | Both participants are equally motivated to engage in the activity and find it sufficiently appealing or challenging to maintain their commitment |
| Dialogic inquiry | The content should inspire collaboration with others to make sense of situations, typically manifested as conversations |
| Co-creation | The experience not only promotes the use but also enhances the construction of a common understanding or intersubjectivity, which serves as the foundation for communication and learning. |
| Boundary crossing | Participant interactions are nourished by past experiences and inspire future activities. |
| Intention to develop | At least one of the participants promotes personal growth for themselves or the other participant through the activity, attending to the needs and interests of the other |
| Focus on content, not control | Technical conditions and user interface do not distract or hinder the interaction of the other participant with the content |

*Figure 1 Screen captures of the apps used:*




"Toca Kitchen 2" app productive JME  Kori Walk app non productive JME

*Coding system*

The coding scheme was specially created for this research and was inspired by the previously cited work of Takeuchi and Stevens (2011), the Parent-Child Interaction System (PARCHISY) by Deater-Deckard and Petrill (2004), previous research on co-use in analog contexts such as shared reading and dyadic play (Padilla-Walker et al., 2020; Tamis-LeMonda et al., 2004), and in sessions of Joint Media Engagement on Mobile Devices (JME-MD) developed by Hiniker et al. (2018) and Yen et al. (2018).

This coding tool analyzes dyadic interaction to identify constructive and disruptive behaviors in Joint Media Engagement on Mobile Devices (JME-MD) activities. It consists of 7 codes that assess: a) the engagement of the participants, capturing whether the actors were motivated to participate in the task and with the other participant, expressed in the codes "engagement in the task" and "engagement with the other"; b) the intention to develop, where the intention to support and share with the other participant is captured, operationalized as "positive content"; c) focus on content, which explores the presence of interactions that stop or inhibit a participant's participation, either due to negative behavior of a participant ("negative content") or due to some technical difficulty that forces participants to configure or adjust the settings of the mobile device ("technical interaction"); d) the participants' interaction with the mobile device, expressed in the codes "device holding" and "main user". This coding system is found in Annex H, and a summary of this is provided in Figure 2.

*Figure 2. Summary Schema of Coding System, Dimensions, and Codes Used*

| Domain | Code |
|---|---|
| **Engagement**.<br>Instances where participants are motivated to engage in the activity, aiming to maintain their commitment throughout, whether with the task itself or with the other participant. | **On the task.** The participant is attentive to the activity, generally keeping their visual attention on the task or the other participant. |
| | **On the other.** The participant is attentive to the other member of the dyad and offers and responds to interaction demands. |
| **Intention to Develop**.<br>The interactions between participants show an intention to support and accompany the other participant. | **Positive content.** Interactions that promote the engagement of the other participant. Compliments, explains, asks, or reacts to the content of the activity or the other's behavior, showing interest |
| **Focus on Content**.<br>Technical features and the user interface do not distract or hinder interactions between participants or with the content. Additionally, behaviors aimed at inhibiting or stopping the participation of the other actor are kept to a minimum. | **Negative Content.** Interactions aimed at stopping or inhibiting the participation of the other, which can be gestural or verbal. |
| | **Technical Interaction**[4]**.** Interactions to configure or adjust the settings of the mobile device (rotation, volume, etc.). |
| **Interaction between participants and the MD.**<br>Records the context of a participant's direct engagement with the mobile device. | **Device Holding:** Indicates which participant holds the mobile device during the segment (1= The Mother exclusively to 5= The child exclusively). |
| | **Main user.** Indicates which user interacts with the device's screen during the segment (1= The Mother exclusively to 5= The child exclusively). |

*Coding process*

The 22 videos of the mother-child device-mediated play sessions (2 videos per participating dyad) were segmented into 30-second blocks, totaling 432

[4] The variable 'technical interaction' appeared in less than 4% of the sequences explored for each dyad and experimental situation, therefore it was excluded from the analysis as it did not capture relevant data.

segments[5]. These segments were coded by a team of eight research assistants, who were unaware of the study's hypotheses and received training on the use of the coding system from the principal investigator. The coders were given a set of video segments of interaction to evaluate, which corresponded to a random selection of them. Thus, each video segment was independently coded by two codifiers, and in case of discrepancies, a third coder intervened to resolve them.

The training process for the coders involved coding practice on 15 interaction segments. During this, the segments were independently coded and then any discrepancies were collectively discussed and resolved. The training was considered complete once intraclass correlation coefficients (ICC) greater than .7 were achieved, thus ensuring the reliability of the coding.

*Productive JME, JME and non-JME*

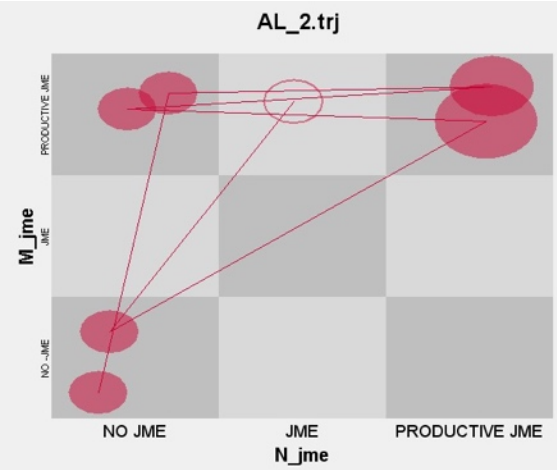
The categories of productive JME (Joint Media Engagement), JME, and non-JME were constructed using the dimensions, "level of engagement with the task," "with the other participant," and "both positive and negative content" from the coding system, creating a variable for each of the participants (mother and child). It was classified as 'productive JME' when a participant maintained a focus on the task or the other, either partially or extensively, accompanied by partial or constant positive content and without negative interactions. In the absence of positive content or the presence of negative content, the interaction was classified as 'JME.' Those interactions that did not meet these categories were considered 'non-JME'.

[5] One of the dyads withdrew from participation at the 6-minute mark of the recording. This dyad was kept in the final analysis considering their incomplete participation.

*Data analysis*

The data analysis included two sequential processes. First, GridWare (Lamey et al., 2004) was used to visualize and quantify the sequences of mother-child interactions with different applications. These interactions are summarized as a sequence of possible states. For example, at a given moment, the child (x-axis) and the mother (y-axis) may be in one of the following states: JME, productive JME, or non-JME, which corresponds to a specific grid within the set of 9 possible states in the field of study (see Figure 3). Additionally, the sequence of states captures the change (or lack thereof) in states over the course of the interaction time (commonly known as the trajectory).

*Figure 3. Example of states and trajectories of a dyad, in GridWare quadrants*

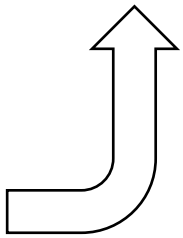



Before incorporating the codes into GridWare, the 30-second video segments were aggregated when participants remained in the same states for 2 or more segments. For example, Figure 4 shows how 20 segments of 30 seconds are condensed into a trajectory of 8 consecutive interaction patterns.

*Figure 4. Collapsed trajectories of dyadic interaction in JME*

| Serie | Block | Child | Mother |
|---|---|---|---|
| 1 | 30 | JME | PRODUCTIVE JME |
| 2 | 30 | JME | PRODUCTIVE JME |
| 3 | 30 | NO JME | NO JME |
| 4 | 30 | NO JME | NO JME |
| 5 | 30 | PRODUCTIVE JME | PRODUCTIVE JME |
| 6 | 30 | PRODUCTIVE JME | PRODUCTIVE JME |
| 7 | 30 | PRODUCTIVE JME | PRODUCTIVE JME |
| 8 | 30 | PRODUCTIVE JME | PRODUCTIVE JME |
| 9 | 30 | PRODUCTIVE JME | PRODUCTIVE JME |
| 10 | 30 | PRODUCTIVE JME | PRODUCTIVE JME |
| 11 | 30 | NO JME | PRODUCTIVE JME |
| 12 | 30 | NO JME | PRODUCTIVE JME |
| 13 | 30 | PRODUCTIVE JME | PRODUCTIVE JME |
| 14 | 30 | PRODUCTIVE JME | PRODUCTIVE JME |
| 15 | 30 | PRODUCTIVE JME | PRODUCTIVE JME |
| 16 | 30 | PRODUCTIVE JME | PRODUCTIVE JME |
| 17 | 30 | NO JME | PRODUCTIVE JME |
| 18 | 30 | NO JME | PRODUCTIVE JME |
| 19 | 30 | NO JME | NO JME |
| 20 | 30 | NO JME | NO JME |

| Time | Child | Mother |
|---|---|---|
| 0 | JME | PRODUCTIVE JME |
| 60 | NO-JME | NO-JME |
| 120 | PRODUCTIVE JME | PRODUCTIVE JME |
| 300 | NO-JME | PRODUCTIVE JME |
| 360 | PRODUCTIVE JME | PRODUCTIVE JME |
| 480 | NO-JME | PRODUCTIVE JME |
| 540 | NO-JME | NO-JME |
| 600 | | |



These specific "trajectories" for each dyad and application are visualized in GridWare as graphic sequences on a grid of 9 possible states (3 x 3, Productive JME, JME, and Non-JME). Figure 3 shows an example of such a grid, with the x-axis representing the child's expression of JME-MD and the y-axis that of the adult. Each quadrant may present one or more circles, whose size captures the time the dyad remained in that quadrant (or be empty if the dyad members were not in that special state configuration), and lines allow tracing the trajectory of the state sequence through which the dyads moved during the dyadic interaction.

