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A New Time-Use Diary App to Measure Parental Investments

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ABSTRACT

A New Time-Use Diary App to Measure Parental Investments*

We introduce a new app that collects 24-hour parental time diaries. To assess its validity, we leverage data from a sample of more than 500 parents with pre-school aged children. Our findings show that our tool is reliable and delivers high-quality data. By exploiting contextual information on the child's involvement and feelings during each activity performed with the parent, we construct new measures of parental investments that capture the quality of daily parent-child interactions. We analyse how these novel measures relate to alternative definitions and discuss the potential advantages of the adoption of our approach to time-use measurement in the rapidly growing field of research on the role of parental investments in child development.

JEL Classification: C81, J13, J24

Keywords: human capital formation, parents, time inputs, app-based survey

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1 Introduction

There is broad consensus in the social sciences that early childhood investments have far reaching implications for important life outcomes, such as educational attainments, labour market success, and health (e.g., Attanasio et al., 2021; Wang et al., 2021). In particular, *parental time investments* are key inputs for the formation of cognitive skills (Del Boca et al., 2014; Carneiro et al., 2015; Del Bono et al., 2016; Caetano et al., 2019; Price and Kalil, 2019; Brilli, 2022) and the prevention of behavioural issues (Cunha et al., 2010). Parental time investments are more important than money or goods investments for the production of cognitive skills of children 3-12 years old. They have also been found to be the most effective input for children aged 0-10 years old when compared to other factors such as time spent by the child using media, attending pre/after school care, or participating in educational activities without their parents (Fiorini and Keane, 2014).¹

The growing amount of scientific knowledge indicating that parent-child interactions are essential to a child’s growth and wellbeing has prompted Government initiatives aimed at improving the quality of these interactions, over the past two decades (see Conti et al., 2021 for recent evidence and Sparrow and Ayoub, 2015 and Jeong et al., 2021 for a review of the ongoing interventions). Further, programs that raise parents’ awareness on the importance of time allocation and the quality of parental time investment with the child might have a significant payoff. However, available evidence is still not conclusive, and more research is needed on the topic. A clear understanding of the most beneficial activities a parent can perform with their child would entail a detailed unpacking of time investments, and two issues arise.

First, to measure the whole spectrum of parents’ activities along the day, the most effective instrument are time-use diaries where individuals self-report events and actions occurred in a given day. Time-use diaries are more accurate and reliable than retrospective questions (Michelson, 2005; Sevilla, 2014), they discourage social desirability biases and superficial or imprecise responses, and they allow for the simultaneous collection of contextual information for each activity. However, they are also costly to collect and impose a significant burden on the respondent.

Second, there is no general agreement on how to define parental time investments. Some studies — based on parents’ time diaries — privilege the use of the total time spent with the child as a proxy for parental time investments, or focus on specific activities carried-out with the child (e.g., those who are considered to be more important for the development of the child, like reading and playing with the child). Others — based on children’s time diaries — split the time according to the level of active engagement of the parent.

¹The evidence on the effect of parental time investments on non-cognitive skills is instead more mixed (Fiorini and Keane, 2014; Baranov et al., 2020), mostly due to measurement issues and lack of data.

In this paper we propose a novel approach to parental time-use measurement, which relies on an app-based time diary. The rich set of information provided by our instrument allows us to precisely define and measure some important facets of parental time investment that would be hard to identify otherwise. We thus contribute to the literature along two main dimensions. First, we build on the fast-growing literature on online and app-based time-use surveys and propose a new, simple, and reliable app-based tool to measure adults' time allocation, with a particular focus on parental time investments. The advantages of an app-based approach have been recently recognized and exploited by researchers in time-use studies (Fernee and Sonck, 2014; Minnen et al., 2014; Chatzitheochari et al., 2018; Bonke and Christensen, 2019; Sullivan et al., 2020) and this approach is becoming more and more popular in applied works, as people have grown accustomed to using smartphones and relying on apps to track their daily actions, e.g., for fitness (Chatzitheochari and Mylona, 2022), to avoid traffic (e.g., Waze), and to stay organized. Many apps are also available to assist parents in running their homes efficiently, discovering nearby playgrounds and kids-friendly activities, doing their food shopping, staying organized, etc. (e.g., Cozy, Flipp, Little Peanut on the Go, Trekaroo in the United States; Onoko and Hoop in the UK).² Compared to traditional paper based time-use surveys, online and app-based time-use are cost effective and provide a user-friendly experience that could guarantee a higher response rate, which is especially important as time-diaries are long and potentially intrusive.

Second, we add to the literature on child development proposing novel measures of parental time investments based on parents' time diaries. In our app-based survey, parents are asked to report whether their child was present during each activity they performed and, if so, to what extent the child was actively involved. They also have to indicate their own and their child's mood while the activity was taking place. Thanks to this very rich contextual information, we construct two new measures of parental time investments: (i) *Engaged Time*; and (ii) *Positive Time*. *Engaged Time* is defined as time spent by the parent in any activity where the child is present and engaged. Our approach takes into account a wide range of activities that parents can do with their child, without taking a stand on the activities that are ex-ante classified as beneficial to child development. Indeed, the psychological literature indicates that everyday interactions between parents and children, even those that are informal, unstructured, and not necessarily educational, can foster caregiver-child attunement and promote the creation of new shared meanings (Bornstein, 2019; Bruner, 1996). Notably, child-caregiver synchronous interactions have been shown to provide optimal opportunities for learning (Chen et al., 2021). *Positive Time* is a subset of *Engaged Time* and it includes only activities in which the child experiences positive feelings. This measure is particularly important as experiencing

²While these apps were developed in the United States and UK, most of them are available also in Italian and are becoming quite popular. In Italy, in 2018 around 86-88% of the population aged 25-44 used a smartphone to navigate the web (ISTAT, 2019), and that percentage is likely increasing over time.

positive parenting, expressed in physical, verbal, or symbolic forms conveying warmth, love, affection, sensitive responsiveness, and acceptance, is fundamental for the quality of the child-caregiver relationship and the child’s well-being and socio-emotional adjustment (Bornstein, 1989; Cui et al., 2018).

A novelty of our study also emerges from our focus on parents’ rather than children’s diaries to construct the *Engaged Time* and *Positive Time* measures. To our knowledge, existing surveys gathering explicit information on the intensity of parent-child interaction, such as the Panel Study of Income Dynamics-Child Development Supplement (Survey Research Center, 2019) collect children’s rather than parents’ diaries. Having access to information on all the activities a parent performs during the day allows us to measure and qualify the time that parents and children spend together, over and above childcare, capturing parent-child interactions that would be unlikely recorded in a child’s time diary³. Moreover, observing parents’ time allocation allow us to control for the – possibly heterogeneous – constraints parents face, in terms of their other commitments.

We report evidence from 812 time-use diaries compiled by over 500 parents of pre-schoolers aged four to five years old, attending kindergartens in the Emilia Romagna region (Italy) in 2021-22. Each participant was granted access to a web-based app and was asked to complete, among other surveys related to parental attitude and stress, two time-use diaries: one for a randomly selected weekday and one for a randomly selected weekend day. We first document that our time-use app provides accurate records of how parents use their time, comparable to previous app-based time-use survey instruments. Next, we show how our measures — *Engaged Time* and *Positive Time* — relate with those ones commonly used in the literature, namely *Total Time with Child*, which includes all the activities performed by the parent when the child is physically present, and *Quality Time*. The latter consists of those “activities that involve a high degree of interaction and have the greatest impact on child development”, as defined in Price (2008).⁴

Our respondents reported a high degree of active parent-child interaction: *Engaged Time* represents 86% of the total time parents spend with their children. Our data also reveal that only two thirds of the *Engaged Time* would be classified as *Quality Time* according to the definition proposed by Price (2008), as it is devoted to activities that are typically regarded as particularly beneficial for the child. The remaining share of *Engaged Time* is instead allocated to other daily activities, such as traveling, cooking, making or receiving visits or even watching television programs, which are simply carried out with the active involvement of both parent and child. This well captures the idea that any kind of everyday parent-child interactions can become a meaningful and constructive learning

³The importance of including in the time spent with children’s activities not reported as childcare but done in the presence of the child was already emphasized by Folbre and Yoon (2007).

⁴The activities included in *Quality Time* are: reading, playing, talking with/listening, arts and crafts, eating, playing sports, attending performing arts, visiting museums, participating in religious practices, looking after, physical care, and helping with homework for older children.

opportunity (Chen et al., 2021). 66% of the weekly time during which parents are actively engaged with their children is also classified as *Positive time*, and this share is the same (66%) for *Quality Time*, suggesting that children are not necessarily happier when the time they spend with their parents is devoted to activities specifically targeted to them. We find that marked differences emerge between weekday and weekend days. As one might expect in a sample in which most parents work full time, there is a generalized increase in the time parents spend with their child during weekend days. Interestingly, the increase is more pronounced for *Engaged Time* and *Positive Time*, hence showing that parents take advantage of weekends — when time constraints are less binding — to increase not only the quantity, but also the quality of the interaction with their children, and do so in a wide range of daily activities.

The remaining of the paper is structured as follows. In Section 2, we briefly describe the recent developments in time-use research exploiting app or web data collection and then move to the design of our app, the time-use questionnaire, and the data collection process. Section 3 is devoted to the analysis of the quality of the time diaries data. In Section 4, we illustrate the four time investment measures we consider and explore their weekday, weekend day and weekly patterns in our sample. Section 5 concludes.

2 Instrument Design and Diary Data Collection

2.1 Recent Advances in Time Diary Data Collection

While paper diaries are still employed by most statistics agencies (Cornwell et al., 2019), online and app-based time diaries are gaining momentum, as they offer a number of advantages (UNECE, 2013). First, they lower the burden for respondents: compiling the diary on people’s own device is easier than carrying it on an extra-device, such as a paper diary. Second, they allow respondents to choose from an exhaustive list of sequentially nested pre-determined activities, hence avoiding ex-post coding and leading to greater transparency (Minnen et al., 2014). Third, collecting time-use data through technological devices is more cost effective, both in terms of administration expenses and of data cleaning costs, making the data collection instrument more easily scalable.

App-based time diaries were pioneered by the Netherlands Institute for Social Research (Fernee and Sonck, 2014), and the encouraging results on the quality of the collected data lead several other studies to follow the same approach. MOTUS (Minnen et al., 2014) and CaDDi (Sullivan et al., 2020) offered an online version of a time-use diary. The respondents of the Millennium Cohort Survey Age 14 (Chatzitheochari et al., 2018) and ETUS (Bonke and Christensen, 2019) could choose among a web version and an app version. In general, diaries collected through app-based or online versions of a time-use survey are found to deliver good quality data, even higher than paper diaries (Chatzitheochari et al., 2018;

Chatzitheochari and Mylona, 2022).

Similarly to their paper-based versions, these time-use diaries apps ask the respondent with whom the recorded activity was performed. However, in case the respondent is a parent performing the activity with children, they do not identify which specific child was present and do not register any information about the intensity or the quality of the interaction. Therefore, they do not allow to derive a proper measure of parental time investment that can be linked to the development of the child.

In the remaining of the section, we illustrate the design of our app-based time-use survey — emphasizing the features that make it particularly suitable to measure parental investments — and the process of collection of the data we use to validate it.

2.2 The App-based Time-Use Survey

The app was developed by the research team with the help of a specialized digital agency.⁵ It was designed to administer the time diary survey along with other questionnaires on socio-demographics, parental attitudes and stress. The app was accessible from any smartphone, tablet and PC with an active internet connection. Data were synchronized and therefore accessible in real-time, allowing for scrupulous monitoring of the process from the research group, in order to avoid and solve any possible malfunctioning in a timely manner. All the contents of the app were available in three different languages: Italian, English and French.

