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Building education resilience through parenting style and out-of-school learning: Field experimental evidence from rural Bangladesh

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ADB Working Paper Series

**BUILDING EDUCATION RESILIENCE
THROUGH PARENTING STYLE AND
OUT-OF-SCHOOL LEARNING:
FIELD EXPERIMENTAL EVIDENCE
FROM RURAL BANGLADESH**

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Abstract

Parents can play a crucial role in children's learning, particularly when children are out of school or during times of school closures. In this study, we evaluate the impacts of two distance educational interventions, which directly involved parents and were delivered via basic mobile phones, on parenting styles and children's cognitive development. Our data come from two randomized control trials (RCTs) administered in rural Bangladesh during the COVID-19 pandemic. In the first intervention, volunteers mentored mothers and tutored children over the phone, while in the second one, participating mothers dialed a toll-free number to access prerecorded audio lessons for their children. Findings reveal that both interventions enhance mothers' authoritative parenting style, leading to improved children's standardized test scores. The results highlight the value of scalable and cost-effective phone-based educational interventions in enhancing the parental role in children's human capital acquisition in developing countries.

Keywords: parenting styles, homeschooling, primary education, distance educational intervention, randomized experiment, Bangladesh

JEL Classification: O15, I21, I24

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1. INTRODUCTION

The early years of a child's life are crucial for cognitive development, with primary caregivers, particularly parents, playing a pivotal role (Bornstein et al. 2012; Grolnick and Ryan 1989; Hill and Tyson 2009; Spera 2005; Zhao and Glewwe 2010). Given that children spend roughly 80% of their waking time taking part in out-of-school activities (Friedlander, Galloway, and Johnson 2018), the parenting styles adopted by their parents can significantly influence their cognitive development. Parenting styles refer to parents' reactions to their children's needs, including rewards, compromises, and setting boundaries (Robinson et al. 1995). Baumrind (1967) characterized parenting styles into three widely used categories – *authoritative*, *authoritarian*, and *permissive*. Doepke, Sorrenti, and Zilibotti (2019) explain these parenting styles as follows: Authoritative parents are nurturing and set clear boundaries, authoritarian parents are strict with high expectations, and permissive parents adopt a laissez-faire approach to supervision. Although past research has identified several correlates of parenting styles (Belsky 1984; Belsky and Jaffee 2015; Bluestone and Tamis-LeMonda 1999; Kendler, Sham, and MacLean 1997), there is limited evidence on whether parenting styles can be influenced.

Dornbusch et al. (1987) show that an authoritative parenting style is linked to better children's academic outcomes, whereas authoritarian and permissive styles are linked to poorer children's performance. More recent studies also confirm similar patterns of associations between parenting styles and children's cognitive development (e.g., Chan and Koo 2011; Hubbs-Tait et al. 2009; Rudy and Grusec 2006). Studies have also indicated that low socioeconomic status and poor education are risk factors in parenting and children's development (Bornstein 2016). Since existing evidence suggests that an authoritative parenting style is linked to better children's cognitive development and that risk factors of poor parenting and children's development are likely higher in a resource-poor setting, enhancing authoritative parenting practices among primary caregivers, particularly parents, can potentially have long-term impacts on human and economic development. There are studies documenting the determinants of parenting styles in developed countries; however, experimental evidence, especially in a resource-poor developing country context, is scant (Bornstein et al. 2012). We are thus motivated to investigate whether parenting styles can be enhanced to facilitate the human capital accumulation of primary school-aged children in a low-resource developing country context. In particular, this study examines whether phone-based distance educational interventions can causally affect parenting styles and, if so, whether these changes subsequently affect children's academic performance in a resource-poor setting.

We draw upon data from two randomized control trials (RCTs) administered in rural Bangladesh during the COVID-19 pandemic (Hassan et al. 2024; Wang et al. 2024). Hassan et al. (2024) implemented a 13-week phone-based telementoring program, in which volunteers mentored mothers in managing their children's homeschooling and provided tutoring help to their children in grades 1 to 3 via basic mobile phones during the COVID-19-induced school closures. The volunteers were university students, referred to as "telementors," who called the participating mothers at a scheduled time each week to provide mentoring and tutoring services free of charge. In the other experiment, Wang et al. (2024) provided prerecorded audio lessons that were accessible via phones at any time over a 15-week period, allowing mothers to dial toll-free numbers to access the audio lessons and play them over the loudspeaker for their children in grades 1 to 4 through interactive voice response (IVR). Educational experts created the lessons using contemporary pedagogical techniques, simulating an

interactive classroom with two instructors and two students. As the lessons played, mothers accompanied the children as active facilitators, helping their children to engage in the learning activities presented in the audio lessons. Hassan et al. (2024) and Wang et al. (2024) show that these distance educational interventions improve children's standardized test scores. Our study delves deeper, exploring whether these interventions also affect the parenting styles of participating mothers, which in turn improves their children's academic achievement.

The theory of behavioral transformation suggests that when individuals consistently engage in specific actions over time, they become ingrained in certain behavioral patterns (Ouellette and Wood 1998). Bandura (1999) social cognitive theory posits that behaviors can often be acquired by observing others in our social surroundings. In the context of parenting, if parents consistently employ positive techniques or witness others actively guiding children's learning by setting goals and helping them to achieve them over several months, they may integrate these practices into their parenting styles.¹ While the two interventions examined here were primarily designed to help children improve their learning, mothers were directly engaged in initiating and facilitating remote learning. Moreover, the interventions integrated contemporary child management principles, including fostering responsive parent-child bonds, enhancing skills for planning and achieving goals, and mitigating children's stressors. The telementoring program engaged mothers in progressive supervisory techniques, whereas the IVR audio-lesson program exposed them to modern interactive teaching modalities. We hypothesize that such exposure would help mothers internalize the standard child management and pedagogical methods embedded in the programs. Engaging with these methods may shift their perspectives and interactions with their children, potentially fostering the adoption of *authoritative* parenting practices.