The GridWare tool provides various measures that allow quantifying the information of the trajectories in the analysis. Among the measures used in this study are: a) Events, episodes that occupy a specific cell or region from its beginning to its end. This corresponds to a line (trajectory) and a node. In an individual trajectory, it represents the total number of discrete events in each cell or region. For example, in Figure 3, the No-JME/No-JME cell records two events, while the JME/JME cell has no events; b) Duration per Event, a measure that represents the total duration of a trajectory divided by its number of events, providing an average duration of each event; and c) Dispersion, calculated as the

sum of the squared durations proportional to each cell, adjusted by the number of cells and inverted, allowing the values to range from 0 (no dispersion, i.e., all activity concentrated in a single cell) to 1 (maximum dispersion). This specific value, of dispersion, is obtained after summing the square of these proportions, multiplied by the total number of cells, and then normalized by subtracting 1 and dividing by the total number of cells minus 1, allowing to obtain indicators of how uniformly the duration is distributed among the cells.

The second part of the data analysis was conducted once these indices were obtained and exported into SPSS databases. To compare the results obtained with the two applications, non-parametric statistics for related samples (Wilcoxon Sign Test) were used. Additionally, for comparisons between different indicators within the same application, the Friedman Test and Wilcoxon Sign Test were used.

## Results

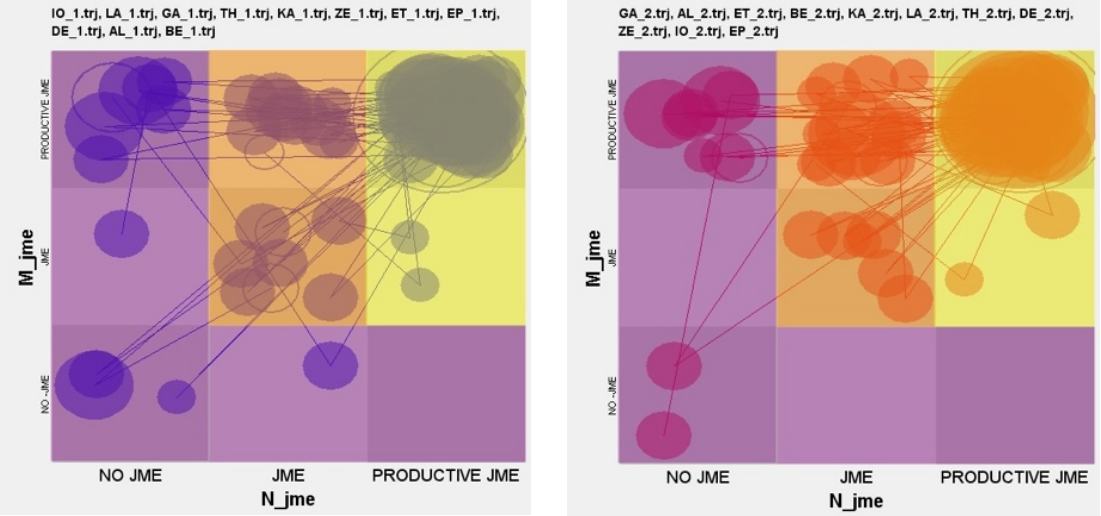
*Productive JME based on application content.*

Figure 5 graphically presents the interaction sequences of the 11 dyads[6] in response to the application that promotes JME (in blue) and the one that does not (in red). The set of possible states (3x3) was grouped into 3 areas/regions, such that the upper right area (yellow zone) indicates the occurrence of productive JME for both participants, the upper central area indicates JME (orange zone),

[6] One of the participating dyads discontinued her participation in the study after 6 minutes of using the non-productive app. The younger participant refused to continue participating by verbally stating that she wished to continue using the first app. Given that the dyad previously used the productive app, the data collected were also incorporated in the subsequent analysis.

and the cells on the left along with the lower ones represent states without JME (purple zone).

*Figure 5. Dyadic quadrants by application used for all dyads*




Productive app: Toca Kitchen 2

Non-productive app: Kori walk

Differences among various indicators based on content for the set of dyads were explored using non-parametric tests (Wilcoxon test), considering the median number of events in each quadrant, as well as the median duration per event. The results of this comparison can be seen in Table 14. These results show that, for each of the regions considered, there are no significant differences according to content.

*Table 14. Comparison of the interaction between both applications used by the dyad*

| Dyadic regions | Record | Productive app JME-MD | | Non-productive App JME-MD | | Group comparation | |
|---|---|---|---|---|---|---|---|
| | | Md. | IQR | Md. | IQR | Z | p |
| Productive JME (N=11) | Event | 3.00 | 4.0 | 3.00 | 5 | 0.241 | .81 |
| | Duration per event | 150.00 | 80.0 | 150.00 | 94 | 0.663, | .51 |
| JME (N=7) | Event | 2.00 | 3.0 | 2.00 | 4 | -.284, | .78 |
| | Duration per event | 60.00 | 17.5 | 60.00 | 0 | 0.552, | 58 |
| Non-JME (N= 4) | Event | 2.00 | 3.00 | 2.00 | 3.00 | -.816 | .41 |
| | Duration per event | 67.50 | 60 | 70 | 60 | 0 | .999 |

*Exploring the strategies for using MDs*

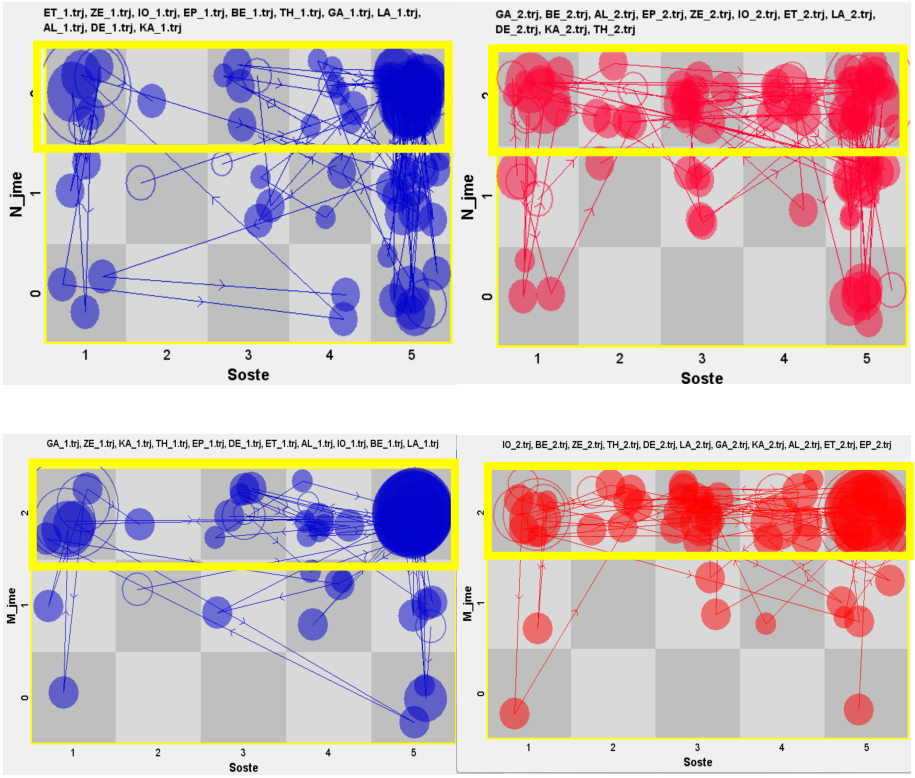
Considering that the results in Productive JME between both tasks do not differ significantly, it is hypothesized that the dyads used different strategies to maintain joint task engagement, somehow compensating for the weaknesses of the content. Based on this result, the behavior of the dyads and the relationship with the variables related to the management and operation of the MD, such as who holds the device and who is the main user during the experimental tasks, will be explored.

To investigate the variables 'device holding' and 'main user', a methodology analogous to the one described above was adopted, highlighting certain specific areas. GridWare software was used, which allowed graphically representing and calculating who holds and who predominantly uses the MD along the x-axis.

To examine how participants distribute their time and participation across different experimental conditions, two specific parameters provided by the software were analyzed: dispersion and duration per event. Dispersion measures the variability in cell occupancy along the trajectories, while duration per event reflects the average time of each trajectory in relation to the total number of events.

Regarding the 'device holding, greater heterogeneity is anticipated among the dyads regarding who holds the device. It is assumed that the exchange of the MD between mother and child promotes shared use, since passing the MD between both participants could be a strategy to maintain joint use, helping to focus the attention of the other. Thus, this turn-taking management strategy is a way to maintain joint use. In Figure 6, the comparison between the JME-promoting app (left) and the non-promoting app (right) is observed, where the yellow border highlights the region in productive JME, for both the child (top) and the mother (bottom). In Table 15, the comparison for each participating actor (child and mother) at the moments of achieving Productive JME is observed.

*Figure 6. Device holding, expressed in dyadic quadrants by application.*




Note: Productive app (left), non-productive app (right).