The app-based adults' time diary we develop departs from the existing ones - either administered by traditional modes (paper) or via app/web - since it includes specific features which makes it possible to capture the quality of the daily parent-child interaction and to measure parental investments as *Engaged Time* and *Positive Time* (in addition to *Total time with Child* and *Quality Time*). To this purpose, the survey contains questions on the level of involvement of the child during each parent's activity, and on the feelings experienced by both the parent and the child. To our knowledge, the only time-use surveys gathering information about parental involvement are those collecting children's rather than parents' diaries.⁶ Retrieving time investments from parent's, rather than child's diaries presents two main advantages: first, it gives full account of all spells of parent-child interaction, regardless the activity performed by the parent⁷; second, it delivers a complete picture of parents' time constraints and trade-offs, rather than focusing only on the segment of time spent with the child. This is especially important when the parent works full time.

⁵*Indici Opponibili* <https://www.indiciopponibili.com/eng/home>

⁶The Panel Study of Income Dynamics-Child Development Supplement (PSID-CDS) Survey Research Center (2019) is a leading example. For each episode of child's activity, the diary reports whether the parents participate to the activity with the child or he is simply around but not actively involved.

⁷For example, starting from children diaries may miss spells in which parent-child interactions are relevant and the activity performed is not related to childcare directly

Our diary starts at 4 a.m. of the assigned day and ends 24 hours later. The time diary is designed to allow users to flexibly define time slots/episodes for each performed activity with a pre-specified minimum duration of 10 minutes. For each episode, the respondents have to pick an activity from a pre-determined list following a hierarchical structure. This facilitates the finding of the activity they want to report, thus reducing measurement errors. In case they were doing more than one activity at the same time, they are explicitly invited to choose the activity they consider the main one.⁸ At the highest level, they are asked to choose one among 11 macro-categories, such as “Sleep, eat, and personal care”, “Work/study activities”, “Household activities”, and “Childcare” (Figure 1, central panel).⁹

Figure 1: Selection of Activities & Time

The figure displays three panels of a mobile application interface for selecting activities and time.

Left Panel: A title screen with the text "Your day 5/26/2021 - 04:00". Below the title, it asks: "Which of these activities were you doing at 04:00 on Wednesday 5/26/2021? Please choose the main activity you were doing at 04:00 on Wednesday 5/26/2021. You may have been doing more than one activity at the same time, but please choose the activity you consider to be the main one." At the bottom is a button labeled "Choose activity".

Central Panel: A list of 11 activity categories, each with a right arrow: "Sleep, eat, personal care", "Work/study activities", "Household activities", "Childcare", "Activities of support for others, club membership, and volunteering", "Social life and entertainment", "Sport and outdoor activities", "Hobbies and pastimes", "TV, reading, communication and mass media", "Travel", and "Other".

Right Panel: A screen showing the selection of a specific activity. At the top, it says "Your day 5/26/2021 - 04:00". Below that, a blue bar contains the text "Sleep, eat, personal care". Below this bar, there are several activity options: "Sleeping, staying in bed (including for illness)", "Insomnia, tossing and turning in bed", "Eating or drinking", "Washing, dressing, combing hair", "Going to the doctor/dentist", and "Other personal care activities (please specify, e.g. barber, hairdresser etc.)". At the bottom is a button labeled "Continue".

Time Selection: Below the right panel, there is a time selection interface. It includes a grid for "Hours" (0 to 23) and a row for "Minutes" (0, 10, 20, 30, 40, 50). The "Hours" grid has a blue bar over the number "2". The "Minutes" row has a blue bar over the number "10". At the bottom are two buttons: "Close" and "Select".

⁸This is consistent with our measures of parental time investments, which rely on the presence and involvement of the child, regardless the activity performed by the parent.

⁹The design of our tool, the selection of the activities included in our list, and their categorization were inspired and guided by the *HETUS European guidelines* for time-use diaries (Eurostat, 2019), The Netherlands Institute for Social Research app-based experience (Fernee and Sonck, 2014), the American Time Use Survey (United States Bureau of Labor Statistics, 2019), and the last available Italian Time Use Survey run in 2013-104 by the Italian National Institute of Statistics ISTAT (ISTAT, 2018).

After selecting the macro-category, they can pick among a more fine-grained sub list of activities, which add up to 69 in total, across all macro-categories excluding Childcare (Figure 1, top-right panel). Since the focus is on the time parents spend with their children, childcare activities are organized within a three-level, rather than a two-level structure: respondents first choose from a set of sub-categories, and then select the activity. The Childcare macro-category includes 11 sub-categories (see Figure 2) and 68 activities in total. The full list of 137 activities of the time-use questionnaire is available in Appendix A. The next step is to state the duration of the activity, with time intervals consisting of a minimum of 10 minutes, selecting the time at which the activity ended (Figure 1, bottom-right panel). In case the reported duration of an activity is longer than 120 minutes, in order to avoid involuntary mistakes in data entry, a pop-up alert appears on the screen and asks respondents to confirm their choice.

Figure 2: List of Childcare Sub-categories

The screenshot shows a mobile application interface for tracking time use. At the top, it says "Your day" with a date and time "5/12/2023 - 3:00 PM". Below this, there is a list of sub-categories under the "Childcare" heading. The "Playing with your children" sub-category is selected and expanded, showing a list of specific activities.

Childcare Sub-category	Specific Activities
Support and care	
Reading or writing with your children	
Playing with your children	<ul style="list-style-type: none"> Playing with your children outdoors Going to the playground with your children Playing with your children indoors Playing games sitting down with your children (cards, jigsaw puzzles, board games etc) Playing with dolls or soft toys with your children Playing with model trains, cars, or similar toys with your children Playing videogames with your children (on mobile phones, consoles, or computers) Playing with your children at acting out roles or dressing up Dancing, laughing, or joking with your children Playing at creative or building games (lego, model-making etc) with your children Other kinds of games (specify)
Leisure and cultural activities	
Manual recreational activities	
Outdoor activities and sport with your children	
Indoor activities and sport with your children	
Speaking with or listening to your children	
Organization, supervision, travel for care and accompaniment	
Activities related to school, religious education, and extracurricular courses	
Medical care for your children	

The question on the duration of the activity was followed by a few additional questions

on contextual information. The respondent is first asked to report *with whom* the activity was carried out (e.g., *alone*, *with the child*, *with the siblings of the child*, *with other adults*, etc.) (Figure 3).¹⁰ If and only if the activity is done in the presence of the child, alone or with their siblings, then an additional question about the degree of involvement between the parent and the child pops-up.¹¹ In total, there are up to five levels of involvement (from "not at all involved" to "fully involved")(Figure 3). When the child is at least *moderately involved* (level 3 or above), respondents are requested to report the child's mood and their own, during the activity, using a 7-level Likert (from "very sad" to "very happy", see Figure 3). Moreover, when the siblings are also present, the same question on the degree of parent-siblings involvement is asked.

Figure 3: Contextual information

The screenshot displays the 'Your day' app interface. At the top, it shows the date and time: '5/26/2021 - 07:40 / 08:00'. Below this, a question asks: 'Who was present, besides yourself, when you were doing the **Helping your children to eat/drink** activity?'. The options are: 'No one else', 'Your child' (selected), 'Your child's sisters and brothers' (selected), 'Other children/and family members (e.g. nephews)', 'Other children/and non-family members', 'Other parent of your child', 'Other adults belonging to your family (e.g. partner of the respondent (if different from the child's other parent), aunts and uncles, grandparents)', and 'Other adults not belonging to the family (e.g. acquaintances, friends, teachers etc)'. A 'Continue' button is at the bottom of this section.

The next section asks: 'Was the child actively involved while carrying out the activity **Listening to music or playing an instrument** ?'. The options are: 'Not at all involved', 'Little involved', 'Medium involved' (selected), 'Highly involved', and 'Fully involved'.

The following section asks: 'Which of these images best represents your mood when you were doing the **Listening to music or playing an instrument** activity?'. It shows a horizontal line with seven dots, where the fourth dot from the left is selected and marked with a red smiley face icon.

The final section asks: 'Which of these images best represents your child's mood while you were doing the **Listening to music or playing an instrument** activity?'. It shows a horizontal line with seven dots, where the seventh dot from the left is selected and marked with a red smiley face icon.

Finally, a summary of the episode reporting the activity, its starting and ending time and contextual information is shown to the users (Figure 4), and they are asked to confirm their choices. Moreover, respondents can see the summary of the whole diary after every answer, and each single activity can be modified or deleted ex-post. The questionnaire

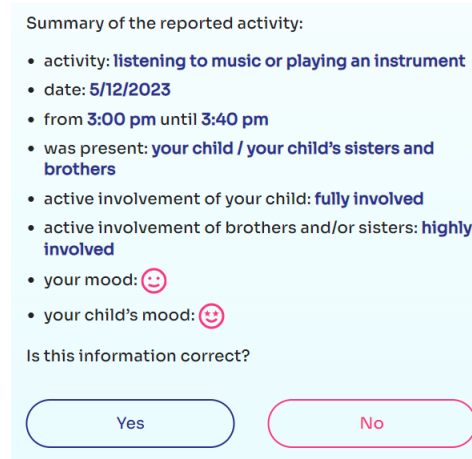
¹⁰The *with whom* question focuses on a specific child in the current version of the app but this - and the following questions- can be easily be adapted to include all the children of the family.

¹¹The question on child's involvement is not asked for some pre-determined activities of *Childcare* such as *reading with your child*, *playing sport with your child*, *doing art and crafts with you child*, where the high degree of involvement of the child is implicit in the definition of the activity.

ends when the parent enters an activity that ended after 4:00 a.m. of the day following the one covered by the diary, that is, when sum of all the described activities covers a time-span of at least 24 hours.

The completion time of the whole 24 hours diary is about 20 minutes. Parents have the flexibility to pause the time-use survey at any point and resume it later. Before opening the diary, the respondent could watch a short video tutorial with instructions.¹²

Figure 4: Summary of the Episode



Summary of the reported activity:

- activity: **listening to music or playing an instrument**
- date: **5/12/2023**
- from **3:00 pm** until **3:40 pm**
- was present: **your child / your child's sisters and brothers**
- active involvement of your child: **fully involved**
- active involvement of brothers and/or sisters: **highly involved**
- your mood: 😊
- your child's mood: 😊

Is this information correct?

Yes No

2.3 Data Collection Process

We administered our app-based time-use survey to parents participating in the MinUTo project, an intervention on mindful parenting targeting parents of pre-schoolers aged four and five attending kindergartens in the Emilia Romagna region, in Italy (for further details, see Guarini et al., 2022). Each parent was asked to fill in two time diaries: one describing a weekday, the other a weekend day. While this procedure increases the burden on respondents, it has the advantage of allowing a separate analysis of time-allocation decisions over the week and over the weekend, an aspect proven to be relevant for research focusing on parental time-investments in children (Barigozzi et al., 2022). In addition, the availability of two diaries per respondent helps reducing measurement errors by computing weekly weighted averages (see Del Boca et al., 2017).

Both days were randomly assigned. More specifically, parents were randomly allocated to ten groups characterized by different pairs of week day and weekend day, the first five groups with week day first (e.g., Monday-Saturday) the second five groups with weekend day first (e.g., Sunday-Wednesday). The data collection took place in winter 2021, specifically from Monday 29/11 to Friday 17/12.¹³

¹²The video is available at the following link: <https://www.youtube.com/watch?v=f75d9SE45KI>

¹³During this period, there were no travel restrictions between regions in Italy due to COVID, and schools were open. Therefore, the pandemic should not have had a direct impact on our data collection. The green pass was mandatory for access to various establishments and activities (restaurants, cultural

Respondents were invited via e-mail or WhatsApp¹⁴ to fill the time-use diary describing the allocation of time across 24 hours, starting from 4 a.m. of the previous day. To ensure that parents have a precise and complete recollection of the events and activities that took place during the day they should describe, it would be optimal to induce them to fill in the diary as soon as possible. However, limiting the timespan during which respondents could access the diary might increase attrition, because parents are not always able to answer immediately. To deal with this trade-off, we allowed parents to fill in the diary within three days.¹⁵

To indirectly compensate respondents for the effort they put in answering our time-use survey and the other questionnaires we proposed to them, we awarded the school of the respondents' children with a voucher for the purchase of toys, books and educational materials.¹⁶ This scheme of incentives on the one side, and the user-friendly experience of the APP on the other side, resulted in a quite high response rate and fostered good quality in the collected time-use data, as we show in the following section.