During the COVID-19 pandemic, schools in Bangladesh closed for more than a year and a half (TBS 2021). The government's distance learning initiatives delivered via TV, radio, and the Internet had limited success, especially in rural areas, given rural households' low ownership of TVs, radios, computers, and smartphones (BBS and UNICEF 2019; Biswas et al. 2020; Rahman et al. 2021).² In contrast, the widespread use of basic mobile phones, including in rural regions (BBS 2022), meant that mobile phone-based educational interventions could better reach children who were most adversely affected by school closures.³ Furthermore, given that female labor force participation in Bangladesh is only 38% (ILO 2022), a feature common in many developing countries, children typically spend a considerable amount of their out-of-school time with their mothers. Thus, the combination of widespread basic mobile phone use and greater potential for maternal involvement in out-of-school education makes rural Bangladesh an ideal environment to study whether phone-based

¹ The duration required to alter one's parenting style cannot be determined definitively, since it is contingent upon several aspects, including the existing parenting style, the desired parenting style, the level of motivation, the availability of support, and the complexity of the obstacles involved. However, studies suggest that the process for a new behavior to become habitual typically takes around 2 months, but this time frame can vary significantly, ranging from 18 to 254 days (Lally et al. 2010).

² Although multimodal distance learning was delivered quickly, a rapid survey conducted by the World Bank revealed that only around 40% of students had the opportunity to engage in remote learning during the initial months of the COVID-19 outbreak (Biswas et al. 2020). One year later, a considerable proportion of children still did not have access to remote learning. Specifically, 44% of rural families and 36% of urban slum households had no access to distance learning (Rahman et al. 2021). The limited availability of educational resources resulted in subpar academic achievements, with just 18% of primary school students and 38% of secondary school students engaging in active learning through assignments in August 2021 (Rahman et al. 2021).

³ More than 96% of households in rural Bangladesh have access to a mobile phone, but less than a third of them have smartphones (Hassan et al. 2024).

educational interventions involving mothers can influence parenting styles and benefit children's cognitive development.

Our findings suggest that distance educational interventions that involve mothers, delivered via basic mobile phones, can effectively enhance mothers' authoritative parenting tendencies and improve children's cognitive development. We find that the telementoring program increases the authoritative parenting scores of treated mothers by 0.53 standard deviations (SD), while the IVR audio-lesson program increases the authoritative parenting scores of treated mothers by 0.24 SD. These positive effects are robust to the potential for respondents to give socially desirable answers. We also find that the increased authoritativeness in parenting styles, in turn, raises treated children's test scores by 0.03 SD in the telementoring program and by 0.04 SD in the IVR audio-lesson program. The indirect effects on test scores may look small relative to the large direct effects of the interventions on children's test scores (0.73 SD and 0.56 SD), however the effect sizes of 0.03 SD and 0.04 SD are nearly a quarter to a third of the effect size of a remote-learning intervention implemented by Angrist, Bergman and Matsheng (2022) and almost a quarter to a half of the effect of school autonomy (Hahn, Wang, and Yang 2018). Since parents can continue to influence their children after a remote-learning intervention ends, these findings underscore the potential long-term benefits of low-cost and scalable phone-based educational interventions in enhancing parenting practices, thereby facilitating the accumulation of human capital in hard-to-reach areas.

There is a growing literature evaluating the potential of low-cost interventions in enhancing parental engagement in their children's education. For example, in Bangladesh, the setting of our study, Islam (2019) finds that providing parents with information through monthly parent-teacher meetings about their children's progress and performance in schools has significant positive effects on both learning and behavioral outcomes. Barrera et al. (2020) indicate that sending parents text messages about their children's activities in school enhances reported parental involvement at home in Nicaragua. Cortes et al. (2023) find that text-message-based parenting curricula effectively support positive parenting behavior. York, Loeb, and Doss (2019) also find that the text-messaging initiative of the *Ready4K* program in San Francisco enhances parental engagement in their preschoolers' academic activities at home. Justino et al. (2023) find significant benefits from a low-cost radio program aimed at enhancing parental inputs and long-term child development in Rwanda. Studies by Attanasio, Meghir, and Nix (2020) in India and Carneiro et al. (2019) in Chile highlight the impacts of affordable parenting programs on children's abilities, which are channeled through transformations in the home setting and shifts in parental behaviors. Diaz et al. (2023) find that a virtual intervention in Jamaica improves caregivers' attitudes and well-being. Our study adds to this growing literature by showing that phone-based educational interventions involving parents can change their parenting styles, which in turn improves their children's cognitive development.

This paper also contributes to the literature on the determinants of parenting styles and the relationship between parenting styles and child development. Existing literature has identified various determinants of parenting styles and found that children's cognitive development is positively associated with authoritative parenting styles (Baumrind 1991; Bluestone and Tamis-LeMonda 1999; Bornstein 2016; Dornbusch et al. 1987; Francesconi and Heckman 2016; Grolnick and Ryan 1989; Karavasilis, Doyle, and Markiewicz 2003; Spera 2005). However, the link between parenting practices and a child's developmental trajectory can be complex, potentially moderated by demographic factors such as socioeconomic status, parental education, and cultural context (Wang et al. 2022). Doepke, Sorrenti, and Zilibotti (2019) shed light on the

effects of a family's financial constraints on child development, concluding that the time investments from parents tend to be more crucial than monetary expenses in fostering a child's cognitive abilities. We contribute to the literature by demonstrating that light-touch educational interventions aimed at improving children's academic performance and involving parents in the process can increase parents' authoritative parenting tendencies, which in turn has an effect on their children's cognitive development.