Above: child's behavioral pattern, below: mother's behavioral pattern

*Table 15.Differences in the "device holding" variable by app used.*

| Participant | Record | Productive app JME-MD | | Nonproductive App CCM-MD | | Group comparation | |
|---|---|---|---|---|---|---|---|
| | | Md | IQR | Md | IQR | Z | *p* |
| Child JME | Dispersion | .29 | .31 | .62 | .43 | -2.50 | .012 |
| | Duration per event | 90 | 92 | 71.25 | 20 | -1.689 | .091 |
| Mother JME | Dispersion | .25 | .27 | .59 | .58 | -2.091 | .037 |
| | Duration per event | 135 | 165 | 108 | 122 | -1.478 | .139 |

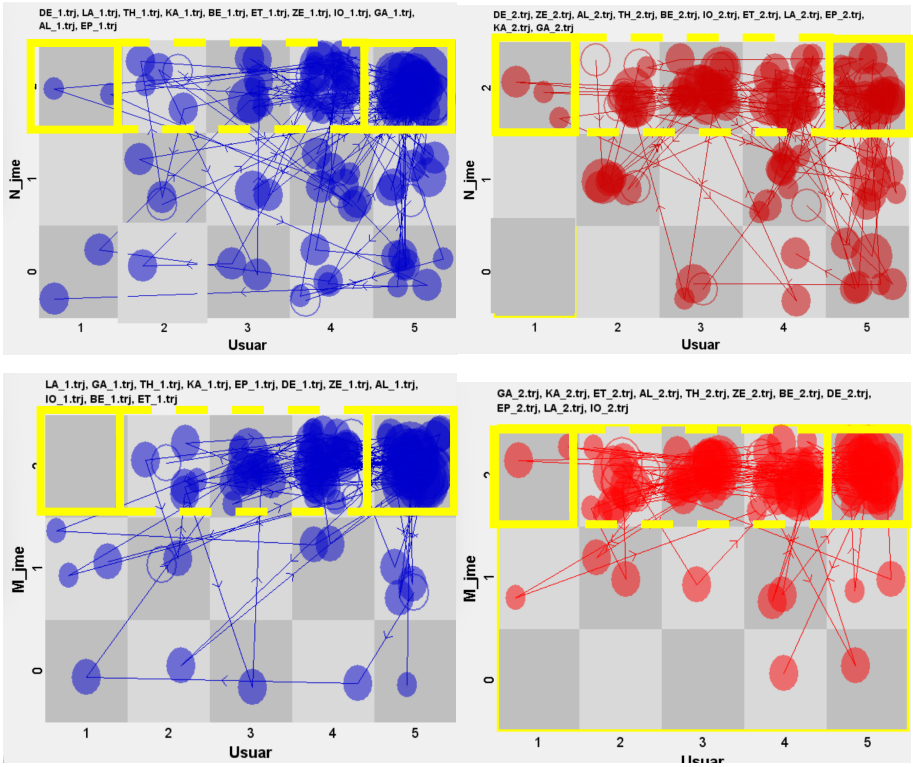
Specifically in the case of the child, there is greater dispersion in holding the device ($Z = -2.50$, $p = .012$) while using the 'non-productive app', although the average duration per event in the different quadrants is similar ($Z = -1.689$, $p = .091$). When applying the same analysis for the mother, it is noted that, as with the child's JME, there is greater dispersion ($Z = -2.091$, $p = .037$) while using the 'non-promoting app' in holding the device, although the average duration per event in the different quadrants is similar ($Z = -1.478$, $p = .139$).

Thus, these results would indicate that the strategy of varying who holds the device, although not how long the device is held, would help maintain joint use in apps that have not been designed for it.

The analytical approach previously described was replicated to examine the 'main user' variable. It is anticipated that in the use of the JME-promoting app, children can maintain productive JME, even if they concentrate on the exclusive use of the MD; on the other hand, with the non-promoting JME app, the exclusive use by the child could capture and focus their attention extremely, causing them to lose focus on the other participant, disabling co-use. Thus, in this condition, it would be more beneficial for achieving productive JME to share some degree of manipulation with the device.

With this working hypothesis, three areas have been individualized in the top row of the Grid, in such a way that the exclusive use of the mother, shared use between both participants, and exclusive use of the child are compared. In this representation, three sub-areas were considered: the upper left quadrant represents exclusively maternal use, the upper right quadrant represents exclusively child use, while the upper middle quadrants account for a shared area of who mainly uses the MD. This strategy allows for comparisons both between subjects and within tasks.

*Figure 7. 'Main user' Grid, for childs an mothers*




Note: Productive app (left), non-productive app (right).

As shown in Table 16, the median number of events and the duration per event in the quadrants of the three usage categories (exclusive use by the mother, shared use, exclusive use by the child) were compared when using the JME-promoting app versus the non-promoting JME app. The results indicate that there are no significant differences between the applications. However, it is noteworthy that children remain in exclusive use of the MD for longer periods in the JME-promoting app ($p$ = .05).

*Table 16. Differences by app used in the 'main user' of the MD.*

| Participant | Record | Main user | Productive app JME-MD | | Nonproductive app JME-MD | | Group comparation | |
|---|---|---|---|---|---|---|---|---|
| | | | Md | IQR | Md | IQR | Z | *p* |
| Child JME | Event | Exclusive mother | $0_a$ | 0 | $0_a$ | 1 | -.577 | .564 |
| | | Share use | $2_b$ | 2 | $4_b$ | 4 | -1.058 | .29 |
| | | Exclusive child | $2_b$ | 3 | $2_c$ | 2 | -1.039 | .299 |
| | Duration per event | Exclusive mother | $0_x$ | 0 | $0_x$ | 30 | 1.732 | .083 |
| | | Share use | $51_y$ | 40 | $60_y$ | 32.86 | -.837 | .402 |
| | | Exclusive child | $84_y$ | 30 | $60_y$ | 30 | -1.962 | .05 |
| Mother JME | Event | Exclusive mother | $0_a$ | 0 | $0_a$ | 0 | -1.414 | .157 |
| | | Share use | $3_b$ | 3 | $4_b$ | 4 | -1.081 | .28 |
| | | Exclusive child | $3_b$ | 2 | $2_c$ | 2 | -1.354 | .176 |
| | Duration per event | Exclusive mother | $0_a$ | 0 | $0_a$ | 0 | -1.342 | .180 |
| | | Shared use | $60_b$ | 60 | $75_b$ | 25.71 | -1.274 | .203 |
| | | Exclusive child | $90_b$ | 45 | $80_b$ | 40 | -.837 | .402 |

*Note: The subscripts indicate intra-task differences*

When performing the intra-task comparison, the Friedman test indicates that there are differences in the median number of events ($\chi^2(2, N = 11) = 11.854$, $p < .003$) and the duration per event ($\chi^2(2, N = 11) = 15.476$, $p < .001$), depending on who acts as the main user when the child is engaged in productive JME while interacting with the JME-promoting app. It is observed that mothers had fewer events ($Z = -2.773$, $p = .006$), and spent less time ($Z = -2.812$, $p = .005$) as exclusive users than when they shared the MD. However, there were no differences either in the median number of events ($Z = -.257$, $p = .797$), or in the

duration of these events (Z = -1.25, $p$ = .211), when comparing shared use to exclusive use by the child.

When performing the same previous comparison (intra-task), but this time considering 'main user' with maternal JME, taking into account the three subcategories of user (exclusive mother, shared, exclusive child), the results displayed in Table 16 show that in the case of the JME-promoting app, there are differences in the median number of events ($\chi^2(2, N = 11) = 17.59$, $p < .001$) and in the duration of these events ($\chi^2(2, N = 11) = 15.674$, $p < .001$) depending on who acts as the main user. The specific comparison points out that mothers had fewer events (Z = -2.773, $p$ = .006), and a shorter duration per event (Z = -2.812, $p$ = .005) as exclusive users than when they shared the MD. A different result was observed when comparing shared use to exclusive use by the child, where there were no differences either in the median number of events (Z = -.257, $p$ = .797), nor in the duration of these events (Z = -1.25, $p$ = .211).

In the case of the non-promoting JME app, the results show that there are differences both in the median number of events ($\chi^2(2, N = 11) = 14.244$, $p < .001$) and in the duration per event ($\chi^2(2, N = 11) = 10.680$, $p < .005$), depending on who acts as the main user when the child is engaged in productive JME. Specifically, the comparison indicates that mothers had fewer events (Z=-2.821, $p$ = .005), and spent less time (Z = -2.666, $p$ = .008), as exclusive users than when they shared the device. Furthermore, there were differences in the median number of events when comparing shared use versus exclusive use by the child (Z = -2.102, $p$ = 0.036), interpreted as the MD being shared more frequently by the participants than used exclusively by the child, although there are no differences in the duration of these events (Z = -0.536, $p$ = .592).

When performing the same previous comparison, but considering the productive maternal JME with this same application, the results shown in Table

16 indicate that in the case of the non-promoting JME app, there are differences in the median number of events ($\chi^2(2, N = 11) = 18.20$, $p < .001$) and in the duration of these events ($\chi^2(2, N = 11) = 15.073$, $p < .001$) depending on who acts as the main user. The comparison indicates that mothers had fewer events (Z=-2.952, $p$= .003), and spent less time (Z=-2.937, $p$ = .003) as exclusive users than when they shared the MD. A different result was observed when comparing shared use versus exclusive use by the child, where there were significant differences in the median of events (Z=-2.439, $p$ =.015), although not in the duration of these events (Z=-.816, $p$ =.415). This is interpreted as the MD being shared more often by the participants than it was used exclusively by the child.

## Discussion and Conclusions

The objective of this body of research is to advance the level of understanding of the predictors of co-use of mobile devices by the preschool population. On one hand, the relation of the beliefs that mothers have about the use of MDs was explored. On the other, it analyzes how the design characteristics of the applications used in co-use sessions impact the productivity of the JME-MD session.

The main findings related to the research questions are reviewed below.

Regarding the first question about the frequency with which mothers and children engage in instances of JME-MD, it was necessary to explore the use of devices by each participant, specifically to understand the use of MDs within the family context.