3 Data Quality and Sample Selection

3.1 Data Quality

We start from a sample of 963 weekday and weekend diaries collected from 863 parents enrolled in the MinUto project. In line with the standard approach adopted in the time-use literature, we dropped: (i) diaries with less than 5 episodes; (ii) diaries describing less than 24 hours; (iii) diaries with outliers;¹⁷ (iv) and invalid diaries due to technical problems and network issues that prevented the data from being registered correctly. Overall, the percentage of valid diaries is quite high (86.9%), leading to 837 diaries, corresponding to 517 respondents. Table C.1 in Appendix C contains the details of the data cleaning process.

Among the 837 valid diaries, 89% recorded 10 or more episodes, and all but 7 reported at least 3 basic activities (*sleeping/resting, eating/drinking, other personal care*). These results highlight a satisfactory performance of our instrument, according to the criteria commonly used in the literature (e.g., Fisher and Gershuny, 2013; Chatzitheochari et al., 2018). As emphasized by Fernee and Sonck (2014), the number of episodes reported in the

and sporting events, gyms, pools and for hotels and public transportation from December 6th) and for some categories of people (public and private sector employees, university students).

¹⁴Parents could choose their preferred communication channel, at the beginning of the study.

¹⁵The respondent could start answering the questionnaire or go back to it -in case of interruption- until midnight of the third day of completion. A reminder was sent in the morning of the last day of completion.

¹⁶The value of the voucher started from a minimum of €50 for schools in which the parents of at least 5 children filled in all the questionnaires, and increased by €10 for each additional responding parent; a €50 top-up was granted to schools with at least 20 respondents.

¹⁷We classify as *outliers* the diaries in which a single activity (different from working and sleeping) is reported for several hours, such as *eating/drinking* for 10 hours.

diary by respondents in the surveyed day is an indicator of the accuracy of the collected time-use data. Table 1 reveals that the average number of reported episodes per day (averaging between weekday and weekend diaries) in our sample is close to 17; consistently with Minnen et al. (2014), this figure is higher for mothers and highly educated individuals (see Table C.2 in Appendix C).

Table 1 also reports the average number of episodes and other characteristics of recent studies collecting time-use diary data through app or web approaches and compares them with those we obtained through our MinUTo survey. Among the app-based we include: ETUS (Bonke and Christensen, 2019; Denmark), MCS Age 14 (Chatzitheochari et al., 2018; UK), and the Netherlands Institute for Social Research (Fernee and Sonck, 2014; Netherlands). Among those web-based we consider the web version of ETUS and MCS Age 14, and three additional surveys: MOTUS (Minnen et al., 2014; Belgium), CaDDI (Sullivan et al., 2020; various countries), and CaDDI Italy (taken from the previous study). These surveys differ from each other in many respects, so that comparison of these figures requires great caution.¹⁸ MinUTo performs relatively well in terms of average number of episodes, with an average number of episodes that is slightly higher than the one obtained in the recent Danish survey ETUS (14 episodes on average). Although both MCS at age 14 and the app developed by the Netherlands Institute for Social Research show a higher number of episodes, their findings are based on a very limited sample.¹⁹

Table 1: Comparison with other Web or App-based surveys

	Resp. Rate	Participants	Valid Diaries	Episodes
<i>MinUTo</i> * - App	59%	863	837 (87%)	17
<i>ETUS</i> ** - App	37%	10913	233	14
<i>MCS Age 14</i> - App	48%	40	- (70%)	22
<i>Netherlands Inst. for Social Research</i> *** - App	-	100	- (83%)	27
<i>ETUS</i> ** - Web	37%	10913	2227	11
<i>MCS Age 14</i> - Web	33%	27	- (92%)	26
<i>MOTUS</i> - Web	52%	≈12,500	-	18
<i>CaDDI</i> - Web	-	-	≈10,000	16
<i>CaDDI - Italy</i> - Web	-	-	-	19

Note: The response rate is usually computed as the ratio between the number of respondents and the number of participants, i.e. those who agreed to compile the questionnaire in the first place;

*MinUTo's response rate is the ratio between the number of respondents after eliminating invalid diaries and the number of participants, i.e. the parents enrolled in the project. **ETUS' response rates are computed on all kinds of time-use diaries adopted, not only app-diaries or online-diaries, but paper & pencil diaries as well; ***data refers to Pilot 1 (2011).

¹⁸A synthetic description of their main features is provided in Appendix B.

¹⁹In addition, these studies are less comparable to MinUTo: The MCS Age 14 is only addressed to teenagers, while the Netherlands study adopts a very pro-active way of administering the questionnaire, with pop-up questions and continuous access to a help desk.

3.2 Time Allocation in Our Sample

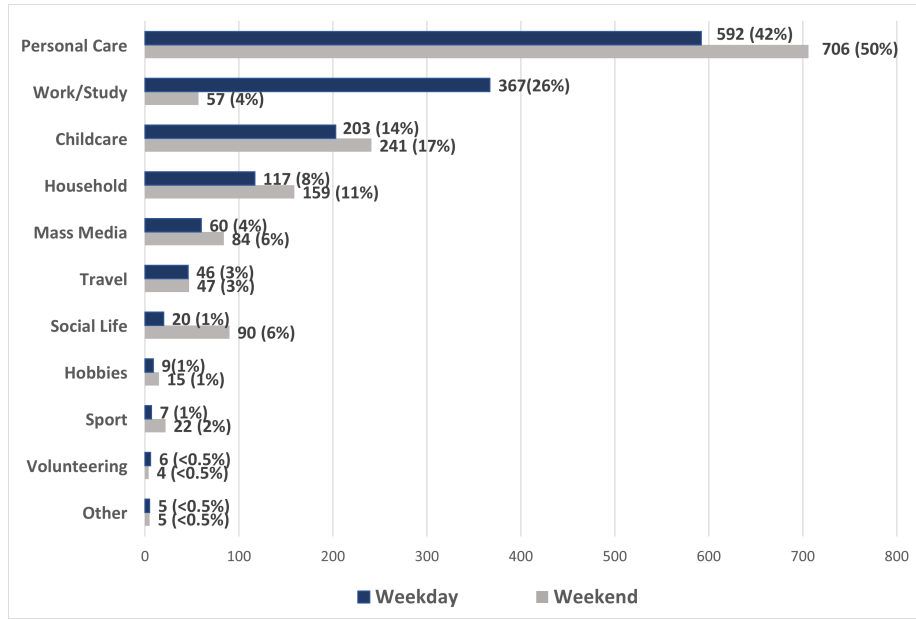
From the 837 valid diaries we discarded 25 observations with missing information on crucial self-reported socio-economic variables collected via the app before the time-use survey. Our final sample consists of 812 diaries, and 501 respondents. Sample selection details and summary statistics on socio-economic variables are available in Tables C.3 and C.4 of Appendix C. The majority of respondents (Parent 1) are female (86%).²⁰ Table C.4 reveals that individuals belonging to the MinUTo sample are highly educated: 71% of respondents have attained a university education. Most likely related to this, the percentage of employed individuals is extremely high: 93% of respondents are employed, 65% full-time.²¹ Finally, 40% of the families have a single child, the median number of children is 2, while the sample is slightly unbalanced towards 4 years old children (the median age is 4).

We now turn to the description of time-use allocation in our sample. Figure 5 shows the average time, in minutes, spent on various activities during weekdays and weekend days. These activities are grouped into macro-categories, as previously described (see Appendix A for the detailed list of activities in each macro-category). In parentheses, we report the percentage of time devoted to each macro-category, based on a 24-hour day, which is equivalent to 1440 minutes. As expected, personal care – including sleeping – is the category with highest average: about 600 minutes (with a share of 42%) in weekdays, reaching over 700 (with a share of 50%) in weekend days. Work/Study time is the next highest value in weekdays, with an average of 367 minutes (26% of daily time) in weekdays, followed by childcare, with an average of 203 minutes (14% of daily time). Instead, in weekend days the second highest value corresponds to childcare, with an average of 241 minutes (17% of daily time) followed by household work, with an average of 159 minutes (11% of daily time). During weekends, working time seems to be almost fully replaced by social life and childcare, whose aggregate takes about 23% of the time of the day. This is a first signal of the deep difference between the two types of day and of the importance of considering them both, in isolation and in combination, to get the full picture of people time allocation.

²⁰The invitation was addressed to any of the parents of children aged 4 or 5, but only one of the parents could participate.

²¹According to the Italian Institute of Statistics, in Italy the percentage of individuals in the age range (25-64) holding a university degree was 20.1% in 2020 (www.istat.it/it/files/2021/10/REPORT-LIVELLI-DI-ISTRUZIONE-2020.pdf) and the yearly employment rate of individuals in the age range (20-64) was 62.7.

Figure 5: Distribution of Time across Macro-categories - Minutes (%)



Notes: The Figure displays the average time allocation of the 24h by type of day, in minutes. Averages are computed over the 392 weekday diaries and the 420 weekend day diaries in our sample.

In order to further corroborate these findings on our new time-use data, we performed a thorough comparison with a sample of diaries obtained from the most recent time-use data gathered by the Italian National Institute of Statistics (ISTAT). In Appendix D we provide evidence that our app-based time diary tool is able to reproduce time allocation patterns that are compatible with those observed from the ISTAT nationally representative sample, after operating appropriate data selection to match our sample.

4 Parental Time Investments: Measurement and New Evidence

4.1 Measuring Parental Time Investments

Defining and measuring parental time investments is an open research issue in the growing empirical literature on the process of children’s skill formation. Different studies rely on different approaches, and there is no agreement on an objective measure. The definition used is often constrained by the information available in the data. Some studies cannot rely on time-use diaries and must resort to indirect measures of time investment or on retrospective surveys, which are more prone to statistical and social desirability bias (Juster et al., 2003; Michelson, 2005).²²

²²Many existing papers use factor analysis to derive proxy of parental investments from the observed variables available.

Even when time diaries are available, the measures that can be obtained from the collected data depend on how diaries or questionnaires are structured. A possible approach consists in merely looking at how much time parents spend with their offspring. The definition and measurement of the total amount of time that parents spend together with their children is unambiguous, and yet, this dimension is unlikely to fit as a good proxy of parental time inputs in child development, as it does not capture the wide heterogeneity in terms of quality and intensity of the parent-child interaction, which reflects factors such as culture, employment and education. On the other hand, studying *how* parents decide to allocate their total time with the child might be more informative on the relationship between time investments and child development. For instance, a highly educated mother with a full-time job is subject to time constraints in the total time she spends with her child but might manage to dedicate a large part of this constrained time to intense interaction with the child.

Based on these considerations, we developed two new measures aimed at capturing the quality and intensity of the parent-child interaction. These measures exploit the availability of high-quality data collected through our app. Specifically, we propose two novel definitions of parental investments:

- *Engaged Time*: this is the time spent by the parent in any activity where the child is present and at least moderately involved. It also includes all those childcare activities for which involvement is implied in the activity description, and therefore taken for granted (e.g., “Speaking or listening to your children”). This concept, based on the parent’s perspective, makes it possible to obtain the full picture of the daily child-parent interaction and its intensity, contrary to approaches based on children’s diary.²³
- *Positive Time*: it is a sub-component of *Engaged Time*, based on the further requirement that – according to the parent’s diary – the child was either happy or very happy during the described activity.

