

Unequal from birth: Can text messages improve language interactions between parents and children in disadvantaged families?

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Children from a disadvantaged background begin school with, on average, a more limited command of language than children from an affluent background. This handicaps their learning during school, increases their risk of dropping out and impacts their future living conditions. However, numerous studies have shown that this situation can be corrected from early childhood, in particular by giving more tools to vulnerable families to help their very young children.

This study uses a randomized controlled trial to evaluate Project SMS, conducted by the 1001mots association. The project aims to raise awareness among parents from modest backgrounds about their child's development issues and to suggest ideas for educational activities and games by sending three SMS messages per week for seven months, supplemented by calls and book deliveries.

Our study shows that Project SMS has a positive impact on the reading practices of the most disadvantaged parents and those with the youngest children. However, this effect is small and does not extend to the other parenting practices measured. This result could be explained by the fact that parents report that they are already familiar with most of the recommended practices, leaving little room for the scheme to encourage their adoption. These limited impacts on parents explain why we do not find significant effects on our measures of child development.

- In France, nearly 500,000 children between 0 and 3 years old grow up in a poor family, which represents 22.7% of French children between 0 and 3 years old. When they begin pre-school, these children have a poorer language proficiency, on average, than children who grew up in an affluent family.
- We use a randomized controlled trial to evaluate the effect of a program that provides SMS support to low-income parents with a place in a childcare centre.
- Project SMS has a small positive impact on parents' reading practices, mainly among the most disadvantaged parents and those with the youngest children.
- However, we do not observe any effect of the intervention on our measures of child development. These small effects may be due to the fact that most parents report that they are already following recommended practices.



The Institut des politiques publiques (IPP) was developed through a scientific partnership between the Paris School of Economics (PSE) and the Groupe des écoles nationales d'économie et de statistique (GENES). The aim of the IPP is to promote quantitative analysis and evaluation of public policy using cutting-edge research methods in economics.

Introduction

Parents play a key role in their children's language development (Jeynes, 2005; Kautz et al., 2014). In particular, parents' socio-economic background is highly correlated with young children's language proficiency (Peyre et al., 2014; Noble et al., 2015; Grobon, Panico, and Solaz, 2019). In a well-known study, Hart and Risley (1995) estimated that at age 3, a child from an affluent background in the US had heard an average of 30 million more words than a child from an underprivileged background.¹ These inequalities persist throughout children's schooling (Walker et al., 1994; Cunningham and Stanovich, 1997) and have repercussions for their future socio-economic wellbeing (Carneiro and Heckman, 2003; Heckman, 2006).

These differences in development according to socio-economic level are partly due to the fact that parents from disadvantaged backgrounds are less likely to systematically adopt the practices most conducive to language stimulation in children, particularly those concerning reading or the way in which parents communicate with their children (Golova et al., 1999; Needlman et al., 2005; Blom-Hoffman et al., 2007; Zuckerman, 2009). It has also been observed that these parents have less information about child development. Parents who have more knowledge about child development are more likely to be involved in their children's development (Goodnow, 1988; Smith, 2001; Rowe, 2008).

A number of schemes (Kern and Fekete, 2019) have been designed in different countries² to raise parents' awareness of these issues. These programs take different forms, such as home visits, specific support from teachers or extra visits to the pediatrician. Duncan, Ludwig, and Magnuson (2010) have shown that this type of intervention has mixed results for parenting practices and struggles to achieve significant effects on children's development, despite the fact that these measures are costly to implement.

Recent studies show that an alternative parental support scheme can produce effects at a very low cost: sending text messages that encourage parents to interact with their children according to certain principles identified in the scientific literature. This intervention method was notably implemented for children aged 4 to 6 years by the Ready4K program – on which Project SMS is based – with encouraging results (York and Loeb, 2014). This scheme can be implemented on a large scale at low cost

and allows parents to be supported step by step. It is not prescriptive, raising awareness and providing information which parents are free to use. The optimal degree of personalization, frequency and variety of media (SMS, e-mails, calls, etc.) have been established by the research literature (Kraft and Rogers, 2015; Doss et al., 2018; Cortes et al., 2018). In particular, a rate of three personalized SMS messages per week maximizes the potential impact on parenting practices and child development.