Mothers surpass their children in the time allocated to using MDs individually, where children show greater use in the evening (3 PM to 9 PM). When exploring the time of MD use developed by the mothers, by the children, and jointly, it is noted that there is individual use by the mothers that exceeds the individual use of the children; while the individual use by the mothers or their children, are greater than the proportion of time devoted to co-use.

In consideration of the activities developed by mother-child dyads on MDs jointly, entertainment activities achieve greater use (such as watching videos and listening to music), followed by tasks related to sociability and community (e.g., making video calls and calling by phone), while most of the participants acknowledged not engaging in joint use with playful content, whether these are motivated by learning promotion or purely for fun. This result is notable as it points out that mothers do not participate in instances of joint reading or playing games

together with their preschool-aged children. Comparing this result with the literature, in an international context, Marsh et al. (2015) reported that the use of MDs under adult supervision reaches 57% and includes activities aimed at distraction, play, and educational purposes, but without distinguishing the specific percentage in each area or activity. Regarding the information available at the national level, the recent study Kids online (UNICEF et al., 2024) showed that the preferred activities developed by the youngest children in the sample (9 to 10 years old) were focused on entertainment, followed by informal learning, social/community relations, and study. Although the data presented in the literature do not allow for a strict comparison, they are consistent with the findings of the current study, where the main activity developed by mothers and children, linked to distraction and entertainment, is highlighted.

Additionally, the results of this exploration indicate that approximately 3.2% of the surveyed population states they do not co-use MDs on weekdays, and 3.7% during weekends. This indicator is related to the findings of Wartella and colleagues (2014), who reported that 8% of their sample never used MDs jointly. The comparison allows us to hypothesize that the greater penetration of technologies in preschool homes, reflected both in the availability of an MD at home and in the early ownership of these devices (UNICEF et al., 2024), makes it possible to consider the MD to develop joint use in a significant percentage of the population. However, there are still no comparative statistics on the co-use of MDs and other traditional media in the Chilean preschool segment, suggesting the need for future research to better understand the dynamics of media co-use in this specific population.

It is important to highlight that the responses related to retrospective use could be influenced by expectations, social desirability, and an underestimation of the time spent in front of media (Kim, 2013, Rosenberg et al., 2002), a situation that could be overcome in future research by creating daily recording strategies

that allow for a more reliable and extended estimation of time over the week, especially when addressing a phenomenon of joint use. Barr et al. (2020) have developed a comprehensive system for measuring family media exposure and its contextual factors that addresses these demands (CAFE tools). This system integrates a comprehensive questionnaire on parental attitudes, practices, and household characteristics regarding media use (Media Assessment Questionnaire – MAQ), an online time-use diary that provides detailed records of daily activities, including information on the content and context of media use (Time-use diary – TUD), and the use of the "Chronicle" app, which allows the mobile device to record the duration, frequency, time of day, type of app (e.g., email, phone, social media, educational), and the app's status (foreground vs. background, screen on vs. screen off). Future research in this area could use the CAFE tools to improve the reliability of collected data.

The second question linked to the first study refers to the possible impact of sociodemographic variables, media use, and maternal beliefs on the development of JME-MD sessions. The gathered results allow us to assert that younger mothers tend to make greater use of MDs, and that this use positively influences a greater joint use of MDs. This result aligns with what was reported by Wartella et al. (2014), who found a negative relationship between maternal age and the development of co-use practices with MDs.

Another element relates to the relationship between educational level and the occurrence of JME-MD. The working hypothesis considered that there would be a relationship between maternal educational level and the probability of developing joint use with MDs, such that mothers with a highest educational level would report greater joint use of MDs. The results of this research do not support this hypothesis.

Before discussing the relationship between beliefs and joint use, it is important to note that previous research primarily investigated parental beliefs about the use of technology by children, rather than exploring specifically the beliefs about joint use (Wood et al., 2016). Their results indicate that beliefs about the positive impact on child development secondary to the use of technologies coexist with concerns and fears about such use (McCloskey et al., 2018). In the case of this research, although items were constructed to specifically explore co-use, the analyses performed on the questionnaires show that maternal beliefs tend to highlight conditions that inhibit co-use (digital gap) or do not consider an active participation of the mother in child use (use of MDs as child distraction). In response to items that explicitly inquired about a joint experience, these did not emerge as a factor, being one more element of the beliefs that envision a positive impact of technological competencies on the future of children. Thus, it seems that beliefs related to the use of MDs inherently based on the idea of individual use, and not as a medium that can be used by two or more users, in contrast to co-use with traditional media such as television or books.

The results show that mothers harbor coexisting discrepant beliefs. On one hand, mothers value the potential benefits of devices in learning and child development, where they have beliefs that relate the use of MDs to academic development more than to daily life skills, yet they adhere to beliefs that point to MDs as a tool for distraction. This is consistent with the concept of the "pass-back effect" developed by Chiong and Shuler (2010), who describe the practice of handing over the MD for the purpose of child distraction, allowing adults to engage in other activities.

A particular element is observed in the relationship between the mother's education and her beliefs about the use of MDs. In the results, participants with a university level of education or higher presented more negative beliefs towards the development of daily life skills, the concept of "my child and I are part of a

digital future," and a lower belief regarding a digital gap, compared to mothers with a mandatory or lower level of education. This result could reflect that, given the higher cultural capital of the mothers, they tend to underestimate the importance of using devices for child development, in favor of providing meaningful experiences that are not necessarily mediated by technology. However, further research is needed to confirm this special point as international literature shows a contrary trend (Bourha et al., 2024).

Additionally, the first study developed sought to link demographic variables, such as the mother's age and educational level, the time of individual use of MDs by the mother and the child, beliefs about the impact of MDs on child development, and beliefs about joint use with the time of JME-MD. The results show that only the time of MD use by the children and maternal belief in the benefits of MDs in the development of life skills act as predictors of JME-MD.

Finally, the relationship of the same variables just described was analyzed with the frequency of co-use in different types of leisure, entertainment, communication with others, and both educational and non-educational playful activities. From these results, the activities of joint digital reading co-use, and the use of playful and educational applications stand out, since their co-use is related to various maternal beliefs, unlike what was previously reported regarding the time they spend co-using an MD, supporting the hypothesis proposed. In this sense, there is greater co-use of these activities when mothers believe that the use of MDs will have positive consequences for the development of academic and everyday life skills in their children, as well as the belief that both are part of a digital future; and they consider that there is a smaller digital gap and are less willing to believe that MDs are useful for distracting their children. These three specific joint use activities are explicitly or implicitly related to a specific motivation and/or contribution to child development (reading and playing), capturing areas of maternal concern (Wartella et al., 2014; Wood et al., 2016). Therefore, by

exploring the beliefs linked to co-use in a global way (e.g., “time of co-use”) without considering the content of the activity, the phenomenon would not be adequately captured. Seen in this way, this result confirms the conception of various researchers (Guernsey, 2013; Lauricella et al., 2017), who advocate that research should move away from just focusing on the medium itself, and focus on the characteristics of the child, the content of the media activity, and the context in which it is used.

Regarding the second study, its goal was to explore JME-MD between mothers and children, using applications together that, due to their design characteristics, could either facilitate or hinder a productive relationship (promoting apps vs non-promoting apps), i.e., significantly impacting the development of the participants. The results of the experiment showed no differences in the productivity of joint use depending on the app used. This outcome, although unexpected considering the theories by Takeuchi and Stevens (2011), could be due to various factors.

A key aspect to consider is how Takeuchi and Stevens (2011) conceptualize JME and productive JME through design principles. These principles emerge from theoretical discussions and case studies and were enriched with elements from active learning strategies. While most of these principles can be captured through observation and subsequent coding of recorded co-use media experiences, they also recognize factors that go beyond the immediate time and space of the specific interaction between children and their mothers during joint use sessions. For example, although it was possible to observe and record the levels of engagement and scaffolding strategies deployed by the participants of the experimental sessions, the 'boundary crossing' design principle, which uses transmedia narratives to connect past and future experiences of the child, requires a broader and more contextual analysis that cannot be captured in the same interaction, but rather demands greater temporal

and contextual attention. This presents a challenge in operationalizing some principles for analysis in experimental designs, indicating that research methods may need adaptations to encompass the complexity of these design principles.

The absence of observed differences between the experimental groups may also be influenced by the design principle known as 'Mutual engagement' (Takeuchi & Stevens, 2011). This principle proposes that assigning specific roles within the tasks of an app can ensure that all participants face appropriate challenges and remain entertained, thus increasing their engagement with the application. In our experimental design, we compared applications that, although both contemplated a single role of engagement with the task, varied in their adherence to design principles. Introducing a more differentiated role assignment among the applications used in the experimental situation by mothers and children could have introduced additional methodological complications, thus making comparisons between groups more difficult.

A third explanation for our results lies in that the experimental condition was specifically designed to foster active and positive participation of the dyads during the session. The instructions encouraged mothers and children to interact with the applications as they would normally do. However, being recorded could have motivated mothers to appear more involved in ensuring the success of the interaction, possibly concealing behaviors that might be observed in more ecological and representative experimental scenarios of everyday life at home. Upon detailed analysis of the dyads' behavior, no significant differences were found in overall participation during the session. However, when making specific comparisons related to the handling and holding of the device, differences did emerge. When the application did not promote joint use, mothers intervened more actively, holding, and manipulating the device. Conversely, in applications designed for joint use, children took on more leading roles, handling the device while mothers facilitated play. This indicates that the design features of the app

do significantly influence the dynamics of interaction between mothers and children, promoting more intense mother collaboration in applications less oriented towards joint use.

Finally, there were some limitations in this study. A significant limitation of this study is that the results are specific to a convenience sample composed exclusively of mothers and preschool children in the Chilean context. This could restrict the generalization of our findings to other demographic groups and cultural contexts. A second limitation is that Study 1 has a correlational scope, which does not allow for causal assertions in the relationships found.