The remainder of the paper is structured as follows. Section 2 provides a concise overview of the study's background. Section 3 presents a detailed account of the experimental design of the two randomized controlled trials (RCTs), including information on the characteristics of the sample, the balance between the different groups, survey attrition, data collection, the main outcome variables, and estimation methodologies. Section 4 provides an overview of the impact of the treatments on parenting style, the combined impact of treatments and parenting styles on test scores, heterogeneous treatment effects, mediation analysis, and a few checks that ensure the reliability of the findings. The paper concludes with a discussion in Section 5.

2. CONTEXT OF THE STUDY

Bangladesh has nearly 17 million primary school-aged children, and many of them face cognitive growth challenges (Hamadani et al. 2014). A staggering 58% of these children cannot read basic text in their native language by the age 10, indicating significant learning deficits (World World Bank 2022). The COVID-19 pandemic placed further strain on education. Schools were closed for 18 months (TBS 2021), severely impacting the academic progress of many students, especially those in primary schools and those without access to distance learning technologies (Li, Sharma, and Matin 2021). In response to the school closures caused by the COVID-19 pandemic, the Bangladeshi government initiated educational programs broadcast on TV and radio, while some urban private schools offered online classes. However, these initiatives struggled in rural areas due to limited access to TVs, radios, and smartphones (BBS and UNICEF 2019). A rapid assessment by BRAC (2020) indicates that 56% of students did not engage in any form of distance education, with non-participation rising to 60% among rural students.

This shortfall in learning—before, during, and after COVID-19—is often linked to insufficient educational resources, overloaded teaching staff, and inadequate budgetary allocations, as well as a lack of awareness among parents (Chaudhury et al. 2006; Chowdhury and Sarkar 2018). Research has demonstrated that increased parental engagement in their children's academic pursuits has positive results, even in underprivileged neighborhoods inside industrialized nations (Islam 2019). Commonly, students view different forms of parental involvement, regardless of their educational background, as a crucial factor that contributes to their academic success. These include social and psychological support, monitoring of schoolwork, practical assistance, high expectations and aspirations, and a sense of obligation and appreciation towards their parents (Schmid and Garrels 2021). But in Bangladesh's educational landscape, a significant observation is the limited active involvement of parents, especially in the context of home-based studies (Kabir and Akter 2014).

This limited parental engagement posed a heightened risk of substantial learning losses, particularly among children in rural areas, during the prolonged COVID-19-induced school closure. The limited accessibility to radio, television, and the internet, compounded by a general parental unawareness of their children's educational needs, exacerbated this risk. Recognizing this challenge and the widespread use of basic

mobile phones, Hassan et al. (2024) and Wang et al. (2024) separately implemented two phone-based distance educational interventions targeted at primary school children and their caregivers in rural Bangladesh. A key aspect of these two interventions was the participation of the children's primary caregivers, with a significant majority being the mothers.

3. EXPERIMENTAL DESIGNS AND DATA

This section presents the details of the two interventions being examined. In particular, we describe the experimental design, the treatment, the characteristics of the sampled participants, and the parenting style variables.

3.1 Telementoring Program

3.1.1 Overview of the Experiment

In partnership with the Global Development Research Initiative (GDRI), Hassan et al. (2024) administered the telementoring program to mother-child dyads across 200 villages in Khulna and Satkhira districts. A total of 219 student volunteers were recruited from various public universities. On average, they were 22 years old and majoring in social sciences, with half of them female and over three quarters possessing prior tutoring experience (see Table A1). They were randomly assigned to 419 mother-child dyads out of the 838 mother-child dyads that participated in the RCT. Thus, each telementor was responsible for no more than two mother-child dyads. The other 419 mother-child dyads assigned to the control group received no intervention at all (i.e., pure control). The telementors provided mentoring services to mothers and tutoring services to their primary school-aged children in grade 1 to grade 3 over 13 weeks, from September to December 2020. Before the program commenced, the telementors participated in online training. They were provided with a plan outlining the weekly content of mentoring sessions and mentoring guidelines adapted from those of the Government Teachers' Training College in Bangladesh. Due to mobility restrictions during the COVID-19 pandemic, baseline characteristics of the 838 mother-child dyads came from data previously collected by the GDRI back in 2019, instead of a survey done at the beginning of the RCT in September 2020. However, a short, rapid survey was conducted at the beginning of the program to determine the homeschooling status and willingness of the mother-child dyads to participate (see Figure A1 for a CONSORT flow diagram of the trial). One month after the intervention ended, 814 mothers participated in the follow-up survey, and their children took a standardized test.

3.1.2 Experimental Treatment

Each telementor called the participating mother at a scheduled time once a week. The weekly mentoring sessions, each lasting approximately 30 minutes, followed a structured process as detailed in Figure A2. The telementors mainly interacted with the mothers to offer advice and support on homeschooling. However, children also participated in each session alongside their mothers by engaging in textbook problem-solving tasks. The telementor commenced each session with cordial greetings with the mother and child. Following this, the mentor assisted the mother in setting goals for the week's homeschooling activities and provided advice on effective time management. Additionally, they addressed challenges the mother and child had encountered in the previous week and identified areas of weakness within the child's textbooks, thereby

facilitating a comprehensive discussion involving both the child and the mother. The mentor also guided and helped the child in solving textbook problems. While the child was solving problems, the mentor conducted theme-based discussions with the mother (see Table A2). The session concluded with a homework assignment for the child and directions for the mother on how she could effectively assist the child with homework. In addition, there were ten different weekly themes for text messages similar to the themes covered by the mentors. These theme-based text messages were sent to the mothers (composed in Bangla) weekly, in weeks 3–12 (see Table A2).