Project SMS

Project SMS began by sending parents three SMS messages per week (see Box 1) between November 2018 and June 2019. These SMS messages were designed by early childhood specialists to provide information about children's language development and advice to support that development. Each weekly SMS series focused on one of the four identified themes: songs, books, daily routines, and games. A rotation between these themes was organized to vary the activities that support children's development. Some SMS messages were personalized according to the child's age (1 to 2 years and 2 to 3 years).

In addition to the SMS messages, the parents received two to three calls from a speech therapist specialized in early childhood. The purpose of these calls was to introduce the program to parents, then to detect possible technical problems and to boost motivation by listening to parents' needs and giving them personalized advice. Lastly, four books that were accessible to the children and differentiated according to age group were sent free of charge to the families benefiting from the program (bath-time book, musical book, etc.).

Project SMS was led by 1001mots, a non-profit association that aims to reduce social inequalities with regard to language in early childhood.³ It specializes in the development of parenting programs aimed at promoting the language development of children aged 0 to 3 years, especially in the most disadvantaged families.

A rigorous evaluation

Recruitment of the 394 families

To establish an experimental population, we selected the parents of 394 children in a set of 70 childcare centers throughout France.⁴ We identified four eligibility crite-

¹Although this estimate has been disputed (Sperry, Sperry, and Miller, 2019), recent analyses confirm the reality and scale of social differences (Golinkoff et al., 2019; Willingham, 2018).

²In France, such programs focusing on early language development are still underdeveloped, as shown in the report "Evaluation de la politique de soutien à la parentalité" (Jacquy-Vazquez, Raymond, and Sitruk, 2013).

³The director and co-founder of 1001mots, Florent de Bodman, is the brother-in-law of Clément de Chaisemartin, a member of the evaluation team. We have been careful to respect the usual separation between the evaluator and the project leader despite this family link. In particular, the analyses carried out follow a pre-analysis plan published prior to data collection and analysis.

⁴These childcare centers also participate in another evaluation, the Parler Bambin program.

Box 1: Examples of SMS messages sent

The parents received three SMS messages each week following a logical sequence of 'Fact - Tip - Developing the advice'. The first SMS aims to provide parents with factual information on children's language and cognitive development. The second gives a tip about promoting the child's development based on the fact presented in the previous SMS. The last SMS develops this advice while trying to promote interactions with the childcare center. Here are two examples from the SMS series sent:

First example – "Books" theme

- Fact: "For toddlers, looking at a book with their parents is a lot of fun! Especially if the child is the one showing the pictures. What do you think about this?"
- Tip: "For a 1-year-old like *first name*, the book is a game to play with, to eat! But with you, like the child in this video vimeo.com/304622436, he learns to listen!"
- Developing the advice: "Hello, maybe your child has a favorite book at the daycare center? Ask the care providers which book he likes at the moment!"

Second example – "Games" theme

- Fact: "When playing, *first name* isn't wasting his time – he learns! Have you ever tried simple games, like in the bottle caps video vimeo.com/266651982"
- Tip :
 - For children aged 1 to 2 years: "Where you see bottle caps, your child sees a game! Watch him: this will give you ideas on how to play with him, like filling and emptying a box"
 - For children aged 2 to 3 years: "Where you see bottle caps, *first name* sees a game! Look at him: he will give you ideas about playing together, like putting all the big caps in the right hole"
- Developing the advice: "Have you tried playing the bottle-cap game like in my video? Ask the daycare center if they play simple games with your child"

ria for the program. First, the child must be between 12 and 34 months at the beginning of the intervention. To target the most disadvantaged families, we selected children according to the CAF rate paid by the parents. This is the hourly daycare rate paid according to the family's income for the year N-2 and the number of dependent children.⁵ Parents with lower incomes have lower hourly CAF rates. In practice, we have prioritized the selection of parents who pay a rate lower than €1 – roughly corresponding to the poverty line – as well as parents with a rate of up to €1.5, in order to ensure a reasonable sample size. Finally, the childcare center must be able to provide the telephone number of at least one of the two parents, and the parents must agree to participate in the experiment.