To get the full picture of parental time with children and for the sake of comparison with other studies, we also consider two additional definitions of parental time investments:

- *Quality Time*: this measure was proposed by Price (2008), based on parents’ diaries from the American Time Use Survey (ATUS). The aggregate includes all those

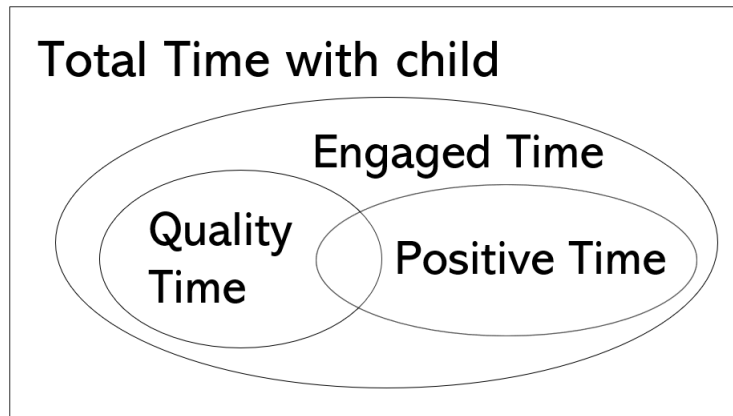
²³Del Boca et al. (2014) used contextual information available in in the PSID-CDS children’s diaries to distinguish between the time children spend with the parents actively engaged (*Active time*) or simply around (*Passive time*). Flood et al. (2022), using the same source of data, defined – among others – measures aimed at capturing the direct involvement of the parent. Resorting to the child’s diary, however, several episodes in which parent-child interaction occurs are likely to be missed out or under-reported (e.g. for activities such as cooking or shopping which will seldom emerge from a child’s diary).

“activities that involve a high degree of interaction and have the greatest impact on child development”. For a list of the activities included in the definition of *Quality time*, see footnote 4.²⁴ The specific activities we include in this measure are emphasized in Table A.1 in Appendix A.²⁵

- *Total Time with Child*: this is the total time spent by the parents with their child during the day, regardless of the specific activity, the degree of interaction and the feelings of the child.²⁶

Figure 6 provides a visual representation of the relationship among the four definitions of parent-child time, which will be used in the next Section.

Figure 6: Measures of Parental Time Investments



4.2 New Evidence on Parental Time Investments

In this section, we present descriptive statistics relative to the four definitions of time investments presented above, based on the responses collected from the parents who completed the app-based time-use surveys administered in the winter 2021 (see Sections 2 and 3). The comparison among these measures illustrates how they complement each other’s and provide a more precise and nuanced representation of parental time-use.

Table 2 shows the average number of minutes and episodes parents report in a *Weekday* (left) or a *Weekend day* (right), regardless of whether the episode contributes to the time

²⁴Hsin (2009) considered a similar concept differentiating between “educationally oriented versus less educationally oriented activities”, using PSID-CDS children’s diaries.

²⁵The time spent by the parent in each of these activities is inserted in the definition only when the child is present and *at least* moderately involved.

²⁶This definition has been adopted by Guryan et al. (2008) with ATUS data, to document that total time with child does not vary with parents’ education - as opposed to activities listed as primary childcare activities. It was also used by Bibler (2020), who leveraged data from the PSID-CDS children’s diaries. Nicoletti and Tonei (2020) using children’s diaries in the Australian LSAC considered time children spend with parents in different categories of activities and in total.

investment measure, i.e., including observations with time investment equal to zero.²⁷ The first noticeable pattern that emerges is that the time parents devote to children increases substantially during weekend days, as expected in our sample where the majority of parents have a full-time job. This confirms that collecting information on both weekdays and weekend days for each parent is crucial to obtain a full picture of overall time investment choices, although it imposes an additional burden on respondents, who are asked to fill in the time-use survey twice.

Further insights from Table 2 can be gained looking at the magnitude of the change in parents' time investments across the type of the day (weekdays *versus* weekend days). *Total time* increases by 71% (from less than 6 to more than 10 hours per day), which is the same increase displayed by *Quality Time* (from 3 hours and 20 minutes to 5 hours and 50 minutes). Our preferred measures show a higher increase: *Engaged Time* from about 5 to almost 9 hours (+79%) and *Positive Time* rises from about 3 to more than 6 hours (+98%). This indicates that parents take advantage of days during which they are less time constrained to increase not only the level, but also the quality of the interaction with their children.

Table 3 describes the average time investments at the week level, in hours. For all respondents who filled in the diary both in a weekday and in a weekend day, we can obtain a weekly measure (WEEK) multiplying the weekday time (WD) by 5 and summing the weekend day time (WE) multiplied by 2 ($WEEK=5*WD+2*WE$). Table F.1 in Appendix F contains pairwise correlations between the four weekly measures of time investments. These correlations are high, as expected, but not huge, confirming the importance of disentangling different time investments measures from the simplest definition represented by the total time parents spend with the child.²⁸

²⁷The observed frequency of parents with zero minutes of investments is very close to 0 for every measure: from 0.01 for *Total Time* to 0.03 for *Quality Time* in the weekday, and around 0.03 for all measures in the weekend day.

²⁸Comparing weekdays and weekend days (see Tables F.2 and F.3 in Appendix F), we observe that the correlations of our preferred measures (*Engaged Time* and *Positive Time*) with the *Quality Time* measure are lower in weekend days with respect to their weekdays counterparts. This suggests that parents take advantage of their higher level of flexibility in time allocation during weekends to find opportunities of positive interaction with their children also outside the activities entering *Quality Time*, which are specifically devoted to them.

Table 2: Average Parental Time Investments - Minutes & Number of Episodes Per Day

	Weekday				Weekend day			
	Mean	Sd	Med	Max	Mean	Sd	Med	Max
<i>Total Time - Min.</i>	352.70	(184.67)	320	1,200	605.45	(189.85)	630	1,050
<i>Total Time - Ep.</i>	8.54	(4.09)	8	25	10.20	(4.95)	10	39
<i>Quality Time - Min.</i>	202.42	(122.02)	180	1,050	342.38	(167.08)	340	1,020
<i>Quality Time - Ep.</i>	5.18	(2.81)	5	16	6.20	(3.38)	6	24
<i>Engaged Time - Min.</i>	298.70	(159.55)	270	1,100	535.83	(189.16)	550	1,050
<i>Engaged Time - Ep.</i>	7.43	(3.61)	7	21	8.90	(4.35)	9	33
<i>Positive Time - Min.</i>	185.13	(166.23)	160	1,100	366.74	(222.83)	395	920
<i>Positive Time - Ep.</i>	4.20	(3.53)	4	18	5.64	(4.13)	5	25

Note: N=392 for Weekday, N=420 for Weekend day.

Table 3: Average Parental Time Investments - Hours Per Week

	Mean	Sd	Med	Max
<i>Total Time</i>	49.69	(17.79)	47.67	121
<i>Quality Time</i>	28.52	(12.99)	27	108
<i>Engaged Time</i>	42.79	(16.03)	40.83	121
<i>Positive Time</i>	28.06	(18.83)	26.33	121

Note: N=311.

Table 3 confirms that *Engaged Time* represents a substantial portion of the *Total Time*, about 86%, which is not surprising given the young age of the children (4 or 5 years old). During most of *Engaged Time*, in which the parent-child interaction is intense, parents report the child to be in a good mood: *Positive Time* represents the 66% of the *Engaged Time*. Interestingly, the share of *Quality Time* classified as *Positive Time* is the same, 66%, indicating that children might be happy also when they are involved in activities with parents not specifically targeted to them. We provide further evidence on this stylized fact in Figure 7, where we decompose *Engaged Time* along its *Positive* and *Quality* dimensions for weekdays, weekend days and for the average day of the week (dividing the weekly figures by 7). In the first bar of the histogram, the weekday *Engaged Time* is split in *Positive Time* (in grey) and *Non-Positive Time* (in blue). Each of these two quantities is further split in *Quality* and *Non-Quality* in the second bar, showing that 56 out of the 185 minutes of weekday *Positive Time*, i.e., the 30% of *Positive Time*, is spent by parents with their children in activities not classified as *Quality Time*. The same percentage increases to 37% in weekend days and is equal to 33% for the average day of the week.

Figure 7: Engaged Time Decomposed in Positive Time & Quality Time

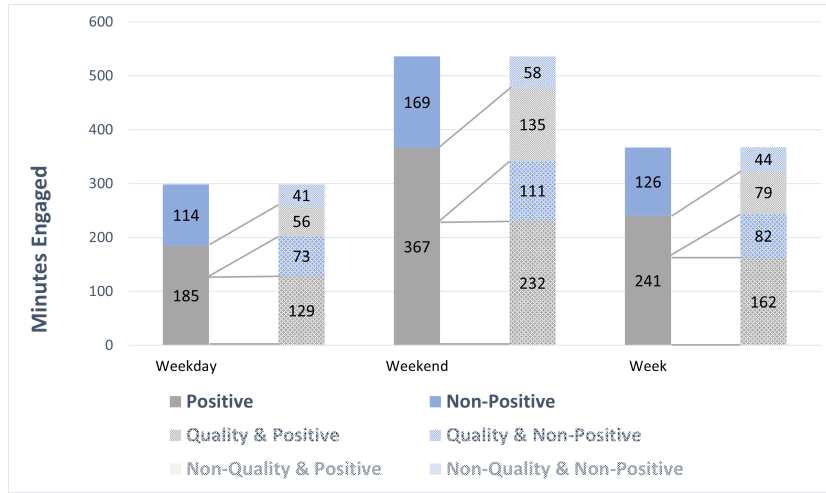


Table 3 also reveals that the share of *Total Time* devoted to the specific activities included in the definition of *Quality Time* is about 57%, which is much lower with respect to that of *Engaged Time*, amounting to about 86%. We dig deeper into the differences between *Quality Time* and *Engaged Time* in Tables 4 and 5. These table show that the macro-categories of activities that do not contribute – or give a limited contribution- to *Quality time* – such as Household activities, Social life and entertainment, Communication and mass-media, and Travel – represent a non-negligible share of the total time during which parents are engaged with their children.²⁹ According to our data, these macro-categories account for more than one hour of *Engaged time* per day in weekdays, and for more than three hours during the weekend days. Tables E.3 to E.4 in Appendix E display the sample averages of the four time investment definitions disaggregated at the activity level and allow us to identify the activities not included in *Quality Time* which give the highest contribution to *Engaged Time*. The most relevant activities turn out to be: *Cooking* (among Household activities), with an average of about 14 minutes in weekdays and 19 minutes in weekend days; *Making or receiving visits from adults or children* (within Social life and entertainment), which accounts for 5 minutes in weekdays and 35 minutes in weekend days; *Watching Television Programs, Films, Videos* (within Communication and mass media), with an average of about 17 minutes in weekdays and 35 minutes in weekend days. Among the Travel activities, *Travel for childcare* displays the highest average of about 10 minutes during weekdays, while the most important activity in weekend days is *Leisure travel*, displaying an average time of about 11 minutes.

In conclusion, our analysis of parental time-use reveals two key findings. Firstly, *Positive* and *Quality time* are distinct categories, meaning that a child’s mood is not influenced by whether the activity they participate in with their parents has an explicit educational or caring purpose. Secondly *Quality time* only accounts for a portion of *Engaged time*,

²⁹The figures for all macro-categories are available in Tables E.1 and E.2 in Appendix E.

indicating that parents often have meaningful interactions with their children even when not engaging in activities specifically aimed at them. These two results, together, suggest that parents may be able to transform different every-day activities into significant moments of bonding and education. Limiting our attention to a set of activities defined ex-ante and exogenously, without taking into consideration the idiosyncratic modality of the parent-child interaction, could lead to an under-assessment of the parental time-investment, which is particularly relevant for households in which parents are time-constrained by their other professional and personal duties. Even though we cannot provide an assessment on a broader and more heterogeneous sample, we believe this pattern is likely to be replicated in a larger population.

Table 4: Average Time Investments for Selected Macro-categories (Minutes) - Weekday

	Total	Quality	Engaged	Positive
Household activities	46.17	0.00	22.21	12.96
Social life and entertainment	8.47	0.51	8.06	6.96
Communication and mass media	20.36	1.45	18.83	12.22
Travel	18.49	0.00	16.86	8.39

Note: This table shows the average of each measure of parental time investments, along those macro-categories that have the greatest difference between Quality Time and Engaged Time (in a weekday) (N=392).