3.2 IVR Audio Lessons

3.2.1 Overview of the Experiment

In partnership with the same NGO, the GDRI, Wang et al. (2024) implemented a three-arm clustered RCT across 90 villages in Khulna and Satkhira districts. This RCT randomly assigned 30 villages to the standard treatment group, 30 to the extended treatment group, and 30 to the control group. A total of 1,763 households with a child in grades 1 to 4 who had previously participated in a GDRI project were randomly selected to participate in the RCT. In the standard treatment group, 596 households received an intervention encompassing literacy and numeracy modules, each divided into 30 prerecorded audio lessons. In the extended treatment group, 586 households received an intervention that included a leadership module divided into 15 prerecorded lessons in addition to the literacy and numeracy modules. In the control group, no intervention was provided at all to 581 households (see Figure A3 for details of the research design). The program spanned 15 weeks between July and October 2021. One month after the intervention had ended, 1,690 mothers responded to the follow-up survey, and their children participated in a standardized test. Since Wang et al. (2024) found that children performed and mothers behaved similarly in both the standard treatment and extended treatment groups, we pool the two treatment groups into one in this study.

3.2.2 Experimental Treatment

During the 15-week program, caregivers in the treated groups could call a toll-free number at any time convenient to them to access the prerecorded audio lessons and play them over the loudspeaker for their children through IVR (see Figure A4). IVR is an automated phone system allowing callers to access information through a preset flow, navigated by voice commands or keypad selections. Unlike radio, which only offers scheduled broadcasts, IVR gives users the flexibility to choose lessons and engage at times convenient to them. The duration of a lesson ranged from 16 to 18 minutes. The lesson modules were created in collaboration with two international organizations, Rising on Air and Lead Africa, and a team of local curriculum experts. These lessons featured prerecorded dialogues involving four characters: two teachers and two students. The program children were prompted by the conversations to participate in activities based on the audio teacher's directives, including clapping, standing, counting, and singing, using the Interactive Audio Instruction (IAI) approach. IAI transforms one-way technology into an active learning tool. It prompts learners to respond verbally, participate in group tasks, and engage in activities during broadcasts, with facilitators overseeing lesson progression (Bosch, Rhodes, and Kariuki 2002).

The intervention leaned heavily on the role of the caregivers as they initiated calls to the program's toll-free numbers and selected the desired lesson through the IVR system. Given that most caregivers are mothers, we refer to these caregivers as "mothers." Once the lesson had been selected, the child and the mother listened to it

together. The children took part in the activities with the assistance of their mothers. While mothers were not expected to teach, their consistent presence and facilitation during the lessons meant they also took on a supervisory role in their children's learning activities.

3.3 Sample Characteristics, Balance, and Attrition

Table 1 provides an overview of the baseline characteristics of the study participants and shows that these characteristics are balanced between treatment and control groups. For the telementoring program, the average children's age is 6.72 years. In comparison, the average age of children in the IVR audio-lesson program is 7.38 years. This difference stems from the grade-level criteria: The telementoring program encompasses grades 1 to 3, while the IVR audio-lesson program includes grades 1 to 4. Baseline literacy and numeracy scores, indicative of the children's initial academic capabilities, are similar between the treatment and control groups.⁴

Table 1: Baseline Characteristics and Tests of Balance

Variables	Telementoring			IVR Audio Lesson		
	Control n=419	Treatment n=419	Difference n=838	Control n=581	Treatment n=1182	Difference n=1763
Panel A: Child characteristics						
Child's literacy score	8.59 (0.20)	8.70 (0.19)	0.11 (0.27)	7.34 (0.27)	7.32 (0.15)	-0.02 (0.31)
Child's numeracy score	9.09 (0.21)	8.74 (0.20)	-0.35 (0.29)	7.36 (0.33)	7.28 (0.16)	-0.08 (0.37)
Child gender (male=1)	0.49 (0.02)	0.49 (0.02)	-0.00 (0.03)	0.48 (0.02)	0.49 (0.02)	0.01 (0.03)
Child's age (year)	6.73 (0.02)	6.72 (0.02)	-0.01 (0.03)	7.38 (0.03)	7.38 (0.02)	0.01 (0.04)
Panel B: Parental characteristics						
Father's age (years)	34.71 (0.34)	34.80 (0.34)	0.09 (0.48)	37.75 (0.32)	37.76 (0.24)	0.01 (0.40)
Father's education (years)	6.01 (0.21)	6.01 (0.21)	0.00 (0.30)	5.75 (0.24)	6.05 (0.17)	0.30 (0.29)
Mother's age (years)	27.68 (0.26)	27.72 (0.25)	0.05 (0.36)	30.28 (0.27)	29.94 (0.19)	-0.34 (0.33)
Mother's education (years)	6.73 (0.17)	6.98 (0.16)	0.26 (0.23)	7.01 (0.19)	7.11 (0.15)	0.10 (0.24)
Panel C: Household characteristics						
Monthly HH income (Tk)	11,342.00 (226.46)	11,409.31 (278.70)	67.30 (359.10)	11,189.67 (433.31)	10,939.05 (228.62)	-250.62 (489.92)
Number of rooms in house	1.81 (0.05)	1.77 (0.04)	-0.04 (0.07)	1.81 (0.07)	1.70 (0.04)	-0.11 (0.08)
Electricity in HH (binary)	0.85 (0.02)	0.87 (0.02)	0.02 (0.02)	0.86 (0.03)	0.84 (0.03)	-0.02 (0.04)
Total HH land (decimal)	46.86 (4.35)	50.16 (5.10)	3.31 (6.70)	54.63 (5.50)	54.14 (7.28)	-0.48 (9.12)
Total children in HH	1.63 (0.03)	1.64 (0.03)	0.00 (0.04)	2.13 (0.05)	2.09 (0.03)	-0.04 (0.06)
F-test of joint significance (F-stat)	0.86			0.53		

Notes: Robust standard errors, presented in parentheses, are clustered at the individual level for the telementoring intervention and at the village level for the IVR audio-lesson intervention. Significance levels are denoted as follows: * for 10%, ** for 5%, and *** for 1%.