Additionally, the study focused only on interactions between mothers and children, omitting the possible influence of fathers in the co-use of mobile devices. Specifically, recent research shows that Chilean fathers are more likely than mothers to believe in the positive impact of technology-mediated play activities in promoting their children's positive development (Aldoney et al., 2022). Therefore, it is crucial to expand the objectives of future research to include a more stratified and diverse sample that incorporates both mothers and fathers, which could provide a more complete view of the co-use dynamics with preschool children. Another significant limitation is that the research did not consider significant variables of the participating mothers and children, such as their parental involvement patterns or child temperament, introducing relevant variables linked to individual susceptibility as expressed by the model of Valkenburg and Peter (2013). Indicators such as those mentioned would strengthen this study and should be considered in future instances. As strengths, firstly, the contribution of this research in addressing a still nascent field of research concerning digital play, specifically in dyadic instances of joint use with MD, is highlighted. Another notable strength of this research is the use of GridWare, an exceptionally useful software tool for the dynamic visualization of social interactions. Although its application has been previously explored in play contexts, as demonstrated by

the study of Hong et al. (2012), its use in the analysis of co-use sessions with MD has enabled the identification of interaction patterns and dynamics that would be difficult to discern with other methodologies. GridWare's ability to detail and visualize the sequence and structure of interactions in real-time has provided valuable insights into how mothers and their children interact when using technologies together, significantly enriching the results and conclusions of this study.

In summary, this research has explored variables that influence participation and the development of co-use instances with mobile devices, revealing complex dynamics that are shaped both by individual characteristics of the participants as well as by the design of the applications used. It was observed not only that a large percentage of the evaluated population engages in co-use activities with these devices, with a marked emphasis on entertainment, which dominates the joint activities, but also that there is limited participation in educational or playful activities. These results underscore the need to promote a more balanced use of MDs in the family context and, together with the future promotion of co-use practices, to maximize the benefits of using MDs in the preschool segment.

Maternal beliefs about the use of technology have shown to have a significant impact on how co-use is conducted, with a notable emphasis on distraction rather than on collaborative learning. This suggests that educational interventions should focus on changing perceptions and increasing awareness about the benefits of interactive and educational use of technology mediated by adult warmth and involvement.

From the standpoint of application design, the results indicate that design can significantly influence how mothers and children interact with devices. Applications that do not actively promote joint use tend to provoke greater

intervention and participation by mothers, while those designed to foster shared interaction allow children to take on more active roles. This emphasizes the importance of considering how design features can facilitate or inhibit productive interactions.

Lastly, this study raises critical questions for future research, especially in terms of developing more effective strategies to integrate technologies into family routines in a way that enhances development and learning. It is imperative that future studies continue to explore these dynamics in broader contexts and with experimental designs that allow for a clearer differentiation of the types of interaction that occur in a dyadic context of MD use.

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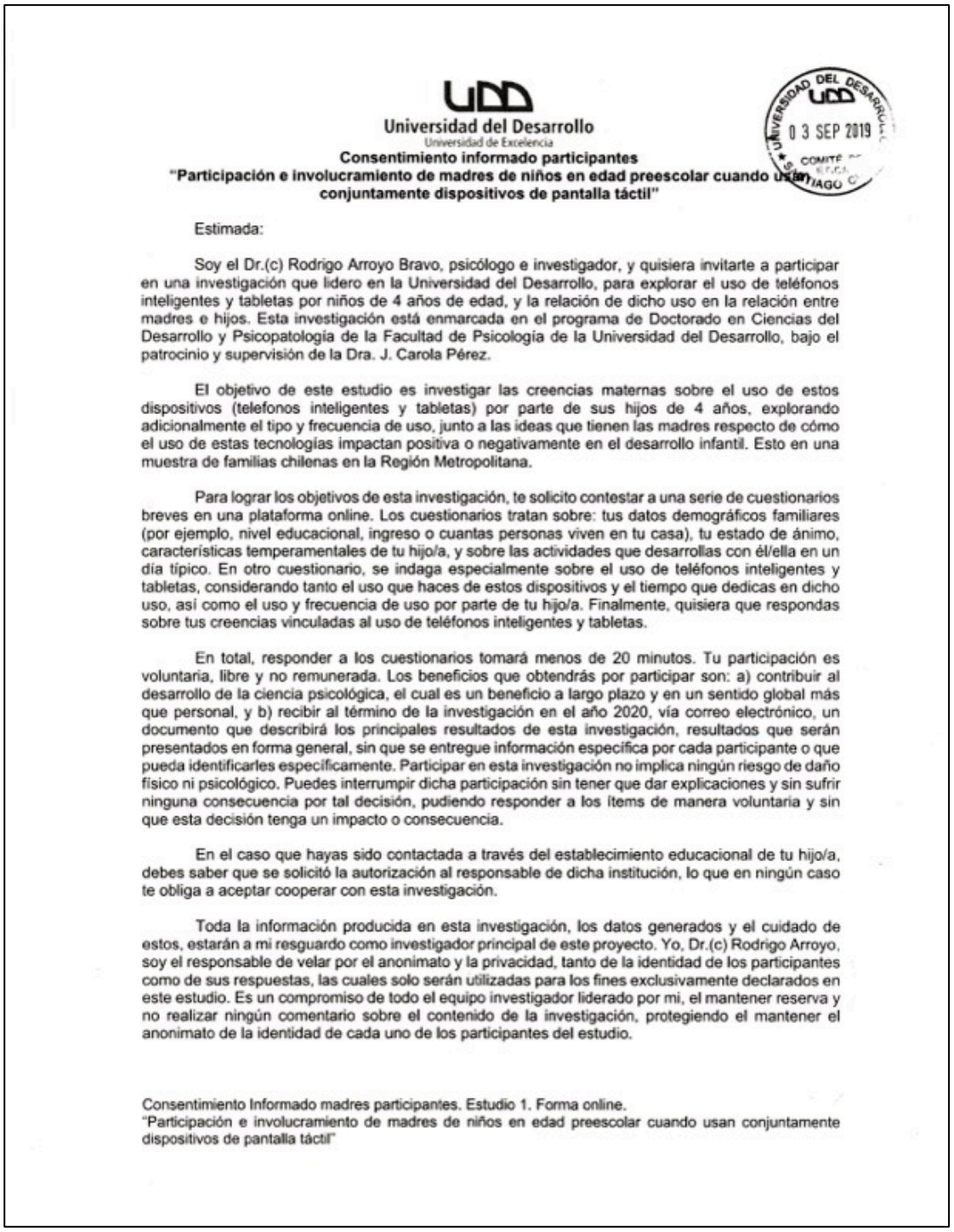
# Annex

## Annex A. Inform consent, study 1.



Universidad del Desarrollo
Universidad de Excelencia



**Consentimiento informado participantes**
**"Participación e involucramiento de madres de niños en edad preescolar cuando usan conjuntamente dispositivos de pantalla táctil"**

Estimada:

Soy el Dr.(c) Rodrigo Arroyo Bravo, psicólogo e investigador, y quisiera invitarte a participar en una investigación que lidero en la Universidad del Desarrollo, para explorar el uso de teléfonos inteligentes y tabletas por niños de 4 años de edad, y la relación de dicho uso en la relación entre madres e hijos. Esta investigación está enmarcada en el programa de Doctorado en Ciencias del Desarrollo y Psicopatología de la Facultad de Psicología de la Universidad del Desarrollo, bajo el patrocinio y supervisión de la Dra. J. Carola Pérez.

El objetivo de este estudio es investigar las creencias maternas sobre el uso de estos dispositivos (telefonos inteligentes y tabletas) por parte de sus hijos de 4 años, explorando adicionalmente el tipo y frecuencia de uso, junto a las ideas que tienen las madres respecto de cómo el uso de estas tecnologías impactan positiva o negativamente en el desarrollo infantil. Esto en una muestra de familias chilenas en la Región Metropolitana.

Para lograr los objetivos de esta investigación, te solicito contestar a una serie de cuestionarios breves en una plataforma online. Los cuestionarios tratan sobre: tus datos demográficos familiares (por ejemplo, nivel educacional, ingreso o cuantas personas viven en tu casa), tu estado de ánimo, características temperamentales de tu hijo/a, y sobre las actividades que desarrollas con él/ella en un día típico. En otro cuestionario, se indaga especialmente sobre el uso de teléfonos inteligentes y tabletas, considerando tanto el uso que haces de estos dispositivos y el tiempo que dedicas en dicho uso, así como el uso y frecuencia de uso por parte de tu hijo/a. Finalmente, quisiera que respondas sobre tus creencias vinculadas al uso de teléfonos inteligentes y tabletas.

En total, responder a los cuestionarios tomará menos de 20 minutos. Tu participación es voluntaria, libre y no remunerada. Los beneficios que obtendrás por participar son: a) contribuir al desarrollo de la ciencia psicológica, el cual es un beneficio a largo plazo y en un sentido global más que personal, y b) recibir al término de la investigación en el año 2020, vía correo electrónico, un documento que describirá los principales resultados de esta investigación, resultados que serán presentados en forma general, sin que se entregue información específica por cada participante o que pueda identificarles específicamente. Participar en esta investigación no implica ningún riesgo de daño físico ni psicológico. Puedes interrumpir dicha participación sin tener que dar explicaciones y sin sufrir ninguna consecuencia por tal decisión, pudiendo responder a los ítems de manera voluntaria y sin que esta decisión tenga un impacto o consecuencia.