Table 5: Average Time Investments for Selected Macro-categories (Minutes) - Weekend day

	Total	Quality	Engaged	Positive
Household activities	79.14	0.00	40.02	22.29
Social life and entertainment	74.64	14.60	73.86	66.26
Communication and mass media	43.71	3.95	39.95	28.86
Travel	34.00	0.00	28.07	17.48

Note: This table shows the average of each measure of parental time investments, along those macro-categories that have the greatest difference between Quality Time and Engaged Time (in a weekend day) (N=420).

5 Conclusions

In this paper we presented a new app-based time diary survey which is particularly suited to capture the quality of everyday child-parent interaction. In addition, we proposed two novel definitions of parental time investments which we regard as crucial to child development and well-being: *Engaged Time*, including the time spent by the parent in any activity where the child is present and engaged, and *Positive Time*, a sub-category of the former which contains only episodes during which the child experiences positive feelings. Leveraging data from a new sample of parents of preschoolers in Emilia Romagna, who filled in the time-use survey in the winter 2021, we showed that our tool delivers good

quality data compared to recent existing app-based time-use studies conducted in other European countries. Then, we analyzed the weekday, weekend day and weekly pattern of alternative time investments measures, documenting how *Engaged Time* and *Positive Time* differ from other measures used in the literature such as *Total Time with Child*, which includes all the activities performed by the parent when the child is physically present, and *Quality Time*, which contains a list of activities selected ex-ante, because they are considered particularly beneficial to child development.

Our app-based time-use survey instrument has three main advantages which make it particularly suitable for child development studies. First, it is delivered through an app, which is user-friendly, cost-effective and easily scalable. Second, it can be very easily incorporated in any app-based intervention which is expected to have a potential effect on parental time-use. Third, it increases the range of the parental time investment measures available to the researcher. These new measures rely on the availability of rich contextual information on the intensity of the interaction between parent and child, and on their feelings when performing each daily activity. For all these reasons, our time-use survey has been included in the MinUTo project, a recent scalable app-based intervention on mindful parenting targeting parents of pre-schoolers aged four to five years old attending kindergartens in the Emilia Romagna region (Italy). The intervention is expected to affect parental time investments - among other outcomes (for further details on the MinUTo intervention, see Guarini et al., 2022).³⁰

The availability of time diary data alongside parents' and children's outcomes is quite rare in the existing sources of data in child development research. Two noticeable exceptions are in USA and Australia respectively: the *Child Development Supplement* of the *Panel Study of Income Dynamics* (PSID-CDS), in the United States and the *Longitudinal Study of Australian Children* (LSAC). However, these studies collect children's rather than parents' diaries and do not provide the adequate set of information to estimate parental time investments choices. In the broader picture of the ongoing data collection within the MinUTo project, the time-use data will contribute to the creation of a new longitudinal dataset for the target population of parents of preschoolers residing in different municipalities of the Emilia Romagna Region (Italy). Within this unique dataset, parental time investments will be linked to parental behaviours, stress, attitudes and beliefs, as well as to selected children outcomes. This will open the possibility to establish new stylized facts and to advance our knowledge about the process of human capital formation in early childhood.

³⁰Each participant was granted access to a web-based app and, prior to the intervention, was asked to complete a number of baseline surveys, including two time-use diaries (one for a randomly selected weekday and one for a randomly selected weekend day).

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Appendix A Complete list of activities included in the App time-use survey

Table A.1: List of activities included in each Macro-category

Macro-category	Sub-category	Activity
Sleeping, eating, personal care		Sleeping, staying in bed (including for illness)
Sleeping, eating, personal care		Insomnia, tossing and turning in bed
Sleeping, eating, personal care		Eating and Drinking
Sleeping, eating, personal care		Washing, dressing, combing hair
Sleeping, eating, personal care		Going to the doctor/dentist
Sleeping, eating, personal care		Other personal care activities (please specify, e.g., barber, hairdresser etc.)
Work/study activities		Work (including training, breaks, travel)
Work/study activities		Remote working
Work/study activities		School/university (lessons, individual study)
Work/study activities		Other work and/or study activities (please specify)
Household activities		Cooking and other activities related to preparing meals
Household activities		Cleaning, tidying, or home maintenance
Household activities		Activities related to clothing care (washing, ironing, etc)
Household activities		Gardening or pet-care activities
Household activities		Building/repairing of household items
Household activities		Shopping and/or buying household items or services
Household activities		Family and home management and administration (planning visits, doing accounts, etc)
Household activities		Other types of household activities (please specify)
Childcare	Support and care	Putting to bed/waking up
Childcare	Support and care	Helping to eat/drink
Childcare	Support and care	Helping to bathe/get dressed/hair/get ready
Childcare	Support and care	Other kinds of support and care (please specify)
Childcare	Reading or writing	Reading
Childcare	Reading or writing	Listening to your child reading
Childcare	Reading or writing	Teaching how to read, write, count
Childcare	Reading or writing	Other writing/reading activities with your children (please specify)
Childcare	Playing	Playing outdoors
Childcare	Playing	Going to the playground
Childcare	Playing	Playing Indoor
Childcare	Playing	Playing board games
Childcare	Playing	Playing with dolls and puppets
Childcare	Playing	Playing with toy cars or similar
Childcare	Playing	Playing videogames
Childcare	Playing	Playing role or dressing-up
Childcare	Playing	Dancing, having fun
Childcare	Playing	Playing creative games
Childcare	Playing	Other kinds of games (please specify)
Childcare	Leisure and Culture	Watching cartoons with your children
Childcare	Leisure and Culture	Watching films/cartoons at the cinema with your children
Childcare	Leisure and Culture	Visiting museums or exhibitions
Childcare	Leisure and Culture	Watching shows and performances
Childcare	Leisure and Culture	Visiting the zoo with your children
Childcare	Leisure and Culture	Listening to music, singing, playing an instrument
Childcare	Leisure and Culture	Watching DVDs, films, television series or programmes with your children
Childcare	Leisure and Culture	Surfing the internet with your children
Childcare	Leisure and Culture	Other leisure/cultural activities with your children (please specify)
Childcare	Manual recreational activities	Colouring and drawing
Childcare	Manual recreational activities	Making a collage
Childcare	Manual recreational activities	Painting
Childcare	Manual recreational activities	Modelling
Childcare	Manual recreational activities	Other manual recreational activities with your children (please specify)
Childcare	Outdoor activities and sport with your child	Walking, hiking
Childcare	Outdoor activities and sport with your child	Teaching a new sport
Childcare	Outdoor activities and sport with your child	Cycling
Childcare	Outdoor activities and sport with your child	Going to the park
Childcare	Outdoor activities and sport with your child	Other outdoor activities or sport with your children (please specify)
Childcare	Indoor activities and sport with your child	Going to the swimming pool
Childcare	Indoor activities and sport with your child	Other indoor activities or sport with your children (please specify)
Childcare	Speaking and listening	Telling fairy tales
Childcare	Speaking and listening	Speaking face to face with your children
Childcare	Speaking and listening	Speaking via live chat, by phone, or SMS with your children
Childcare	Speaking and listening	Giving instructions
Childcare	Speaking and listening	Scolding your children
Childcare	Speaking and listening	Listening to your children talk about his/her day or other things that have happened
Childcare	Speaking and listening	Other activities involving speaking with or listening to your child (please specify)
Childcare	Organisation, supervision, travel for care and accompaniment	Planning activities and/or events (e.g., birthday parties)
Childcare	Organisation, supervision, travel for care and accompaniment	Helping your children to pack his/her rucksack
Childcare	Organisation, supervision, travel for care and accompaniment	Helping your children to tidy up his/her things
Childcare	Organisation, supervision, travel for care and accompaniment	Supervising your children without interacting
Childcare	Organisation, supervision, travel for care and accompaniment	Watching your children while he/she does other activities (swimming, sport, playing with other children etc)
Childcare	Organisation, supervision, travel for care and accompaniment	Waiting for your children (outside school, after sport etc)
Childcare	Organisation, supervision, travel for care and accompaniment	Travel due to accompanying your children for care
Childcare	Organisation, supervision, travel for care and accompaniment	Other children organisation and supervision-related activities (please specify)
Childcare	School, religion, extracurricular activities	Helping with homework
Childcare	School, religion, extracurricular activities	Correcting Homework
Childcare	School, religion, extracurricular activities	Teaching your children subjects related to school education
Childcare	School, religion, extracurricular activities	Discussions with your children's teachers or with other adults in official roles
Childcare	School, religion, extracurricular activities	Other activities related to your children's school (please specify)
Childcare	School, religion, extracurricular activities	Activities related to your children's religious education (please specify)
Childcare	School, religion, extracurricular activities	Activities related to your children's extracurricular courses (please specify)
Childcare	School, religion, extracurricular activities	Activities related to children's clubs or volunteering (e.g., scouts) (please specify)
Childcare	School, religion, extracurricular activities	Other (please specify)
Childcare	Medical care for your children	Disinfecting or applying bandages to a wound on your children
Childcare	Medical care for your children	Accompanying your children to a medical appointment
Childcare	Medical care for your children	Speaking to your children's doctor
Childcare	Medical care for your children	Other kinds of medical support for your children (please specify)
Support for others/club/volunteering		Volunteering through an organisation
Support for others/club/volunteering		Helping other family members
Support for others/club/volunteering		Informally helping people who do not belong to your family
Support for others/club/volunteering		Religious activities, prayer, ceremonies, visits to the cemetery
Support for others/club/volunteering		Gatherings, organised meetings
Support for others/club/volunteering		Other activities of support for others/club/volunteering (please specify)

Note:

Macro-category	Sub-category	Activity
Social life and entertainment		Making or receiving visits to/from relatives/adult friends
Social life and entertainment		Making or receiving visits to/from children
Social life and entertainment		Taking part in children's parties (birthday parties etc) as an accompanying adult
Social life and entertainment		Other kind of parties
Social life and entertainment		Going to the restaurant, bar, pub, disco
Social life and entertainment		Speaking face to face
Social life and entertainment		Talking on the phone, live chat, or SMS
Social life and entertainment		Going to the cinema, theatre, concerts, library (not to study)
Social life and entertainment		Going to sporting events
Social life and entertainment		Visiting the zoo
Social life and entertainment		Listening to music or playing an instrument
Social life and entertainment		Other entertainment activities (please specify)
Sport and outdoor activities		Walking, hiking
Sport and outdoor activities		Practising ball sports
Sport and outdoor activities		Cycling
Sport and outdoor activities		Swimming
Sport and outdoor activities		Gym, Fitness
Sport and outdoor activities		Hunting, Fishing
Sport and outdoor activities		Other sporting activities (please specify)
Hobbies and pastimes		Artistic or creative pursuits
Hobbies and pastimes		IT and/or programming
Hobbies and pastimes		Internet communication, acquiring information via the internet
Hobbies and pastimes		Other computer use (please specify)
Hobbies and pastimes		Videogames
Hobbies and pastimes		Gambling
Hobbies and pastimes		Other hobbies and pastimes (please specify)
TV, reading, communication and mass media		Reading newspapers and magazines
TV, reading, communication and mass media		Reading books
TV, reading, communication and mass media		Watching television programmes, films, or videos
TV, reading, communication and mass media		Listening to the radio or podcasts
TV, reading, communication and mass media		Other (please specify)
Travel		Travel to/from place of work/study
Travel		Travel to do the shopping and/or make other purchases
Travel		Travel due to accompanying your children for care
Travel		Travel to care for adult members of your family
Travel		Travel for volunteering/participatory activities
Travel		Travel for socialising and/or entertainment
Travel		Travel because of transfer
Travel		Leisure travel
Travel		Other (please specify)
Other		Relaxing, waiting, not doing anything
Other		Other Don't know, don't remember
Other		Other activity not listed (please specify)

Note: The activities included in the definition of *Quality Time* are highlighted, based on the guidelines suggested by Price (2008).