⁴ The baseline literacy assessment was measured on a scale of 25 points, while the numeracy assessment was measured on a scale of 20. As a result of limitations caused by the pandemic, it was not possible to conduct a comprehensive baseline survey. Alternatively, we utilized data from 2019 to establish a baseline assessment of children's numeracy (such as counting) and literacy (such as reciting the alphabet) skills.

Fathers in the telementoring program average 34.76 years of age, whereas those in the IVR audio-lesson program average 37.75 years. Mothers in both programs have lower average ages: 27.70 years for the telementoring program and 30.10 years for the IVR audio-lesson program. In both RCTs, mothers have more years of formal education than fathers. The average monthly household income is BDT11,375 for those in the telementoring program and BDT11,021 for those in the IVR audio-lesson program.⁵ While the difference is marginal, households in the control group of the IVR audio-lesson program have a slightly higher average number of rooms. Other household attributes, such as access to electricity, total land ownership, and the number of children, underscore the balanced characteristics achieved through randomization. The F-test of joint differences among baseline characteristics further indicates that these baseline characteristics do not explain the treatment status in each RCT. The evidence is consistent with the random assignment of treatment, where we expect no systematic relationship between baseline characteristics and treatment assignment.

In both RCTs, attrition was minimal. Hassan et al. (2024) and Wang et al. (2024) find that attrition rates between treatment and control groups are similar. Out of the initial 838 mother-child dyads for the telementoring intervention, 814 participated in the endline survey, indicating a 3% attrition rate. Similarly, in the IVR audio-lesson intervention, from the starting sample of 1,763 mother-child dyads, 1,690 responded to the survey and assessment at the endline, reflecting a 4% attrition.

3.4 Data Collection

In the endline survey, each mother-child dyad was attended to by two field personnel: one enumerator and one assessor. The enumerator conducted a survey with the mother, collecting data on household socioeconomic status, the child's current educational circumstances, parental involvement in the child's education and other activities, and the parent's views on their engagement in the child's learning. Meanwhile, the assessor separately carried out standardized cognitive assessments with the child.

3.5 Defining Parenting Styles

In the endline survey, questions about parenting styles and dimensions were collected. Following Robinson et al. (1995), we classify parents based on their scores from these questions and emphasize three primary parenting categories: authoritative, authoritarian, and permissive.⁶ For the authoritative category, the questions revolve around factors such as warmth, involvement, reasoning, participation, and a good-natured attitude. The authoritarian category focuses on factors such as verbal hostility, corporal punishment, nonreasoning approaches, punitive strategies, and directiveness. The permissive category encompasses factors such as inconsistency, overlooking misbehavior, and self-confidence. Table A3 contains the three sets of questions utilized by Hassan et al. (2024) and Wang et al. (2024). This part of the survey consists of 20 statements for the authoritative category, nine statements for the authoritarian

⁵ The mean monthly nominal household income in Bangladesh was estimated to be BDT32,422 in 2022, up from BDT15,988 in 2016 and BDT11,479 in 2010 (TBS 2023).

⁶ In the telementoring program, the correlation between authoritative and authoritarian parenting styles is 0.05, while between authoritative and permissive styles it is -0.08, and between authoritarian and permissive styles it is 0.18. In the IVR audio-lesson program, the correlation between authoritative and authoritarian parenting styles is 0.01, while between authoritative and permissive styles it is 0.08, and between authoritarian and permissive styles it is 0.50.

category, and six statements for the permissive category. Note that as the number of different questions were taken into consideration in defining the index proposed by the original scale, the imbalance in the number of questions across categories is not an issue. Mothers rated their agreement with each statement related to the three parenting categories on a five-point scale, ranging from “never” (1) to “always” (5).

Instead of strictly labeling parents as authoritative, authoritarian, or permissive, our analysis centers on the mean scores from each set of parenting style dimension questions. For each observation, we calculate the average scores from the three question sets, resulting in three variables: authoritative parenting scores, authoritarian parenting scores, and permissive parenting scores. Following Kling, Liebman and Katz (2007), we normalize (standardize) each of these average scores based on the mean and variance in the control group. The standardized scores are our outcome variables. We are particularly interested in examining how authoritative parenting scores might shift due to the two interventions.

3.6 Learning Outcomes

The endline survey measured learning outcomes using standardized individual assessment tests. The test questions were prepared based on textbooks from the National Curriculum and Textbook Board of Bangladesh. In the telementoring intervention, the test was divided into four sections: English, Bangla, numeracy, and general knowledge, adding up to 100 points. The IVR audio-lesson intervention had tests on literacy (English, Bangla) and numeracy, totaling 80 points. Both interventions had three distinct sets of questions catering to the different grade levels of the children.

When administering the standardized test, the assessor verbally asked the questions and recorded the answers on a handheld tablet device. Questions with potentially partial correctness were avoided to avert assessment biases. For instance, for the question “What is 8 plus 2?” the answer was deemed correct for “10” and incorrect otherwise. Answers were formatted in a binary manner to prevent assessment bias. Each child’s scores were normalized using the control group’s mean and variance and serve as the learning outcome variable.

3.7 Estimation Strategy

First, we aim to estimate the effects of each intervention on the scores of three parenting styles. Our objective is to understand how these interventions influence parenting styles. Specifically, we examine whether the interventions promote authoritativeness while reducing both authoritarian and permissive tendencies among mothers. Following this, we assess whether authoritative parenting scores mediate the effect of the intervention on children’s standardized test scores.