Table 1 provides a socio-economic portrait of the experimental population selected according to these criteria. This is a disadvantaged population with a high unemployment rate and almost half of the families are below the poverty line.

⁵The hourly CAF rate is calculated by multiplying the monthly taxable household resources for the year N-2 by a percentage that decreases with the number of dependent children. This percentage also varies according to the type of care offered. For example, a family with three dependent children with a declared annual household income of €18,000, or €1,500 per month, will have an hourly rate for group childcare of $1500 \times 0.004\% = 0.6$ €/hour. Each hour of group childcare will cost this family €0.60. This calculation method makes the hourly CAF rate a good indicator of families' income level.

Experimental protocol

The 394 children selected according to these criteria were randomly assigned to two groups of equal size: a "test" group whose parents are included in the SMS program, and a "control" group whose parents are excluded (Figure 1). Random assignment allows us to precisely identify the effect of the SMS Project by comparing the results of the test group with those of the control group. Parents gave explicit consent to participate in the study, and the acceptance rate to take part in the program was very high (95%). In the test group, it was usually the mothers who received the text messages, although both parents could choose to receive them. Parents in the test group also had the option to stop receiving SMS messages at any time by replying with a "STOP" message, and only 4.8% used this option.

Tools for measuring effects

We study the effects of this initiative at two levels. First, we analyze the impact of the intervention on parenting practices. Second, we estimate its effects on child development.

Different aspects of parenting practices are evaluated us-

Table 1: Socio-economic characteristics of the experimental population

Average age of respondent parent	33 years
Number of years of education	13 years
Proportion of parents who speak a language other than French at home	56%
Proportion of parents with French nationality	76%
Proportion of respondents in single-parent families	28%
Proportion of parents unemployed	20%
Average income of respondent parent	€1,262
Average income by household unit of consumption	€975
Proportion of parents below the poverty line	44%
Average age of children at beginning of program	24 months

Notes: The consumption unit assigns a coefficient to each member of the household, making it possible to compare the living standards of households of different sizes or compositions. The poverty line is defined as being equal to 65% of median income (median income is that which divides the population into two equal parts: the income of 50% of the population is lower, the income of the rest is higher). A 12-year education corresponds to a level equivalent to the French *baccalauréat*. Thus, 13 years of study are equivalent to a Bac+1. The high proportion of parents above the poverty line is explained by two main mechanisms: (i) when parents were selected, nearly one-third of them had an hourly rate between €1 and €1.5; and (ii) the hourly CAF rate is calculated based on income in year N-2, so that the selection of parents is based on a past financial situation that is likely to change.

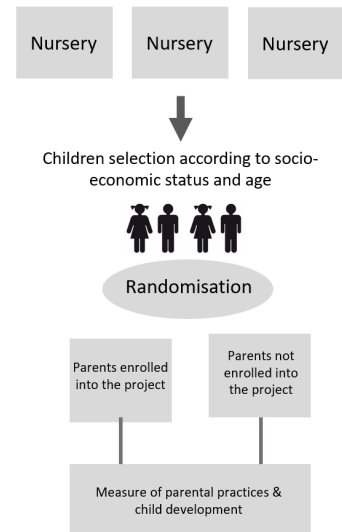
Sources: Survey data.

ing the StimQ questionnaire.⁶ It allows us to measure the parental reading practices and other actions that are most likely to stimulate children's development.

Each child's progress is assessed using questionnaires with the parents and child development tests. The IFDC questionnaire (*Inventaire Français du Développement Communicatif*, the French adaptation of the MacArthur-Bates Communicative Development Inventories, or MB-CDIs) is used to evaluate language development: it asks parents to indicate which words their child knows from a list of suggested words. A few questions selected from the IDE questionnaire (*Inventaire du Développement de l'Enfant*, the French adaptation of the Child Development Inventory, or CDI) are also proposed to parents, allowing us to evaluate the children's socio-affective development. These two questionnaires were developed in the United States and approved in both France and the United States. They are recognized by pediatricians, psychologists, and the French Ministry of Health and Solidarity as good indicators of the language and socio-affective development of young children. Lastly, we use two development tests according to the age of the child at the end of the experiment. The Brunet-Lézine scale, if the child is less than 30 months old, is used to evaluate language and psychomotor development. If the child is over 30 months, we use the Wechsler Intelligence Scale for Children (WISC), which provides a comprehensive picture of the child's language and cognitive development. These two tests are internationally

⁶This questionnaire has been validated by Dreyer, Mendelsohn, and Tamis-LeMonda (1996).