Appendix B Main features of recent app-based or web-based time diary surveys

- **ETUS** (Bonke and Christensen, 2019). Danish 2017-2018 Time-Use Survey. Respondents were given the opportunity to choose between a dedicated app or a web version of the app. They could choose among 60 predetermined activities. Three fourths of respondents were exposed to incentive prizes (lottery).
- **MCS Age 14** (Chatzitheochari et al., 2018). Pilot survey of 86 participants (adolescents) who were asked to choose between a web-administered diary and a smartphone app. The diary is a light form of the *MCS Age 14* 2016, with 44 age-specific activities, nested under 13 broad categories. 83% of app diaries were of *good quality*, i.e., they did not include more than 90 min of missing main activity time, reported at least 7 episodes and at least 3/4 of basic activity daily domains.
- **Netherlands Institute for Social Research** (Fernee and Sonck, 2014). They used a downloadable app, with 41 predetermined hierarchically ranked activities. 150 participants, 50 of which used a borrowed phone. Not enough information for computing exact response rates, given also that data were retrieved from 4 different pilot waves. A large number of episodes on average (27), possibly explained by a more intrusive way of delivering the questionnaire, with pop-up questions after 2 hours of no-access to the diary. Moreover, they provided continuous helpdesk for any possible incurring problem. Data for episodes count are from pilot wave 1, where 100 people were invited to submit time-use diaries.
- **MOTUS** (Minnen et al., 2014). Online diary with a 3-level tree structure or an alternative *search* method for finding activities. Extensive 7-day time diary with a list of over 225 activities. 31.5% of the people who were sent the invitations adhered to complete the time-use survey, which was compiled by 52% of them.
- **CaDDI** (Cornwell et al., 2019). A development of a *light* form of the UKTUS 2015 diary, implemented in 9 different countries. Survey respondents selected activities with a pointer that is dragged across a horizontal timeline bar (*click-and-drag* survey instrument).

Appendix C Data quality details and final sample description

Table C.1: Time Diaries' Cleaning Process

	First day	Second day	Total
<i>Original N of diaries</i>	509	454	963
<i>Diaries ≤ 5 episodes</i>	31	22	53 (5.5%)
<i>Incomplete Diaries (≤ 24 hours)</i>	38	25	63 (6.5%)
<i>Outliers</i>	1	1	2 (0.2%)
<i>Technical Problems</i>	5	3	8 (0.8%)
<i>Total Dropped Diaries</i>	75	51	126 (13.1%)
<i>Final N of diaries (separate)</i>	434	403	837
<i>Final N of diaries (combined)</i>			837
<i>Final N of diaries' respondents</i>			517
<i>Weekday Diaries</i>			406
<i>Weekend day Diaries</i>			431
<i>Diaries with both days</i>			320

Table C.2: Average Number of Episodes Per Day

	Mean	Sd	Med	Min	Max	N
<i>Episodes (All)</i>	16.92	(6.06)	16.08	5	53	517
<i>Episodes (Mothers)</i>	17.15	(6.08)	16.46	5	53	444
<i>Episodes (Fathers)</i>	15.49	(5.78)	15	5	34	73
<i>Episodes (Highly Educated)</i>	17.30	(6.19)	16.6	5	53	364
<i>Episodes (Low Educated)</i>	16.12	(5.80)	15.72	5	37	154
<i>Episodes (Full-time)</i>	16.36	(5.94)	16	5	53	334
<i>Episodes (Part-time)</i>	17.93	(6.15)	17	7	37	183

Note: Number of reported episodes per day (average between weekend and weekday diaries).

Table C.3: Sample Selection

	MinUTo Sample
<i>Original N of diaries</i>	837
<i>Original N of respondents</i>	517
<i>No Info on Parent 1 Employment</i>	1
<i>No Info on Parent 2</i>	7
<i>No Info on Parent 2 Gender</i>	4
<i>No Info on Parent 1 Age</i>	3
<i>No Info on Nr. of Children</i>	1
<i>N of diaries</i>	812
<i>Final N of respondents</i>	501
<i>Weekday diaries</i>	392
<i>Weekend day diaries</i>	420
<i>Diaries with both TUs</i>	311

Table C.4: Descriptives Statistics - Respondents' Socio-economic and Demographic Variables - MinUTo Sample

	Mean	Sd	Med	Min	Max	N
Respondent (Parent 1)						
<i>Female</i>	0.86	(0.34)	1	0	1	501
<i>Age</i>	39.66	(4.55)	39	23	58	501
<i>Nationality (Italian)</i>	0.93	(0.25)	1	0	1	501
<i>University Education</i>	0.71	(0.46)	1	0	1	501
<i>High-School Education</i>	0.28	(0.45)	0	0	1	501
<i>Employed</i>	0.93	(0.26)	1	0	1	501
<i>Full-time</i>	0.65	(0.48)	1	0	1	501
<i>Part-time</i>	0.28	(0.45)	0	0	1	501
Respondent's Partner (Parent 2)						
<i>Female</i>	0.14	(0.34)	0	0	1	501
<i>Age</i>	41.49	(5.16)	41	29	57	501
<i>Nationality (Italian)</i>	0.95	(0.21)	1	0	1	501
<i>University Education</i>	0.54	(0.50)	1	0	1	501
<i>High-School Education</i>	0.38	(0.49)	0	0	1	501
<i>Employed</i>	0.98	(0.14)	1	0	1	501
<i>Full-time</i>	0.92	(0.27)	1	0	1	501
<i>Part-time</i>	0.06	(0.24)	0	0	1	501
Family Characteristics						
<i>Child Gender: Female</i>	0.47	(0.50)	0	0	1	501
<i>Child Age</i>	4.29	(0.46)	4	4	5	501
<i>Number of Children</i>	1.66	(0.60)	2	1	3	501
<i>Single Child</i>	0.40	(0.49)	0	0	1	501

Note: This table shows some summary statistics for some key socio-economic and demographic variables.

Appendix D Comparison with ISTAT time-use data

Here, we compare the time-use patterns estimated in our sample, which we dub as MinUTo sample, with those from the time-use data collected in 2013-2014 by the ISTAT’s *Multipurpose Survey on Households*, which were released in July 2018 and are the most recent ones made available. We selected a subsample of the ISTAT sample, to make it as comparable as possible to the MinUTo sample. Specifically, ISTAT’s diaries were selected according to the following respondents’ characteristics (and in the following order): (i) households with a single family unit; (ii) households with at least one child; (iii) households with a child aged from 3 to 5 years-old (included); (iv) only parents as respondents; (v) only mothers as respondents; (vi) only mothers who live in North or Central Italy. For the sake of comparison, we focus on the subsample of the respondent mothers in the MinUTo study. The two samples we compare are described in Table D.1, which shows that, even after the selection we operate on the ISTAT sample, MinUTo’s mothers have much higher levels of education and employment, and they are more often of Italian nationality with respect to their ISTAT sample counterparts.³¹

Table D.1: Descriptives Statistics - Socio-economic and Demographic Variables - MinUTo Sample (Mothers) vs ISTAT Sample (Mothers)

	MinUTo		ISTAT North & Central	
	Mean	SD	Mean	SD
<i>Female</i>	1.00	(0.00)	1.00	(0.00)
<i>Age</i>	39.25	(4.21)	37.39	(5.65)
<i>Nationality (Italian)</i>	0.93	(0.26)	0.79	(0.40)
<i>University Education</i>	0.72	(0.45)	0.28	(0.45)
<i>High-School Education</i>	0.26	(0.44)	0.49	(0.50)
<i>Employed</i>	0.92	(0.27)	0.70	(0.46)
<i>Full-time</i>	0.60	(0.49)	0.40	(0.49)
<i>Part-time</i>	0.32	(0.46)	0.30	(0.46)
N	433		571	

To perform meaningful comparisons, we rearranged the activities of the MinUTo diary into macro-categories that could match as close as possible those usually retrieved from the ISTAT time-use data (see, for example, Barigozzi et al., 2022). Since the macro-category *Childcare* in MinUTo is made up by more detailed activities than in ISTAT (the structure is three-levels in MinUTo versus two-levels in ISTAT), the mapping for *Childcare* required some attention.³²

³¹We reach a similar conclusion comparing observables from the sample of participants to MinUTo and a sample extracted from the nationally representative survey run by the Bank of Italy, i.e. the Survey on Household Income and Wealth.

³²We split the MinUTo *Childcare* macro-category in two: *Childcare Istat* and *Childcare Other*. The former includes all those activities that we were able to map one to one between the two surveys (i.e.

Tables D.2 and D.3 show that during both weekdays and weekend days there is a statistically significant (two-sample t-test) and sizeable difference between time spent on average in Paid Work, Unpaid Work and Childcare across the two samples, with MinUTo displaying higher Paid Work in weekdays, lower Unpaid Work in both types of days, and higher Childcare in both types of days. However, when we control for the remarkable difference in educational level and select only mothers with university education in both samples, all the above-mentioned distances between the two samples become smaller (see Tables D.4 and D.5). In particular, the difference in Childcare becomes not significant and shrinks from about 29 to about 24 minutes during weekdays and from 40 to 21 minutes during weekend days. Overall, we interpret this finding as suggestive that our app-based time diary survey is able to reproduce time allocation patterns which are compatible with those observed from a nationally representative sample.

Table D.2: Mothers' Total Time (Weekday)

	MinUTo	ISTAT North & Central
Paid Work***		
Minutes	366.97 (207.21)	246.34 (243.01)
Max	790	876
Unpaid Work***		
Minutes	129.97 (99.52)	223.88 (138.90)
Max	490	606
Childcare Istat*		
Minutes	200.71 (121.73)	171.77 (110.32)
Max	1050	696
Childcare Other		
Minutes	25.79 (55.68)	
Max	580	
Self-care***		
Minutes	119.02 (69.01)	152.67 (58.95)
Max	390	462
Sleeping		
Minutes	478.01 (100.81)	487.57 (68.62)
Max	1100	762
Voluntary Work		
Minutes	6.20 (38.69)	5.59 (31.01)
Max	520	336
Leisure***		
Minutes	99.44 (87.04)	149.96 (116.17)
Max	430	576
Other		
Minutes	6.88 (24.56)	
Max	240	
N	337	191

*** p<0.01, ** p<0.05, * p<0.1

Table D.3: Mothers' Total Time (Weekend day)

	MinUTo	ISTAT North & Central
Paid Work		
Minutes	62.26 (146.45)	75.28 (177.54)
Max	750	1008
Unpaid Work***		
Minutes	173.99 (125.42)	254.67 (147.79)
Max	590	654
Childcare Istat***		
Minutes	186.42 (139.97)	146.70 (127.01)
Max	840	684
Childcare Other		
Minutes	57.22 (82.68)	
Max	510	
Self-care***		
Minutes	151.54 (88.87)	181.23 (78.68)
Max	570	486
Sleeping***		
Minutes	554.90 (131.17)	537.11 (91.40)
Max	1300	924
Voluntary Work*		
Minutes	4.52 (27.21)	12.00 (35.62)
Max	330	276
Leisure		
Minutes	227.41 (160.33)	231.11 (150.74)
Max	660	810
Other		
Minutes	9.97 (31.12)	
Max	270	
N	363	380

*** p<0.01, ** p<0.05, * p<0.1

support and care, reading or writing, playing, speaking or listening to, organization and supervision, included travel). In *Childcare Other*, reversely, we included the time spent on activities for which we could not find an exact match in the ISTAT diary. These are: *Leisure and Cultural activities, Manual Recreational activities, Outdoor and Indoor Sports and activities, Activities related to School, Religious education, Extra-curricular courses (except helping with homework), Medical care.*

Table D.4: Highly Educated Mothers' Total Time (Weekday)

	MINUTO	ISTAT North & Central
Paid Work*		
Minutes	391.27 (196.25)	336.53 (249.44)
Max	720	852
Unpaid Work**		
Minutes	120.82 (95.60)	169.61 (129.65)
Max	490	552
Childcare Istat		
Minutes	194.04 (105.43)	169.82 (123.81)
Max	600	696
Childcare Other		
Minutes	26.90 (61.37)	
Max	580	
Self-care***		
Minutes	118.41 (69.24)	156.54 (60.93)
Max	390	312
Sleeping		
Minutes	476.57 (104.84)	478.07 (64.03)
Max	1100	606
Voluntary Work		
Minutes	7.76 (44.77)	3.75 (21.02)
Max	520	144
Leisure**		
Minutes	90.24 (79.15)	124.07 (91.17)
Max	430	444
Other		
Minutes	5.84 (20.08)	
Max	140	
N	245	56