To examine the effects of each intervention on parenting styles, we estimate the following OLS regression specification by intervention:

$$M_i = \alpha + \beta T_i + \Gamma' X_i + g_i + \varepsilon_i, \quad (1)$$

where M_i captures the mean scores of a particular parenting style of a mother i measured at the endline, and T_i is the treatment indicator of an intervention. β provides the average causal effect of treatment assignment on the mean parenting style scores. X_i is a set of controls that include the child’s gender, age, baseline test scores, access to private tuition, parental education, and household income. g_i is the fixed effect for the grade of study. We expect that β will be positive for authoritative parenting scores,

suggesting that the intervention enhances mothers' authoritative parenting tendency. Conversely, for the other two parenting style scores, we expect β to be negative.

To examine the direct effect of an intervention and its indirect effect on children's test scores mediated through authoritative parenting scores, we employ a formal mediation analysis introduced by Imai, Keele, and Yamamoto (2010). Our focus will be the mediation role of an authoritative parenting style. First, we estimate the following specification by intervention:

$$Y_i = \gamma + \delta T_i + \theta M_i + \Gamma' X_i + g_i + u_i, \quad (2)$$

where Y_i is the test scores of child i measured at the endline; T_i is the treatment indicator of an intervention; M_i is the authoritative parenting scores of mother i examined in Equation (1), X_i is a set of controls including the child's gender, age, baseline test scores, access to private tuition, parental education, and household income; g_i is the fixed effect for the grade of study; δ represents the impact of intervention participation on children's test scores; θ denotes the effect of authoritative parenting scores. We anticipate that both δ and θ will be positive, suggesting that the intervention and authoritative parenting styles improve children's test performance.

Substituting Equation (1) into Equation (2) gives the following specification:

$$Y_i = \lambda + (\delta + \beta\theta)T_i + \Gamma' X_i + g_i + u_i. \quad (3)$$

Equation (3) provides the direct effect (δ), the indirect effect ($\beta\theta$), and the total effect ($\delta + \beta\theta$) of an intervention on a child's test scores. We decompose the total effect into the direct and indirect effects (i.e., the residual effect by everything else). The indirect effect captures the extent to which the effect of an intervention on test scores mediates through the change in authoritative parenting scores. For authoritative parenting to play a significant role in mediating the effect of an intervention on students' test scores, it is essential that $\beta\theta$ is not equal to 0. If $\beta\theta$ equals 0, there is no indication that an authoritative parenting style is a crucial mediator.

Imai, Keele, and Yamamoto (2010) outline the identifying assumption required to test the average causal mediation effect, represented as $\beta\theta \neq 0$ in Equation (3). They further introduce a sensitivity analysis to evaluate the robustness of the sequential ignorability assumption. This assumption posits that the treatment is ignorable based on pretreatment covariates. Subsequently, the mediator variable (authoritative parenting scores) is assumed to be ignorable, contingent upon the observed treatment value and the pretreatment covariates. The randomization of treatment addresses the basic assumptions required for credible mediation analysis. The random treatment assignment ensures control over confounding variables, directly addressing the first ignorability assumption. Furthermore, the fact that the children were tested separately and the parents were not immediately informed of their children's performance while responding to the parenting style questionnaires minimizes the concerns that the data collection process might lead to the violation of the latter part of the sequential ignorability assumption. Nonetheless, potential challenges may still arise concerning the latter part of the sequential ignorability assumption, as there might be observed or unobserved post-treatment confounders. To address this, Imai, Keele, and Yamamoto (2010) suggest a sensitivity analysis, adjusting the correlation between the error terms in Equations (1) and (2). This helps determine the extent of correlation required for the average causal mediation effect to nullify or reverse. While we emphasize the role of authoritative parenting as a mediator, we acknowledge the potential existence of other pathways.

4. RESULTS

This section presents the results of this study. We first present the estimated effects of each intervention on the three different types of parenting scores. We then present the estimated effects of an intervention and parenting scores on children's test scores. We focus our analysis mainly on authoritative parenting styles. Thirdly, we present the heterogeneous treatment effects of the intervention. Lastly, we present the mediation analysis for authoritative parenting styles that decomposes the total treatment effects on test scores into direct and indirect effects.

4.1 Effects of the Treatments on Parenting Style Scores

Table 2 presents the regression outcomes derived from Equation (1). Panel A of Table 2 shows that the telementoring program significantly influences authoritative parenting scores. Mothers in the treatment group exhibit an increase of 0.53 SD in their average authoritative parenting scores relative to mothers in the control group. Furthermore, the telementoring program leads to a reduction of 0.20 SD in permissive parenting scores. There is no significant change observed in the authoritarian parenting scores. The results suggest that with its interactive and personalized approach, the telementoring program might be particularly effective in promoting the authoritative parenting style, characterized by a balance of warmth and discipline. The program has nudged permissive parents, who typically might be less involved in their children's education, into adopting a more balanced and involved approach. However, the lack of change in authoritarian parenting scores indicates that an authoritarian parenting style, which is more rigid and strict, might be deeply ingrained and less amenable to change through the telementoring program.

The IVR audio-lesson program, on the other hand, shows a smaller but wider impact across all three parenting styles (Panel B of Table 2). The authoritative parenting scores among mothers in this intervention increased by 0.24 SD relative to their counterparts in the control group. This statistically significant effect indicates that mobile-based interventions can positively influence positive parenting styles. The IVR audio-lesson program resulted in a decline of 0.17 SD in authoritarian parenting scores and 0.21 SD in permissive parenting scores. Both of these declines are statistically significant. The findings imply that the IVR audio-lesson program, embedded with a modern teaching pedagogy that aims to enhance parent-child interactions in the household setting, could be especially potent in encouraging an authoritative parenting approach while diminishing authoritarian and permissive parenting styles.