Figure 1: Experimental protocol



recognized and regularly used by psychologists in routine early childhood assessments. They are performed in the child's daycare center by qualified and experienced psychologists. Excerpts from these questionnaires are presented in Figure 2.

Main results

Impact on parenting practices

Project SMS has a small positive impact on parents' reading practices. The "story reading" score constructed from parents' responses to the StimQ questionnaire is higher in the test group than in the control group. The difference represents 16% of the standard deviation of this measure in the population, an effect that is considered to be modest. This difference is statistically significant at the 10% threshold but not at the 5% threshold.

This effect of Project SMS on parental reading practices is more pronounced for three groups with highly correlated characteristics: the least educated parents, those who speak a language other than French at home, and those with an income per consumption unit less than or equal to the median of the sample. In these groups, the difference between the test and control groups is respectively 33%, 25% and 30% of a standard deviation, i.e. an effect twice as strong as in the experimental population as a whole. These differences are significant at the 10% threshold, but not at the 5% threshold.

Parents whose children were less than 24 months old at the start of the program also appear to be more affected by the program. Their reading practices appear to have improved significantly (+32% of a standard deviation). This difference is significant at the 5% threshold.

We can thus observe that the most economically disad-

Figure 2: Excerpts from the questionnaires

EXTRACTS OF THE QUESTIONNAIRES

MBCDI

Indicate if your child uses the words:

Hello	<input type="checkbox"/>
Butterfly	<input type="checkbox"/>
Diner	<input type="checkbox"/>
Pencil	<input type="checkbox"/>

CDBI

Does your kid ...

Show some affection	YES/NO
Take in her arms	YES/NO
Kiss	YES/NO
Look at herself in the mirror	YES/NO

BRUNET-LÉZINE

At 24 months old, does the kid ...

Name 6 images	YES/NO
Produce 3-word sentences	YES/NO
Use her name to talk about her	YES/NO
Identify 8 objects or name 4	YES/NO

WPPSI

Score each action 0 or 1:

"Show me the telescope"	0 1
"Show me the cymbals"	0 1
"Show me the desert"	0 1

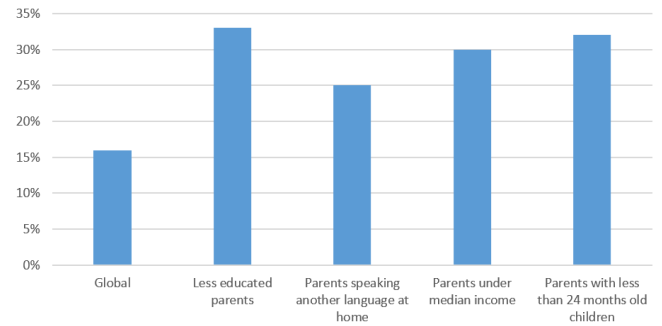
vantaged parents and those with the youngest children at the beginning of the intervention were the ones who were the most influenced in their reading practices by Project SMS.

In parallel with reading, the StimQ questionnaire allows us to measure other parenting practices that are more focused on the child's overall development. In general, we do not observe any effects on the other parenting practices measured: teaching children to count (by familiarizing them with numbers), teaching the alphabet, or pointing/naming (verbalizing the content of pictures or objects around the child and asking them to name them in return) are not influenced by the intervention. We do, however, identify an effect of 31% of a standard deviation on these parenting practices that promote general development and verbal responsiveness, but only in children less than 24 months of age at the start of the program. This effect is significant at the 5% threshold, but as it is isolated (i.e., this is the only subgroup where a significant effect of such intensity is found), it is possible that this effect is only a "false-positive" due to the number of different statistical analyses performed.