En el caso que hayas sido contactada a través del establecimiento educacional de tu hijo/a, debes saber que se solicitó la autorización al responsable de dicha institución, lo que en ningún caso te obliga a aceptar cooperar con esta investigación.

Toda la información producida en esta investigación, los datos generados y el cuidado de estos, estarán a mi resguardo como investigador principal de este proyecto. Yo, Dr.(c) Rodrigo Arroyo, soy el responsable de velar por el anonimato y la privacidad, tanto de la identidad de los participantes como de sus respuestas, las cuales solo serán utilizadas para los fines exclusivamente declarados en este estudio. Es un compromiso de todo el equipo investigador liderado por mi, el mantener reserva y no realizar ningún comentario sobre el contenido de la investigación, protegiendo el mantener el anonimato de la identidad de cada uno de los participantes del estudio.

Consentimiento Informado madres participantes. Estudio 1. Forma online.
"Participación e involucramiento de madres de niños en edad preescolar cuando usan conjuntamente dispositivos de pantalla táctil"


Finalmente, como investigador principal, me comprometo a responder dudas o comentarios referidos a esta investigación o a tu participación. Si deseas más información sobre el estudio o bien tienes alguna duda, puedes contactarme al teléfono +56223279273 o bien al correo rarroyob@udd.cl. Además, en caso de cualquier otra consulta sobre tus derechos como participante de este estudio, puedes contactar al Dr. Francisco Cerić, Director del Comité de Ética de la Universidad del Desarrollo, al teléfono +56 2 3279443 (Dirección de Investigación UDD – Santiago), o bien al e-mail fceric@udd.cl, en caso de algún potencial conflicto.

En nombre del equipo de investigación y del mío propio, agradezco tu tiempo. Si estas de acuerdo con participar en esta investigación, te pido que manifiestes dicha intención respondiendo a la pregunta que está a continuación, junto con entregar tu dirección de correo electrónico. Una copia de este documento será enviada a tu correo electrónico a modo de respaldo.

¿Aceptas participar en esta investigación según los términos descritos en este consentimiento?

☐ SI , mi dirección de correo electrónico es la siguiente _____
☐ NO

Consentimiento Informado madres participantes. Estudio 1. Forma online.
"Participación e involucramiento de madres de niños en edad preescolar cuando usan conjuntamente dispositivos de pantalla táctil"

## Annex B. Sociodemographic data questionnaire.

| N | Question | Response options |
|---|---|---|
| 1 | Write your email address as a way to sign your response regarding participation in this study | -- |
| 2 | How old are you? | -- |
| 3 | What is your current marital status? | Single<br>Married<br>Civil union<br>Separated/ divorced<br>Cohabiting /live together<br>Widowed |
| The following questions refer to your son or daughter aged between 4 and 6 years. If you have multiple children of this age, please answer thinking of the one whose name appears first in alphabetical order. | | |
| 4 | What is your child's first name? | -- |
| 5 | Has [Q04] ever used/handled a mobile device (smartphone and/or tablet)? (Consider watching or recording a video, playing an app, taking pictures, etc., as usage.) | Yes<br>No |
| 6 | Has [Q04] ever been diagnosed with a disability or any educational need? | No<br>Yes, due to hearing difficulties<br>Yes, due to visual difficulties<br>Yes, due to learning difficulties<br>Yes, due to a motor disorder<br>Yes, due to intellectual disability<br>Yes, due to communication disorders (Autism/Asperger)<br>Other |
| 7 | What is [Q04]'s date of birth? | DD/MM/AAAA |
| 8 | [Q04] is | Girl<br>Boy |
| 9 | What is your current educational level (or the highest level completed)? | Incomplete Elementary Education<br>Complete Elementary Education<br>Incomplete Secondary Education (includes technical secondary) |

| | | |
|---|---|---|
| | | Complete Secondary Education (includes technical secondary) |
| | | Incomplete Technical Education |
| | | Complete Technical Education |
| | | Incomplete University Education |
| | | Complete University Education |
| | | Master's / Doctorate |
| 10 | What is approximately the monthly family income? (Consider the salary/income of all the people living in your home who contribute to the expenses). | Less than $300.000 |
| | | Between $300.001 and $500.000 |
| | | Between $500.001 and $1.000.000 |
| | | Between $1.000.001 and $2.500.000 |
| | | Between $2.500.001 and $4.000.000 |
| | | More to $4.000.001 |
| | | I don't know/I'm not sure |

Thank you very much for your interest and participation in this study on the use of smartphones and tablets by preschool-aged children.
To begin, we would like you to answer the following questions:

## Annex C. Use of MD's within the Family Context Questionnaire

The following questions aim to obtain answers related to the use of mobile devices, namely, the use of smartphones and tablets.

• By smartphones, we understand mobile devices with a touchscreen, which allow sending emails, sending messages, watching videos, downloading and using various apps, or browsing the internet on them. The most popular smartphones are the iPhone, a Samsung Galaxy phone, or another Android device..
• Tablets are similar to a mobile computer, but larger than a smartphone. They allow sending emails, sending messages, watching videos, downloading and using various apps, or browsing the internet on them. Some of the most well-known tablets are: iPad, Kindle Fire, Galaxy Tab, or another similar one.

| | | |
|---|---|---|
| 11 | What mobile devices do you have? | Smartphone<br>Tablet<br>Both<br>None |
| 12 | And [Q04], what devices does he or she have or use? | Smartphone<br>Tablet<br>Both<br>None |
| 13 | What age did [Q04] start using or playing with a mobile device? | Has no used to this date<br>Before 6 months<br>Between 6 months – 11 months<br>Between 1 year – 1 year 4 months<br>Between 1 and a half years – 1 year 11 months<br>Between 2 years – 2 years 5 months<br>Between 2 and a half years – 2 years 11 months<br>Between 3 years – 3 years 5 months<br>Between 3 and a half years – 3 years 11 months<br>Between 4 years – 4 years 5 months<br>Between 4 and a half years – 4 years 11 months<br>Between 5 and a half years – 5 years 11 months<br>During the 6th year |
| 14 | Have you ever downloaded an application (app or game) especially for [Q04] to use? | Yes<br>No |

Below, there are a series of questions aimed at finding out how much time you spend using mobile devices (such as smartphones and tablets).

• When answering these questions, consider the time spent on activities such as: watching videos (YouTube, Netflix, etc.), viewing and participating in social networks (Instagram, Facebook, Twitter, Pinterest, among others), playing with apps, using apps for work/study, talking on the phone, reading and sending emails, etc.

The following questions aim to identify how many hours you spend using mobile devices.

| | | |
|---|---|---|
| 15 | Please mark at which times of the day you use mobile devices: | Before 9AM (Breakfast)<br>Between 9AM and 12 noon (in the mornings)<br>Between 12 and 2PM (lunch hour)<br>Between 4 and 6PM (during the afternoon)<br>Between 6PM and 8PM (Tea/dinner/near bedtime)<br>After 8PM<br>I do not use them regularly |
| 16 | Thinking about your mobile use on labor days... How many hours a day do you spend using a mobile device? | I do not use<br>Less than hour<br>Around 1 hour<br>Around 2 hours<br>Around 3 hours<br>Around 4 hours<br>Around 5 hours<br>More than 6 hours a day |
| 17 | And on weekends, how many hours a day do you spend using a mobile device? | I do not use<br>Less than hour<br>Around 1 hour<br>Around 2 hours<br>Around 3 hours<br>Around 4 hours<br>Around 5 hours<br>More than 6 hours a day |
| 18 | At what times of the day does your child use mobile devices? | Before 9AM (Breakfast)<br>Between 9AM and 12 noon (in the mornings)<br>Between 12 and 2PM (lunch hour)<br>Between 4 and 6PM (during the afternoon)<br>Between 6PM and 8PM (Tea/dinner/near bedtime)<br>After 8PM<br>She/he do not use them regularly |

| | | |
|---|---|---|
| 19 | Thinking about [Q04], during the workweek... How many hours a day does your child spend using a mobile device? | Does not use<br>Less than hour<br>Around 1 hour<br>Around 2 hours<br>Around 3 hours<br>Around 4 hours<br>Around 5 hours<br>More than 6 hours a day |
| 20 | And on weekends, how many hours a day your child spend using a mobile device? | Does not use<br>Less than hour<br>Around 1 hour<br>Around 2 hours<br>Around 3 hours<br>Around 4 hours<br>Around 5 hours<br>More than 6 hours a day |

Frecuencia de uso preescolar

Thinking about the time [Q04] spends using a mobile device, how often do you think they engage in some of the following activities?

| | | |
|---|---|---|
| 21 | Listens to music or watches music videos | Never<br>Rarely<br>Sometimes<br>Often<br>Frequently |
| 22 | Watches videos or television content (e.g., Netflix / YouTube) | Never<br>Rarely<br>Sometimes<br>Often<br>Frequently |
| 23 | Reads (views) a digital children's book | Never<br>Rarely<br>Sometimes<br>Often<br>Frequently |
| 24 | Takes photos (views/edits them) or makes videos | Never<br>Rarely<br>Sometimes<br>Often<br>Frequently<br>Never |

| | | |
|---|---|---|
| 25 | Plays with a game or app specifically dedicated for that purpose | Rarely<br>Sometimes<br>Often<br>Frequently<br>Never |
| 26 | Learns with a game or app designed to teach something | Rarely<br>Sometimes<br>Often<br>Frequently<br>Never |
| 27 | Contacts other people through a social network (e.g., messages, chat, etc.) | Rarely<br>Sometimes<br>Often<br>Frequently<br>Never |
| 28 | Talks with other people via video calls (e.g., Skype, Facetime, etc.) | Rarely<br>Sometimes<br>Often<br>Frequently<br>Never |
| 29 | Talks on the phone with other people | Rarely<br>Sometimes<br>Often<br>Frequently<br>Never |

## Annex D. Beliefs about the use of mobile device in child development questionnaire (BMD-CD)

The following questions are to learn about some of your beliefs regarding the use of mobile devices (smartphones and tablets).