Panel C of Table 2 presents the differential effect of the telementoring intervention relative to the IVR audio-lesson intervention. We find that the telementoring intervention increases authoritative parenting scores by 0.28 SD more than the IVR audio-lesson intervention. There is no significant differential effect on the scores for authoritarian and permissive parenting styles.

The difference in the effect sizes of the telementoring and IVR audio-lesson programs on authoritative parenting scores can be attributed to the structure and focus of the two interventions. The telementoring program involves personalized one-on-one consultation, emphasizing assistance for mothers in better supervising their children at home and fostering positive interactions for improved educational outcomes. In contrast, the IVR audio-lesson program primarily employs one-way communication, focusing on textbook-based lessons to enhance children's learning outcomes through effective homeschooling. Moreover, there was an SMS campaign in the telementoring program that emphasizes positive parenting practices. Therefore, the larger effect of

the telementoring intervention on authoritative parenting scores compared to the IVR audio-lesson intervention is not too unexpected.

Table 2: Treatment Effects on Parenting Style Scores

Variable	Authoritative Parenting		Authoritarian Parenting		Permissive Parenting	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Telementoring						
Treatment effect	0.53*** (0.07)	0.53*** (0.07)	-0.07 (0.07)	-0.08 (0.07)	-0.19*** (0.07)	-0.20*** (0.07)
Controls and FEs	No	Yes	No	Yes	No	Yes
Sample size	814	814	814	814	814	814
R-squared	0.06	0.10	0.00	0.03	0.01	0.04
Panel B: IVR Audio lesson						
Treatment effect	0.25*** (0.07)	0.24*** (0.06)	-0.17** (0.07)	-0.17** (0.07)	-0.21*** (0.07)	-0.21*** (0.07)
Controls and FEs	No	Yes	No	Yes	No	Yes
Sample size	1,690	1,689	1,690	1,689	1,690	1,689
R-squared	0.01	0.07	0.01	0.02	0.01	0.02
Panel C: Differential treatment effect						
Treatment effect	0.28*** (0.10)	0.28*** (0.10)	0.10 (0.10)	0.10 (0.10)	0.02 (0.10)	0.02 (0.10)
Controls and FEs	No	Yes	No	Yes	No	Yes
Sample size	2,504	2,503	2,504	2,503	2,504	2,503
R-squared	0.03	0.08	0.01	0.03	0.01	0.03

Notes: The treatment effects are estimated using OLS regression, both with and without control variables and grade fixed effects. Robust standard errors, presented in parentheses, are clustered at the individual level for the telementoring intervention and at the village level for the IVR audio-lesson intervention. Significance levels are denoted as follows: * for 10%, ** for 5%, and *** for 1%.

We also observe that while authoritarian and permissive parenting tendencies decrease in the IVR audio-lesson intervention, mothers' authoritarian parenting scores remain unchanged in the telemonitoring intervention. The telementors encouraged mothers to set goals and plan studies for their children. This might motivate permissive parents to become more authoritative, while authoritarian parents might remain strict to ensure that goals are met and homework is done. The IVR audio-lesson intervention, on the other hand, does not necessitate such goal-setting or structured activities. Mothers observe the approach of the instructors, who exhibit a warm and authoritative manner. As a result, both authoritarian and permissive parents may end up adopting an authoritative approach in the IVR audio-lesson intervention.

4.2 Effects of the Treatments and Parenting Styles on a Child's Test Scores

Table 3 presents the regression outcomes derived from Equation (2). In this equation, our coefficients of interest are represented by θ and δ . They respectively explain the effect of authoritative parenting scores and that of the intervention on children's test scores. In both interventions, authoritative parenting scores positively affect children's test scores. Column 1 of Table 3 shows that the effect of authoritative parenting scores on test scores is 0.10 SD, which means that a one SD increase in authoritative parenting scores enhances a child's test score by 0.10 SD, on average. The effect remains even when we incorporate the other two parenting scores into the model as explanatory variables. However, after controlling for baseline characteristics of mothers

and children, this effect of the telementoring intervention becomes statistically significant only at the 10% level of significance.

Table 3: Impacts of Interventions and Parenting Style Scores on Children's Test Scores

Variables	Overall Test Score			
	(1)	(2)	(3)	(4)
Panel A: Telementoring				
Treatment effect	0.72*** (0.07)	0.73*** (0.07)	0.69*** (0.07)	0.70*** (0.07)
Authoritative parenting	0.10*** (0.03)	0.06* (0.03)	0.10*** (0.03)	0.06* (0.03)
Authoritarian parenting			-0.10** (0.04)	-0.08** (0.03)
Permissive parenting			-0.11*** (0.04)	-0.09*** (0.03)
Controls and FEs	No	Yes	No	Yes
Sample size	814	814	814	814
R-squared	0.14	0.29	0.16	0.30
Panel B: IVR Audio lesson				
Treatment effect	0.56*** (0.08)	0.56*** (0.07)	0.54*** (0.08)	0.55*** (0.07)
Authoritative parenting	0.21*** (0.03)	0.15*** (0.02)	0.21*** (0.03)	0.15*** (0.02)
Authoritarian parenting			-0.10*** (0.02)	-0.08*** (0.02)
Permissive parenting			0.01 (0.03)	0.01 (0.03)
Controls and FEs	No	Yes	No	Yes
Sample size	1,690	1,689	1,690	1,689
R-squared	0.14	0.24	0.15	0.24

Notes: The treatment effects are estimated using OLS regression, both with and without control variables and grade fixed effects. Robust standard errors, presented in parentheses, are clustered at the individual level for the telementoring intervention and at the village level for the IVR audio-lesson intervention. Significance levels are denoted as follows: * for 10%, ** for 5%, and *** for 1%

Panel B of Table 3 shows that for the IVR audio-lesson intervention, the impact of authoritative parenting scores on children's test scores is more pronounced, with a positive effect of 0.15 SD observed when controlling for the other two parenting styles and other characteristics (Column 4). We also observe that both interventions directly improve children's test scores. In particular, the telementoring program has a larger direct effect (0.73 SD) than the IVR audio-lesson program (0.56 SD).