Impact on child development

The absence of strong effects on parenting practices, beyond a specific effect on reading, suggests an absence of

Figure 3: Impact on reading practices



Interpretation: Effects are expressed as the percentage of standard deviation of the score in the population. A positive coefficient indicates a beneficial effect of Project SMS.

Note: Results are expressed as a percentage of standard deviation: a value of 0.3 thus corresponds to an effect equivalent to 30% of a standard deviation. In education, effects are generally considered to be "weak" when they are less than 5% of a standard deviation, "moderate" between 5% and 20%, and "strong" when greater than 20%. The least educated parents have at most a *baccalauréat* or equivalent level, or 12 years of education at most. The last category refers to children under 24 months of age at the start of the program.

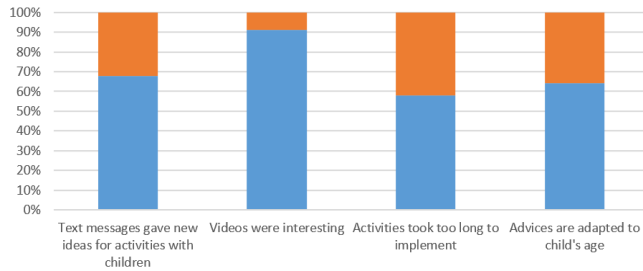
significant effects on children's development. Indeed, language, visuo-spatial, socio-affective and working memory development does not seem to be affected by the intervention. The effect of the program on children's language development is -0.3% of standard deviation. The impact of the program on their visuo-spatial development is -4% of standard deviation. Working memory and socio-affective development of children are affected by -13% and +7% of standard deviation respectively. These effects are small and not statistically significant. Analysis of subgroups leads to the same conclusions: children who speak a language other than French at home, those under 24 months of age, and those whose parents have less than 12 years of education or incomes per consumption unit below the median income do not seem to be affected by the program.

Interpretation of results

Our results show first of all that **the parents who are most likely to change their practices in keeping with the recommendations are those with the lowest income.** This finding is consistent with the literature on children's language development (Peyre et al., 2014; Noble et al., 2015; Grobon, Panico, and Solaz, 2019). In addition, **our results show that it was easier to influence parenting practices when the children involved were younger.** The critical age range in this sample of families appears to be 12-24 months.

To try to understand the general weakness of the effects of the scheme on parenting practices, we conducted a survey of parents in the "test" group that benefited from the program, investigating their attitudes towards the intervention.

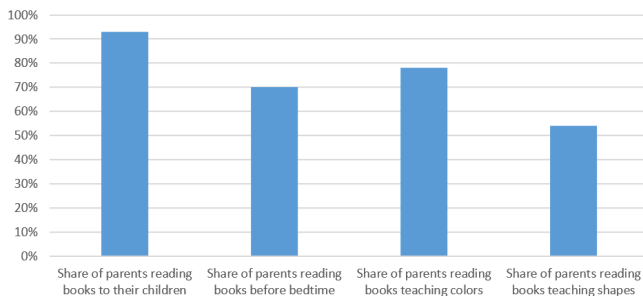
Figure 4: Parental satisfaction with the program



Interpretation: To the question: "Did the SMS give you new ideas for activities with your child?", about 70% of the parents in the test group answered positively. Conversely, 30% of the parents did not believe that the SMS messages provided new ideas for activities.

On the whole, the families are satisfied with Project SMS, as shown in Figure 4. The majority of them consider that the activities suggested in the text messages were interesting, innovative, not too time-consuming, and adapted to the child.

Figure 5: Parenting practices of the control group



Interpretation: In the group of parents who did not benefit from Project SMS (control group), more than 90% of parents said they read books to their child and 70% said they read a book before their child went to bed.

But one of the key findings of this survey is that **83% of parents report that they were already implementing the recommended practices at the start of the program.** The results of the control group⁷ for the StimQ questionnaire point in the same direction: 93% of control parents already read books with their child, 70% routinely read a story before their child goes to bed, 77% read books that help teach their child colors, and 54% read books that help teach shapes. These results can be seen in Figure 5.

These results could explain the weak average impact of the program on parenting practices. Since most of the parents said they already had good practices, the room for improvement through the program was potentially small.