*** p<0.01, ** p<0.05, * p<0.1

Table D.5: Highly Educated Mothers' Total Time (Weekend day)

	MinUTo	ISTAT North & Central
Paid Work		
Minutes	67.14 (150.64)	67.86 (158.70)
Max	750	744
Unpaid Work**		
Minutes	165.34 (119.48)	233.49 (132.10)
Max	550	576
Childcare Istat		
Minutes	183.85 (129.03)	162.45 (134.01)
Max	720	684
Childcare Other		
Minutes	59.16 (84.63)	
Max	510	
Self-care***		
Minutes	150.65 (87.80)	185.77 (82.31)
Max	570	420
Sleeping***		
Minutes	556.90 (129.36)	530.09 (79.81)
Max	1300	768
Voluntary Work*		
Minutes	4.47 (24.03)	14.66 (42.14)
Max	250	276
Leisure		
Minutes	231.76 (162.01)	244.01 (148.38)
Max	640	612
Other		
Minutes	10.34 (33.33)	
Max	270	
N	262	106

*** p<0.01, ** p<0.05, * p<0.1

Appendix E Time investments by macro-category and activity

Table E.1: Average Time Investments by Macro-category (Minutes)- Weekday

	Total	Quality	Engaged	Positive
Personal Care	65.64	49.23	56.96	31.04
Work/study activities	12.93	0.00	3.21	2.09
Household activities	46.17	0.00	22.21	12.96
Childcare	172.93	145.59	165.94	3.26
Support for others/club/volunteering	1.94	1.76	1.76	1.50
Social life and entertainment	8.47	0.51	8.06	6.96
Sport and outdoor activities	1.51	1.51	1.51	1.30
Hobbies and pastimes	3.19	2.37	2.53	2.09
Communication and mass media	20.36	1.45	18.83	12.22
Travel	18.49	0.00	16.86	8.39
Other	1.07	0.00	0.92	0.61

Note: This table shows the average of each measure of parental time investments along all macro-categories in a weekday (N=392).

Table E.2: Average Time Investments by Macro-category (Minutes) - Weekend day

	Total	Quality	Engaged	Positive
Personal Care	121.05	102.33	114.12	65.14
Work/study activities	3.76	0.00	0.43	0.43
Household activities	79.14	0.00	40.02	22.29
Childcare	218.69	198.38	213.76	150.49
Support for others/club/volunteering	2.60	1.64	1.64	1.10
Social life and entertainment	74.64	19.74	73.86	66.26
Sport and outdoor activities	16.95	16.36	16.36	8.90
Hobbies and pastimes	16.95	16.36	16.36	8.90
Communication and mass media	43.71	3.95	39.95	28.86
Travel	34.00	0.00	28.07	1.52
Other	3.12	0.00	2.36	1.69

Note: This table shows the average of each measure of parental time investments along all macro-categories in a weekend day (N=420).

Table E.3: Average Time Investments by Activity (Minutes) - Weekday

	Total	Quality	Engaged	Positive
Personal Care				
<i>Sleeping</i>	241.58	0	0	0
<i>Insomnia</i>	2.98	0	0	0
<i>Eating or drinking</i>	52.09	49.23	49.23	44.84
<i>Washing, dressing</i>	10.30	0	7.44	5.49
<i>Going to the doctor</i>	0.25	0	0	0
<i>Other</i>	0	0	0	0
Work/study activities				
<i>Work</i>	3.82	0	1.76	0.99
<i>Remote work</i>	8.87	0	1.22	1.22
<i>School/University</i>	0.22	0	0	0
<i>Other</i>	0	0	0	0
Household activities				
<i>Cooking</i>	24.84	0	14.05	13.92
<i>Cleaning</i>	13.13	0	3.23	2.27
<i>Clothing care</i>	2.39	0	0	0
<i>Gardening or pet-care</i>	0.25	0	0	0
<i>Building/repairing</i>	0.15	0	0	0
<i>Shopping</i>	2.70	0	2.55	2.55
<i>Family and home manag.</i>	1.76	0	0.8	0.8
<i>Other</i>	1.07	0	0.8	0.8

Note: This table shows the average of each measure of parental time investments along all activities in a weekday (N=392).

	Total	Quality	Engaged	Positive
Childcare - Support and care				
<i>Putting to bed or waking</i>	25.86	24.38	24.38	19.43
<i>Helping to eat/drink</i>	12.80	12.21	12.21	9.82
<i>Helping to bath or get dressed</i>	26.22	25.68	25.68	18.26
<i>Other</i>	1.78	1.47	1.47	0.5
Childcare - Reading or writing with child				
<i>Reading with child</i>	9.03	9.03	9.03	8.91
<i>Listening to child reading</i>	0	0	0	0
<i>Teaching how to read or write</i>	1.05	1.05	1.05	0.99
<i>Other</i>	0.17	0	0	0
Childcare - Playing with child				
<i>Playing with child outdoors</i>	2.14	2.14	2.14	2.14
<i>Going to the playground</i>	0.81	0.81	0.81	0.81
<i>Playing with child indoor</i>	16.58	16.58	16.58	16.02
<i>Playing games sitting down</i>	7.5	7.5	7.5	7.5
<i>Playing with dolls</i>	3.77	3.77	3.77	3.77
<i>Playing with model trains, cars</i>	4.18	4.18	4.18	4.18
<i>Playing video games with your child</i>	0.25	0.25	0.25	0.25
<i>Acting out roles or dressing up</i>	1.86	1.86	1.86	1.86
<i>Dancing, laughing, joking with your child</i>	5.79	5.79	5.79	5.79
<i>Playing at creative or building games</i>	6.91	6.91	6.91	6.91
<i>Other</i>	0.22	0	0	0
Childcare - Leisure and cultural activities				
<i>Watching cartoons</i>	3.90	0	3.90	3.90
<i>Watching movies at the cinema</i>	0.10	0	0	0
<i>Visiting museums</i>	0.43	0.43	0.43	0.43
<i>Watching shows</i>	0.81	0.81	0.81	0.81
<i>Going to the zoo</i>	0	0	0	0
<i>Listening to music or singing</i>	0.35	0.35	0.35	0.35
<i>Watching DVDs, films, tv series</i>	1.27	0	1.27	1.27
<i>Surfing the internet</i>	0	0	0	0
<i>Other</i>	0.25	0.25	0.25	0.25
Childcare - Manual recreational activities				
<i>Colouring and drawing</i>	2.72	2.72	2.72	2.72
<i>Making a collage</i>	0.43	0.43	0.43	0.43
<i>Painting</i>	0.48	0.48	0.48	0.48
<i>Model making</i>	0	0	0	0
<i>Other</i>	1.96	1.96	1.96	1.96
Childcare - Outdoor activities and sport				
<i>Walking, strolling or hiking</i>	0.76	0.76	0.76	0.76
<i>Teaching a sport</i>	0.22	0.22	0.22	0.22
<i>Cycling together</i>	0.10	0.10	0.10	0.10
<i>Going to the park</i>	1.60	1.47	1.47	1.47
<i>Other</i>	0.68	0.68	0.68	0.68
Childcare - Indoor activities and sport				
<i>Swimming pool</i>	1.30	1.30	1.30	1.30
<i>Other</i>	0.43	0.43	0.43	0.43
Childcare - Speaking or Listening				
<i>Telling stories or fables</i>	0.96	0.96	0.96	0.96
<i>Speaking face to face</i>	2.16	2.09	2.09	2.09
<i>Speaking via live chat, phone, SMS</i>	0	0	0	0
<i>Giving instructions</i>	0.07	0	0	0
<i>Scolding your child</i>	0	0	0	0
<i>Listening to your child</i>	4.33	4.33	4.33	4.23
<i>Other</i>	0.02	0	0	0
Childcare - Organisation and supervision				
<i>Planning activities</i>	0.17	0	0	0
<i>Helping to pack</i>	0.07	0	0	0
<i>Helping to tidy up</i>	0.30	0	0.31	0.28
<i>Supervising your child</i>	0.74	0	0.74	0.61
<i>Watching your child</i>	2.04	0	2.04	1.86
<i>Waiting for your child</i>	0.81	0	0.79	0.69
<i>Travel due to accompanying your child</i>	10.63	0	8.95	8.13
<i>Other</i>	0.33	0	0.33	0.33
Childcare - Activities related to school, religious educ., extracurricular				
<i>Helping with homework</i>	1.47	0.43	0.43	0.15
<i>Checking/correcting homework</i>	0	0	0	0
<i>Teaching subjects</i>	0	0	0	0
<i>Discussion with teachers</i>	0.17	0	0.18	0.02
<i>Other act. related to school</i>	0	0	0	0
<i>Other act. related to relig. educ.</i>	0	0	0	0
<i>Other extracurric. act.</i>	0.71	0.71	0.71	0.71
<i>Other act related to volunteering</i>	0	0	0	0
<i>Other</i>	0	0	0	0
Childcare - Medical care				
<i>Disinfecting or applying bandages</i>	0	0	0	0
<i>Accompanying to a medical appointment</i>	0.63	0	0.63	0.41
<i>Talking to child's doctor</i>	0.07	0	0	0
<i>Other</i>	1.68	0	0.94	0.61

Note: This table shows the average of each measure of parental time investments, along all activities in a weekday (N=392).

	Total	Quality	Engaged	Positive
Support for others/club/volunteering				
<i>Volunteering</i>	0.17	0	0	0
<i>Helping adult family members</i>	0	0	0	0
<i>Informally helping people</i>	1.30	1.30	1.30	1.30
<i>Religious activities</i>	0.28	0.28	0.28	0.28
<i>Gatherings and organised meetings</i>	0.15	0.15	0.15	0.15
<i>Other</i>	0.02	0	0	0
Social life and entertainment				
<i>Making or receiving visits from adults</i>	3.85	0	3.85	3.85
<i>Making or receiving visits from children</i>	1.22	0	1.22	1.22
<i>Taking part in children parties</i>	0.33	0	0.33	0.33
<i>Other kind of parties</i>	0.33	0	0.33	0.33
<i>Going to the restaurant, pub, disco</i>	1.02	0	1.02	1.02
<i>Speaking face to face</i>	0.33	0	0.15	0
<i>Talking on the phone, chat, SMS</i>	0.58	0	0.35	0.35
<i>Going to the cinema, theatre, concerts</i>	0.43	0	0.43	0.43
<i>Going to sport events</i>	0	0	0	0
<i>Going to the zoo</i>	0	0	0	0
<i>Listening to music or playing an instrument</i>	0.35	0.35	0.35	0.35
<i>Other</i>	0	0	0	0
Sport and outdoor activities				
<i>Walking or hiking</i>	0.96	0.96	0.96	0.92
<i>Playing ball games</i>	0	0	0	0
<i>Cycling</i>	0.23	0.23	0.23	0.23
<i>Swimming</i>	0	0	0	0
<i>Fitness, gym</i>	0.30	0.30	0.30	0.30
<i>Fishing, hunting, fruit picking</i>	0	0	0	0
<i>Other</i>	0	0	0	0
Hobbies and pastimes				
<i>Artistic or creative pursuits</i>	2.16	2.04	2.04	1.78
<i>Programming</i>	0	0	0	0
<i>Internet</i>	0.25	0	0	0
<i>Other computer use</i>	0.28	0	0	0
<i>Videogames</i>	0.15	0	0.15	0.15
<i>Gambling</i>	0	0	0	0
<i>Other</i>	0.33	0.33	0.33	0.33
Communication and mass media				
<i>Reading newspapers and magazines</i>	0.15	0	0	0
<i>Reading books</i>	1.86	1.45	1.45	1.45
<i>Watching television programmes, films, videos</i>	18.34	0	17.37	16.81
<i>Listening to radio and podcast</i>	0	0	0	0
<i>Other</i>	0	0	0	0
Travel				
<i>Travel to/from work</i>	1.91	0	1.83	1.65
<i>Travel to do shopping</i>	0.94	0	0.94	0.89
<i>Travel for childcare</i>	10.58	0	10.10	9.05
<i>Travel for family care</i>	0.25	0	0.25	0.25
<i>Travel for volunteering</i>	0	0	0	0
<i>Travel for socialising</i>	1.07	0	0.61	0.61
<i>Travel for transfer</i>	0.05	0	0	0
<i>Leisure travel</i>	2.47	0	1.98	1.65
<i>Other</i>	1.19	0	1.07	1.07
Travel				
<i>Relaxing, waiting, doing nothing</i>	0.71	0	0.63	0.58
<i>Don't know or don't remember</i>	0.25	0	0.17	0.17
<i>Other activity not listed</i>	0.10	0	0.10	0

Note: This table shows the average of each measure of parental time investments, along all activities in a weekday (N=392).