In general, for children of [Q04]'s age, do you believe that mobile devices have a POSITIVE, NEUTRAL, or NEGATIVE effect on their...

| | | |
|---|---|---|
| 41 | ... gross motor skills (such as running, jumping, etc.) | Very negative<br>Negative<br>Neutral<br>Positive<br>Very positive |
| 42 | ... basic reading skills (learning letters, syllables, vocabulary, etc.) | Very negative<br>Negative<br>Neutral<br>Positive<br>Very positive |
| 43 | ... basic mathematical skills (learning numbers, geometric figures, etc.) | Very negative<br>Negative<br>Neutral<br>Positive<br>Very positive |
| 44 | ... basic language-related skills (learning new words, the sound of letters, etc.) | Very negative<br>Negative<br>Neutral<br>Positive<br>Very positive |
| 45 | ... science-related learning (understanding the world, history, nature, etc.) | Very negative<br>Negative<br>Neutral<br>Positive<br>Very positive |
| 46 | ... social skills (learning to relate to others, good manners, etc.) | Very negative<br>Negative<br>Neutral<br>Positive<br>Very positive |

| | | |
|---|---|---|
| 47 | ... emotional regulation (managing frustration, calming down in the face of stress, etc.) | Very negative<br>Negative<br>Neutral<br>Positive<br>Very positive |
| 48 | ... the ability to pay attention and concentrate. | Very negative<br>Negative<br>Neutral<br>Positive<br>Very positive |
| 49 | ... hand-eye coordination (making fine movements like pointing, dragging with the finger, etc.) | Very negative<br>Negative<br>Neutral<br>Positive<br>Very positive |
| 50 | ... the ability to solve problems and use logical thinking | Very negative<br>Negative<br>Neutral<br>Positive<br>Very positive |
| 51 | ... artistic skills (such as painting, drawing, creating, etc.) | Very negative<br>Negative<br>Neutral<br>Positive<br>Very positive |

## Annex E. Beliefs on Joint Media Engagement on mobile devices questionnaire (BJME-MD)

What is your level of agreement/disagreement with the following statements?

| | | |
|---|---|---|
| 52 | I think [Q04][1] feels comfortable and confident using a mobile device. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 53 | One way to punish children when they behave inappropriately is to suspend their use of mobile devices. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 54 | Children the age of [Q04] learn to use mobile devices on their own (they don't need someone like me to teach them). | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 55 | Mobile devices allow me to easily entertain my child. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 56 | I believe we mothers can have time to do other activities while our children use mobile devices. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 57 | Mobile devices are useful for mothers because they contain educational activities and content for [Q04]. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |

| | | |
|---|---|---|
| 58 | I believe children benefit from their mother's (or another adult's) support when using (or learning to use) an app on a mobile device for the first time | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 59 | Mobile devices allow me to calm [Q04] when he/she is agitated or upset. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 60 | A problem with mobile devices is limiting the amount of time children use them | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 61 | I feel comfortable and confident using smartphones and tablets. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 62 | I believe [Q04] is more skilled at using a mobile device compared to other children his/her age | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 63 | Tomorrow everything will be digital and technological, so mothers should encourage their children to learn to use technologies like mobile devices. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 64 | Mobile devices are so attractive to children that when they use them, they don't pay attention to what's happening around them. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |

| | | |
|---|---|---|
| 65 | Mobile devices teach children things without moms having to intervene. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 67 | When [Q04] uses a smartphone/tablet, he/she doesn't pay attention when I talk to him/her. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 68 | I believe children the age of [Q04] have a good balance between the time they spend using mobile devices and doing other activities. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 69 | Controlling the time children use mobile devices is a tool for making them behave appropriately. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 70 | A benefit of mobile devices is that they correct or reward [Q04] according to what he/she does on the screen. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 71 | When a child doesn't know how to do something on a mobile device, the app itself provides help and shows how it's done. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 72 | At the end of the day, mobile devices are just another problem in the mother-child relationship | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |

| | | |
|---|---|---|
| 73 | I believe mobile devices are a good option for entertaining [Q04] when I'm busy. | Disagree |
| | | Somewhat disagree |
| | | Neither agree nor disagree |
| | | Somewhat agree |
| | | Agree |
| 74 | Nowadays, a child who knows how to use mobile devices will have better grades in the future than those who don't know how to use them | Disagree |
| | | Somewhat disagree |
| | | Neither agree nor disagree |
| | | Somewhat agree |
| | | Agree |
| 75 | Mobile devices are so easy to use that children don't need their mothers' help to use them. | Disagree |
| | | Somewhat disagree |
| | | Neither agree nor disagree |
| | | Somewhat agree |
| | | Agree |
| 76 | I believe children can become addicted to using mobile devices. | Disagree |
| | | Somewhat disagree |
| | | Neither agree nor disagree |
| | | Somewhat agree |
| | | Agree |
| 77 | Children of [Q04]'s age know how to use mobile devices much better than their mothers | Disagree |
| | | Somewhat disagree |
| | | Neither agree nor disagree |
| | | Somewhat agree |
| | | Agree |
| 78 | I find it easier to use a mobile device than other mothers my age. | Disagree |
| | | Somewhat disagree |
| | | Neither agree nor disagree |
| | | Somewhat agree |
| | | Agree |
| 79 | I believe [Q04] knows more or has greater skills than I do in using a mobile device. | Disagree |
| | | Somewhat disagree |
| | | Neither agree nor disagree |
| | | Somewhat agree |
| | | Agree |

| | | |
|---|---|---|
| 80 | I believe children stop engaging in other more beneficial activities for their development because they are using mobile devices | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 81 | Children the age of [Q04] know how to use mobile devices because they have grown up surrounded by this technology. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 82 | I believe that mobile devices are designed to be used by only one person at a time. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 83 | When mothers and children use a mobile device together, it fosters a better relationship between them | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 84 | While mother and child use a mobile device together, mothers can be attentive to the child not damaging the device. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 85 | I believe that when mother and child use a mobile device together, it's as if the mother is encouraging the child to spend more time in front of the device. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 86 | Children learn better when they use a mobile device together with their mother than when they use it alone. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |

| | | |
|---|---|---|
| 87 | Children are more entertained when they use a mobile device with their mothers than when they use it alone. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 88 | I wouldn't know what to do if [Q04] asked me to use a mobile device together with him/her. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 89 | I believe there are no attractive apps for mothers and children to use together. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 90 | I prefer that [Q04] share other activities with me rather than using mobile devices together. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 91 | I think [Q04] prefers to use a mobile device alone rather than using it with me. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 92 | When [Q04] asks me to use a mobile device together, it's because he/she wants to share something with me. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 93 | I would not feel comfortable if [Q04] taught me 'how to do something' on a mobile device. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |

| | | |
|---|---|---|
| 94 | I find it boring to use a mobile device together with [Q04]. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 95 | The way mobile devices are used makes it difficult for two people to see what is happening on the screen at the same time. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 96 | Mothers should be much more familiar with mobile devices, so they can use them together with their children. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 97 | A positive aspect of using a mobile device together with [Q04] is that it allows me to supervise that he/she does not access inappropriate content. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |
| 98 | One way to share a moment with our children is to use mobile devices together. | Disagree<br>Somewhat disagree<br>Neither agree nor disagree<br>Somewhat agree<br>Agree |

## Annex F. Informed consent and assent, study 2

Universidad del Desarrollo
Universidad de Excelencia

**Consentimiento Informado Participantes**
**"Participación e involucramiento de madres de niños en edad preescolar cuando usan conjuntamente dispositivos de pantalla táctil"**

Estimada:

Te invitamos a participar en una investigación que estamos realizando en la Universidad del Desarrollo, de un estudio sobre el uso de teléfonos inteligentes y tabletas por niños de 4 años de edad, , y la relación de dicho uso en la relación entre madres e hijos, a cargo del psicólogo e investigador Dr.(c) Rodrigo Arroyo Bravo, perteneciente al programa Doctorado en Ciencias del Desarrollo y Psicopatología de la Facultad de Psicología de la Universidad del Desarrollo, bajo el patrocinio y supervisión de la Dra. J. Carola Pérez.

El objetivo de este estudio es investigar las creencias maternas sobre el uso de estos dispositivos (teléfonos inteligentes y tabletas) por parte de sus hijos de 4 años, y cómo estas creencias impactan en la relación e interacción entre madres e hijos cuando usan conjuntamente una tableta tipo iPad. Esto en una muestra de familias chilenas en la Región Metropolitana.

Para lograr los objetivos de esta investigación, te solicitamos contestar a una serie de cuestionarios breves en una plataforma online sobre tus datos demográficos familiares (por ejemplo, nivel educacional, ingreso o cuántas personas viven en tu casa), preguntas relativas a tu estado de ánimo, junto con otros cuestionarios sobre el temperamento de tu hijo/a y las actividades que desarrollas con él/ella. También, te pediremos que nos contestes algunas consultas sobre el uso de teléfonos inteligentes y tabletas, referidas al uso que haces de estos dispositivos y al tiempo y uso de estos dispositivos por parte de tu hijo/a. Finalmente, quisiera que nos puedas responder sobre algunas de tus creencias vinculadas al uso de teléfonos inteligentes y tabletas.