Analysis of parenting practices by subgroups seems to confirm this hypothesis. The parents who were influenced by Project SMS were those who were least familiar with the practices suggested by the system. Among parents with the youngest children and the lowest income only 62% and 68% respectively read a book before their child went to bed, compared to 79% and 73% for parents with the oldest and most advantaged children.

This interpretation is supported by the fact that we do not find any significant difference between these same subgroups before the intervention for practices not affected by Project SMS, such as pointing/naming, counting or teaching the alphabet. The most disadvantaged parents often prove to be even more familiar with these practices than the most affluent parents, as can be seen in Figure 6. Thus, the most disadvantaged parents report that 96% of them are used to naming the child's surrounding objects in the street, compared to 92% of the most affluent parents. This lack of potential for improvement, all subgroups taken together, could explain the program's lack of impact on pointing/naming, teaching the alphabet, or counting.

Finally, **the significant effect that we observe on reading practices may be due to the sending of books rather than SMS messages.**⁸ The most disadvantaged parents initially have fewer books for their child than the most advantaged parents, and the effect of the intervention on their reading practices is higher, which is compatible with this hypothesis. However, two other observations suggest that the sending of books cannot explain the entire effect on reading practices. First, parents whose child was less than 24 months of age at the beginning of the experiment reported having more books for their child than parents whose child was over 24 months of age, whereas the effect of the intervention on their reading practices was higher. Second, the parents included in this experiment already have many books for their children (median of 20 books in the control group), so that the four books sent during the experiment represent only a 20% increase in the number of books available to these families.

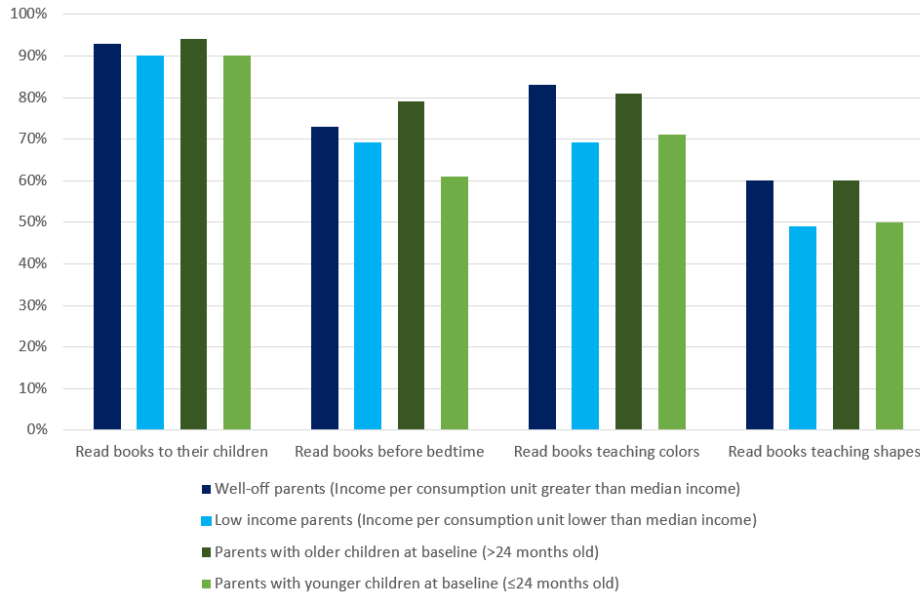
Our results could suffer from a desirability bias: from the questions asked, parents could guess the "right answers". Rather than reporting their real practices, they could instead report those they guess are desirable for their child's development. To identify such a bias, we added a section of very specific questions on the reading practices carried out the day before the questionnaire. These contextual questions differ from those in the StimQ questionnaire, which are more general and therefore more prone to desirability bias. To test for the existence of this bias, for each parent we drew lots to determine whether these specific and objective questions appeared before or after the general StimQ questions. If the StimQ questions are subject to a strong desirability bias, asking these specific questions before the StimQ should reduce this bias: the fact that parents listed their reading practices the day before very precisely should lead them to answer the more general StimQ questions more truthfully.⁹ In practice, parents' responses to the StimQ questionnaire are not signif-

⁸See "Project SMS", above.