Table E.4: Average Time Investments by Activity (Minutes) - Weekend day

	Total	Quality	Engaged	Positive
Personal Care				
<i>Sleeping</i>	328.5	0	0	0
<i>Insomnia</i>	1.23	0	0	0
<i>Eating or drinking</i>	106.23	102.33	102.33	93.28
<i>Washing, dressing</i>	13.57	0	11.14	7.78
<i>Going to the doctor</i>	0	0	0	0
<i>Other</i>	0	0	0	0
Work/study activities				
<i>Work</i>	1.28	0	0	0
<i>Remote work</i>	1.02	0	0	0
<i>School/University</i>	0.88	0	0.42	0.42
<i>Other</i>	0.57	0	0	0
Household activities				
<i>Cooking</i>	32.35	0	18.52	17.26
<i>Cleaning</i>	28.59	0	8.71	7.97
<i>Clothing care</i>	5.80	0	1.62	1.41
<i>Gardening or pet-care</i>	0.90	0	0.81	0.81
<i>Building/repairing</i>	0.59	0	0.38	0.38
<i>Shopping</i>	8.73	0	7.83	7.09
<i>Family and home manag.</i>	0.11	0	0.11	0.11
<i>Other</i>	2.02	0	2.02	1.64

Note: This table shows the average of each measure of parental time investments, along all activities in a weekend day (N=420).

	Total	Quality	Engaged	Positive
Childcare - Support and care				
<i>Putting to bed or waking</i>	23.42	22.83	22.83	17.64
<i>Helping to eat/drink</i>	9.45	8.92	8.92	8.02
<i>Helping to bath or get dressed</i>	25.66	25.26	25.26	20.07
<i>Other</i>	0.73	0.73	0.73	0.41
Childcare - Reading or writing with child				
<i>Reading with child</i>	11.78	11.71	11.71	11.54
<i>Listening to child reading</i>	0	0	0	0
<i>Teaching how to read or write</i>	1.78	1.78	1.78	1.78
<i>Other</i>	0.45	0.45	0.45	0.45
Childcare - Playing with child				
<i>Playing with child outdoors</i>	4.33	4.33	4.33	4.33
<i>Going to the playground</i>	1.54	1.54	1.54	1.41
<i>Playing with child indoor</i>	22.66	22.59	22.59	21.47
<i>Playing games sitting down</i>	13.83	13.83	13.83	13.83
<i>Playing with dolls</i>	6.73	6.73	6.73	6.73
<i>Playing with model trains, cars</i>	6.42	6.42	6.42	6.42
<i>Playing video games with your child</i>	1.19	1.19	1.19	1.07
<i>Acting out roles or dressing up</i>	3.19	3.19	3.19	3.19
<i>Dancing, laughing, joking with your child</i>	6.52	6.45	6.45	5.79
<i>Playing at creative or building games</i>	12.71	12.71	12.71	12.71
<i>Other</i>	0.92	0.92	0.92	0.92
Childcare - Leisure and cultural activities				
<i>Watching cartoons</i>	6.16	0	6.16	5.57
<i>Watching movies at the cinema</i>	1.23	0	1.23	1.23
<i>Visiting museums</i>	2.71	2.71	2.71	2.42
<i>Watching shows</i>	2.85	2.85	2.85	2.85
<i>Going to the zoo</i>	0	0	0	0
<i>Listening to music or singing</i>	0.66	0.66	0.66	0.66
<i>Watching DVDs, films, tv series</i>	2.95	0	2.95	2.81
<i>Surfing the internet</i>	0	0	0	0
<i>Other</i>	2.04	2.04	2.04	2.04
Childcare - Manual recreational activities				
<i>Colouring and drawing</i>	5.11	5.11	5.11	5.11
<i>Making a collage</i>	0.76	0.76	0.76	0.76
<i>Painting</i>	1.23	1.23	1.23	1.23
<i>Model making</i>	1.73	1.73	1.73	1.45
<i>Other</i>	7.97	7.97	7.97	7.97
Childcare - Outdoor activities and sport				
<i>Walking, strolling or hiking</i>	4.40	4.40	4.40	4.40
<i>Teaching a sport</i>	0.07	0.07	0.07	0.07
<i>Cycling together</i>	1.78	1.78	1.78	1.78
<i>Going to the park</i>	3.04	3.04	3.04	3.04
<i>Other</i>	1.97	1.97	1.97	1.97
Childcare - Indoor activities and sport				
<i>Swimming pool</i>	1.09	1.09	1.09	1.09
<i>Other</i>	0.59	0.59	0.59	0.59
Childcare - Speaking or Listening				
<i>Telling stories or fables</i>	1.45	1.40	1.40	1.40
<i>Speaking face to face</i>	2.07	2.07	2.07	1.95
<i>Speaking via live chat, phone, SMS</i>	0	0	0	0
<i>Giving instructions</i>	0.14	0.09	0.09	0.02
<i>Scolding your child</i>	0.11	0.11	0.11	0
<i>Listening to your child</i>	2.61	2.61	2.61	2.52
<i>Other</i>	0.14	0.14	0.14	0.14
Childcare - Organisation and supervision				
<i>Planning activities</i>	0.11	0	0.11	0.11
<i>Helping to pack</i>	0.11	0	0.09	0.09
<i>Helping to tidy up</i>	0.26	0	0.19	0
<i>Supervising your child</i>	0.16	0	0.16	0.16
<i>Watching your child</i>	0.76	0	0.76	0.76
<i>Waiting for your child</i>	0	0	0	0
<i>Travel due to accompanying your child</i>	1.85	0	1.83	1.31
<i>Other</i>	0.14	0	0.14	0
Childcare - Activities related to school, religious educ., extracurricular				
<i>Helping with homework</i>	1.78	0.16	0.16	0.16
<i>Checking/correcting homework</i>	0.52	0.45	0.45	0.45
<i>Teaching subjects</i>	0.09	0	0	0
<i>Discussion with teachers</i>	0	0	0	0
<i>Other act. related to school</i>	0	0	0	0
<i>Other act. related to relig. educ.</i>	0.04	0	0	0
<i>Other extracurric. act.</i>	1.16	0.90	0.90	0.90
<i>Other act related to volunteering</i>	0	0	0	0
<i>Other</i>	0.26	0.26	0.26	0.26
Childcare - Medical care				
<i>Disinfecting or applying bandages</i>	0	0	0	0
<i>Accompanying to a medical appointment</i>	0.33	0	0.33	0.11
<i>Talking to child's doctor</i>	0	0	0	0
<i>Other</i>	1.66	0	1.38	0.14

Note: This table shows the average of each measure of parental time investments, along all activities in a weekend day (N=420).

	Total	Quality	Engaged	Positive
Support for others/club/volunteering				
<i>Volunteering</i>	0	0	0	0
<i>Helping adult family members</i>	0.07	0	0	0
<i>Informally helping people</i>	0	0	0	0
<i>Religious activities</i>	2.19	1.45	1.45	1.31
<i>Gatherings and organised meetings</i>	0.21	0	0	0
<i>Other</i>	0.11	0.11	0.11	0.11
Social life and entertainment				
<i>Making or receiving visits from adults</i>	24.47	0	24.47	24.33
<i>Making or receiving visits from children</i>	10.21	0	10.21	10.21
<i>Taking part in children parties</i>	5.33	0	5.33	5.33
<i>Other kind of parties</i>	2.09	0	2.09	2.09
<i>Going to the restaurant, pub, disco</i>	9.90	0	9.90	9.76
<i>Speaking face to face</i>	2.26	2.19	2.19	2.19
<i>Talking on the phone, chat, SMS</i>	0.95	0	0.78	0.71
<i>Going to the cinema, theatre, concerts</i>	5	0	5	5
<i>Going to sport events</i>	1.54	0	1.54	1.54
<i>Going to the zoo</i>	0	0	0	0
<i>Listening to music or playing an instrument</i>	0.85	0.85	0.85	0.85
<i>Other</i>	12	0	11.54	11.21
Sport and outdoor activities				
<i>Walking or hiking</i>	12.21	11.80	11.80	10.54
<i>Playing ball games</i>	0.33	0.33	0.33	0.33
<i>Cycling</i>	2.26	2.26	2.26	2.26
<i>Swimming</i>	1.64	1.61	1.61	1.57
<i>Fitness, gym</i>	0	0	0	0
<i>Fishing, hunting, fruit picking</i>	0	0	0	0
<i>Other</i>	0.5	0.33	0.33	0.33
Hobbies and pastimes				
<i>Artistic or creative pursuits</i>	5.97	5.04	5.04	5.04
<i>Programming</i>	0	0	0	0
<i>Internet</i>	0.61	0	0	0
<i>Other computer use</i>	0	0	0	0
<i>Videogames</i>	0.78	0	0.15	0.15
<i>Gambling</i>	0	0	0	0
<i>Other</i>	0.41	0	0	0
Communication and mass media				
<i>Reading newspapers and magazines</i>	0.11	0	0	0
<i>Reading books</i>	4.28	3.88	3.88	3.78
<i>Watching television programmes, films, videos</i>	38.71	0	35.40	34.33
<i>Listening to radio and podcast</i>	0.59	0	0.59	0.59
<i>Other</i>	0	0	0	0
Travel				
<i>Travel to/from work</i>	0.26	0	0.26	0.26
<i>Travel to do shopping</i>	6.07	0	5.23	4.47
<i>Travel for childcare</i>	1.5	0	1.5	1.42
<i>Travel for family care</i>	0.78	0	0.66	0.66
<i>Travel for volunteering</i>	0.28	0	0.26	0.26
<i>Travel for socialising</i>	6.26	0	5.07	4.66
<i>Travel for transfer</i>	0.28	0	0.28	0.28
<i>Leisure travel</i>	14.14	0	11.11	8.38
<i>Other</i>	4.40	0	3.5	1.07
Travel				
<i>Relaxing, waiting, doing nothing</i>	2.28	0	1.69	1.64
<i>Don't know or don't remember</i>	0.33	0	0.23	0.23
<i>Other activity not listed</i>	0.5	0	0.42	0.26

Note: This table shows the average of each measure of parental time investments, along all activities in a weekend day (N=420).

Appendix F Correlations among time investments measures

Table F.1: Correlations Among Measures - Week

Variables	Total Time Week	Quality Week	Engaged Week	Positive Week
Total Time Week	1.000			
Quality Week	0.715 (0.000)	1.000		
Engaged Week	0.865 (0.000)	0.805 (0.000)	1.000	
Positive Week	0.607 (0.000)	0.629 (0.000)	0.771 (0.000)	1.000

Table F.2: Correlations Among Measures - Weekday

Variables	Total	Quality	Engaged	Positive
Total	1.000			
Quality	0.737 (0.000)	1.000		
Engaged	0.865 (0.000)	0.822 (0.000)	1.000	
Positive	0.653 (0.000)	0.694 (0.000)	0.790 (0.000)	1.000

Table F.3: Correlations Among Measures - Weekend day

Variables	Total	Quality	Engaged	Positive
Total	1.000			
Quality	0.584 (0.000)	1.000		
Engaged	0.861 (0.000)	0.676 (0.000)	1.000	
Positive	0.532 (0.000)	0.366 (0.000)	0.643 (0.000)	1.000