Adicional a responder a estos cuestionarios, quisiéramos que puedas usar junto a tu hijo/a una tableta tipo iPad durante 10 minutos, en una sala especialmente acondicionada para ello. Durante este tiempo, habrá dos cámaras de video que grabarán cómo ustedes interactúan (tu hijo/a y tu) mientras utilizan una aplicación especialmente diseñada para su uso con niños de la edad de tu hijo/a. por parte de madres e hijos en edad preescolar, explorando el impacto de las creencias en el uso infantil de estos dispositivos.

La duración total de tu participación junto a tu hijo/a será aproximadamente de 20 minutos. Tanto tu participación como la de tu hijo/a es voluntaria, libre y no remunerada. Los beneficios que obtendrán por participar son: a) contribuir al desarrollo de la ciencia psicológica, el cual es un beneficio a largo plazo y en un sentido global más que personal, y b) recibir al término de la investigación en el año 2020, vía correo electrónico, un documento que describirá los principales resultados de esta investigación, resultados que serán presentados en forma general, sin que se entregue información específica por cada participante o que pueda identificarles específicamente. La participación en esta investigación no implica ningún riesgo de daño físico ni psicológico. Tanto tu como tu hijo/a pueden interrumpir su participación sin tener que dar explicaciones y sin sufrir ninguna consecuencia por tal decisión.

Toda la información producida en esta investigación, los datos generados y el cuidado de estos, estarán a cargo del investigador principal de este proyecto, Dr.(c) Rodrigo Arroyo B. Él será el responsable de velar por el anonimato y la privacidad, tanto de la identidad de los participantes como de sus respuestas y los videos obtenidos, las cuales solo serán utilizadas para los fines exclusivamente declarados en este estudio. Es un compromiso de todo el equipo investigador liderado por Dr.(c) Rodrigo Arroyo, el mantener reserva y no realizar ningún comentario sobre el contenido de

la investigación, protegiendo el mantener el anonimato de la identidad de cada uno de los participantes del estudio.

Como una medida de transparencia, al finalizar el estudio, el investigador responsable ofrecerá vía correo electrónico, la posibilidad de solicitar una copia del video de la interacción madre e hijo conseguida en el marco de esta investigación.

Finalmente, el investigador principal, Dr.(c) Rodrigo Arroyo, se compromete a responder dudas o comentarios referidos a esta investigación o la participación de ambos (tu y tu hijo/a). Si deseas mas información sobre el estudio o bien tienes alguna duda, puedes hablar con el investigador principal, Dr.(c) Rodrigo Arroyo, en el teléfono +56223279273 o bien al correo rarroyob@udd.cl. Además, en caso de cualquier otra consulta sobre sus derechos como participante de este estudio, puedes contactar al Dr. Francisco Cerić, Director del Comité de Ética de la Universidad del Desarrollo, al teléfono +56 2 3279443 (Dirección de Investigación UDD – Santiago), o bien al e-mail fceric@udd.cl, en caso de algún potencial conflicto.

Como equipo de investigación, agradecemos tu tiempo y el de tu hijo/a. Si estas de acuerdo con participar en esta investigación, te pediremos que firmes al pie de este documento. Una copia de este documento será enviada a tu correo electrónico y otra será entregada impresa.

| | | | |
|---|---|---|---|
| Nombre de la madre participante | | | |
| Correo electrónico: | | @ | |
| Nombre del hijo/a: | | | |
| Fecha: | | | |

| | |
|---|---|
| Nombre del investigador principal | Rodrigo Arroyo |
| Correo electrónico | rarroyo@udd.cl |
| Firma | |

Consentimiento Informado madres participantes. Estudio 2.
"Participación e involucramiento de madres de niños en edad preescolar cuando usan conjuntamente dispositivos de pantalla táctil"

Universidad del Desarrollo
Universidad de Excelencia

**Asentimiento**

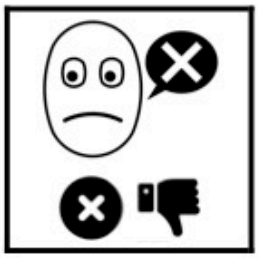
Hola. _____(nombre niño/a)!

Te invito a participar en la siguiente actividad:

1) Usar una tableta (iPad) con tu mamá.

2) Nosotros estaremos grabando durante ese rato.

¿Quieres participar?



| | |
|---|---|
| Nombre evaluador | |
| Fecha | |
| Nombre responsable del proyecto | Rodrigo Arroyo |

| | |
|---|---|
| Firma de la madre del niño/a participante | |

Asentimiento Informado Participantes de 4 años
"Participación e involucramiento de madres de niños en edad preescolar cuando usan conjuntamente dispositivos de pantalla táctil"

## Annex G. Level of compliance with principles of productive JME

| | | | Chomp  | Toca Monsters  | Kori Walk  | Thinkrolls space  | Ride whit the frog  | Miximal  |
|---|---|---|---|---|---|---|---|---|
| Mutual engagement | Partners are equally motivated to participate in the activity and find it appealing to sustain engagement throghout | 1: Low Performance 2: Average Performance 3: High Performance | 2,5 | **3** | **1,75** | 2,25 | 1,75 | 2,75 |
| Dialogic inquiry | inspire collaborating with others to make meaning of situations | | 2,5 | **2** | **1,75** | 2,75 | **2,25** | 1,75 |
| Co-creation | The app allows participants to have the opportunity to do things together, thus it is designed to promote active interaction between participants. | | 1,25 | **3** | 1,25 | 1,75 | 1 | 1,75 |
| Boundary crossing | The content presented in the app leverages the participants' past experiences, their current curiosities, and motivates interest for future experiences. | | 2,75 | **2,25** | **1,75** | 2 | **2,75** | 2 |
| Intention to develop | At least one of the participants promotes personal growth for themselves or the other participant through the activity, attending to the needs and interests of the other | | 2,5 | **2,75** | **1,75** | 2 | 1,75 | 2,25 |
| Focus on content, not control | Technical features and user interface neither distracts nor hinders interactions between partners or partners' interactions with content. | | 1,75 | **2** | **1,5** | 1,5 | 1,25 | 2,25 |
| Total | | | **13,25** | **15** | **9,75** | **12,25** | **10,75** | **12,75** |

## Annex H. Coding system

| Domain | Code | 0 | 1 | 2 |
|---|---|---|---|---|
| Engagement. Instances where participants are motivated to engage in the activity, aiming to maintain their commitment throughout, whether with the task itself or with the other participant. | **On the task.** The participant is attentive to the activity, generally keeping their visual attention on the task or the other participant | Interest is slight or absent, or disinterest in the activity is appreciated (lack of enthusiasm). Explicit refusal to participate in the task. | Moderate interest, maintains attention on the task, despite occasionally looking away from the task or the other participant. | Interest and persistence in the task at hand, evidenced both in their body language, behavior, and actions attentive to the demands of the activity (not requiring touching the screen or interacting directly with the device). |
| | **On the other.** The participant is attentive to the other member of the dyad and offers and responds to interaction demands. | During the interaction, the participant disregards the other member. They do not interact with them or direct their visual attention towards the other participant. | The participant interacts, responding verbally or gesturally to the other occasionally, directing their gaze towards the other, offering and partially responding to communicative offerings. | The participant interacts, responding verbally or gesturally to the other occasionally, directing their gaze towards the other, offering and partially responding to communicative offerings. |
| Intention to Develop. The interactions between participants show an intention to support and accompany the other participant. | **Positive content.** Interactions that promote the engagement of the other participant. Compliments, explains, asks, or reacts to the content of the activity or the other's behavior, showing interest | There is no evidence of positive content. | Positive content exists, but it is not consistently expressed throughout the segment (only reaching less than half of the observed time). | Positive content expressed throughout the segment, predominantly. |
| Focus on Content. Technical features and the user interface do | **Negative Content.** Interactions aimed at stopping or | There is no evidence of native content | There is occasional negative content during the segment, which | Negative content expressed throughout the segment, predominantly. |

| | | | | |
|---|---|---|---|---|
| not distract or hinder interactions between participants or with the content. Additionally, behaviors aimed at inhibiting or stopping the participation of the other actor are kept to a minimum. | inhibiting the participation of the other, which can be gestural or verbal. | | does not predominate in the interaction (only reaching less than half of the observed time). | |
| | **Technical interaction .** Interactions to configure or adjust the settings of the mobile device (rotation, volume, etc.). | There is no evidence of technical interactions. | There is at least one interaction involving the configuration of the MD, which distracts attention from the task or participant. | Two or more interactions involving the configuration of the DP, which distract attention from the task or participant. |

| Domain | Code | Definition | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|
| Interaction between participants and the MD. Records the context of a participant's direct engagement with the mobile device. | **Device Holding:** Indicates which participant holds the mobile device during the segment (1= The Mother exclusively to 5= The child exclusively). | Prompt indicating which participant holds the device during the segment. | Throughout the segment, the device was held by the mother. | Device holding shared between both participants, but with predominance of the mother. | Device holding shared equally between both participants during the segment. | Device holding shared between both participants, but with predominance of the child. | Throughout the segment, the device was held by the child. |
| | **Main user.** Indicates which user interacts with the device's screen during | Prompt indicating which participant interacts with the device | Throughout the segment, the mother touches and interacts with the | Although there is usage by both participants, mother-device interaction prevails over child- | Interaction and use of the screen shared between the participants. | Usage by both participants, although child-device interaction prevails over that developed | Throughout the segment, the child touches and interacts with the screen. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | the segment (1= The Mother exclusively to 5= The child exclusively). | screen during the segment. | DP screen. | device interaction. | | by the mother. | |