⁹We observe no difference between the test group and the control group on the reading time the day before the questionnaire, measured with these specific questions.

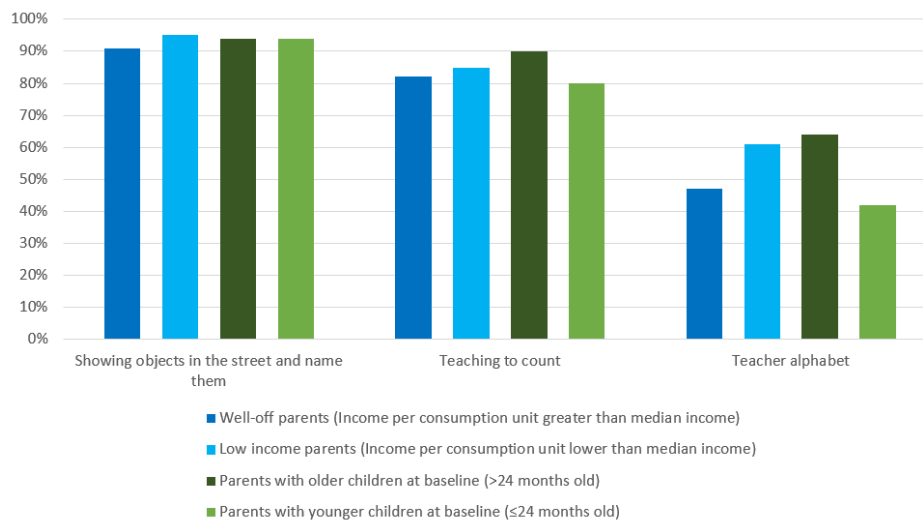
⁷The "control" group did not benefit from the intervention.

Figure 6: Control group parental reading practices by subgroup at the end of the intervention



Interpretation: In the control group, among the most affluent parents (whose income per unit of consumption is above the median), nearly 95% read books to their child compared to 90% among the most disadvantaged parents. These proportions are similar when parents of children over 24 months of age are compared with those whose children were under 24 months of age at the start of the program.

Figure 7: Control group parenting practices (pointing/naming, counting, and teaching the alphabet) by subgroups at the end of the intervention



Interpretation: In the control group, among the most affluent parents (whose income per consumption unit is higher than the median), nearly 45% report teaching their child the alphabet through reading. Conversely, among the most disadvantaged parents, 60% of parents report teaching their child the alphabet.

icantly different depending on whether they were asked the specific questions before or after, suggesting that our results do not suffer from a desirability bias.

Our evaluation is also limited by the tools available to measure parenting practices. There are few validated questionnaires that accurately measure parenting practices with such young children. Measurements based on direct observations, using audio recordings, for example, would allow for an accurate assessment of the quantity and quality of practices, but such measures are difficult to implement and parents may have reservations about participating.

Conclusion

Overall, our results suggest that the SMS intervention may not have been appropriate for the population included in the experiment. Several factors could explain this mistargeting of the population. Firstly, the socio-economic selection criterion is based on the hourly CAF rate, which is calculated on the income for year N-2¹⁰. Based on this past situation, we likely selected a significant number of families whose low income in N-2 was only temporary (for example, families in which one parent

¹⁰See "Recruitment of the 394 families", above.

was a student at the time the hourly CAF rate was calculated). Furthermore, to ensure a sufficient sample size, we also selected parents above the poverty line based on the hourly CAF rate (see footnote n°5). Secondly, by selecting parents whose children have been in the childcare centre several days a week for at least a year, we targeted families who had probably already been made aware by the childcare centre of practices that promote children's development, either directly (advice from childcare professionals) or indirectly (observation by parents of the practices of the professionals, good habits adopted by the child and repeated at home). Finally, our results show that practices to stimulate language development are less systematic among parents of younger children, yet many of the children selected were over two years old at the beginning of the intervention, thus limiting the program's potential impact. Therefore, **it seems important to re-target the intervention towards more disadvantaged families, with children younger than those who took part in this experiment, and who are not enrolled in childcare.**

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