The differential impacts between the two interventions can also be attributed to their distinct focuses. The telementoring program is designed to guide mothers in enhancing their children's homeschooling experience. Each session not only focuses on the child's academic activities through direct tutoring but also includes guidance for the mother in setting goals for the child, advice on effective time management, and thematic discussion. The interactions between the mentor and mother can influence parenting styles, as is evident in Table 2 where we observe a large treatment effect on authoritative parenting scores. Given that the telementoring program delivers more personalized textbook content and solutions to the children via their mothers, it is expected that parenting time spent on homeschooling and children's homeschooling

activities will be more effective. Therefore, the direct effect of the intervention on test scores is likely to be large and the effect of parenting style is likely to be smaller.

On the other hand, the IVR audio-lesson program primarily delivers curriculum-based generic lessons to children during the program time. The lessons do not aim to change children's and parental homeschooling activities beyond the program time. Thus, there is relatively less room for the program to influence children's performance directly and relatively more room for parents to influence children's performance through their parenting approach. The relatively larger effects of parenting styles and relatively smaller effect of the intervention on children's test scores may reflect these program features. This suggests that while both interventions positively influence authoritative parenting scores, parents may have a greater role to play in their children's cognitive development when the distance program is less personalized.

4.3 Heterogeneous Treatment Effects

Table 4 presents heterogeneous treatment effects on various parenting style scores and children's test scores. We basically estimate Equation (1) with an additional dummy variable either for the gender of the child, median baseline test scores of the child, median household income, or median combined parental educational level, and an interaction between the dummy and the treatment status. Panel A of Table 4 reports the estimates for the telementoring program, while Panel B of Table 4 reports the estimates for the IVR audio-lesson program.

Panel A of Table 4 shows that the treatment effects of the telementoring intervention on various parenting style scores and children's test scores are statistically similar for mother-boy and mother-girl dyads. Treatment effects are also statistically similar by baseline test scores of the child, household income, and combined parental educational level. Thus, the telementoring program influences children of different genders, children with different baseline test scores, parents with different household incomes, and parents with different educational levels similarly.

Panel B of Table 4 shows a similar lack of heterogeneous treatment effects of the audio-lesson intervention on most parenting style scores. The exception is authoritative and permissive parenting scores, where the treatment tends to reduce the mothers' authoritative and permissive parenting scores when their children are boys rather than when their children are girls. There is also some evidence of heterogeneous treatment effects on test scores – notably, students with low baseline test scores and low parental education benefit more. Importantly, these differences are only marginally significant at the 10% level. Comparing the differences between the telementoring program and the IVR audio-lesson program, it appears that heterogeneous treatment effects may be more likely to emerge in a less personalized distance program.

Overall, there is no strong evidence that the two interventions generate heterogeneous treatment effects on parenting styles and children's test scores by the gender of the child, baseline test scores of the child, household income, and combined parental educational level. These results provide some credibility for the identifying assumptions of our empirical analysis. First, our mediation analysis relies on the assumption that parents do not adapt their parenting styles according to observation of their children's cognitive development. As past literature indicates that less-educated caregivers may face challenges in assessing their children's abilities (Dizon-Ross 2019), the lack of heterogeneous treatment effects on parenting style scores by parental education and children's baseline test scores implies that it is unlikely that parents adapt their parenting styles by observing and identifying their children's cognitive development through their interactions during the intervention period. Second, Hahn and Wang

(2019) argue that the presence of heterogeneous treatment effects on both the outcome and mediator provides suggestive evidence that the correlation of the errors in Equations (1) and (2) is not zero. Thus, the general lack of heterogeneous treatment effects, especially for the telementoring program, further ensures that the sequential ignorability assumption holds up.

Table 4: Heterogeneous Treatment Effects of Interventions

Variables	W: Gender			X: Baseline Score		
	(1) Boy	(2) Girl	(3) Interaction	(4) Above Median	(5) Below Median	(6) Interaction
Panel A: Telementoring						
Authoritative parenting	0.57*** (0.10)	0.49*** (0.10)	0.09 (0.14)	0.54*** (0.11)	0.52*** (0.10)	0.02 (0.14)
Authoritarian parenting	0.00 (0.10)	-0.16 (0.10)	0.17 (0.14)	-0.12 (0.11)	-0.03 (0.09)	-0.09 (0.14)
Permissive parenting	-0.17 (0.10)	-0.23* (0.10)	0.07 (0.14)	-0.22* (0.10)	-0.19* (0.10)	-0.02 (0.14)
Test Score	0.74*** (0.10)	0.82*** (0.10)	-0.09 (0.14)	0.73*** (0.10)	0.82*** (0.10)	-0.08 (0.14)
Panel B: IVR Audio lesson						
Authoritative parenting	0.14 (0.07)	0.36*** (0.07)	-0.21* (0.10)	0.25*** (0.07)	0.26*** (0.07)	-0.00 (0.10)
Authoritarian parenting	-0.25*** (0.07)	-0.10 (0.07)	-0.15 (0.10)	-0.20** (0.07)	-0.15 (0.08)	-0.05 (0.10)
Permissive parenting	-0.33*** (0.07)	-0.10 (0.07)	-0.23* (0.11)	-0.18* (0.07)	-0.25** (0.08)	0.06 (0.11)
Test score	0.55*** (0.07)	0.68*** (0.07)	-0.13 (0.10)	0.51*** (0.06)	0.72*** (0.07)	-0.22* (0.10)
Variables	Y: Household Income			Z: Parental Education		
	(7) Above Median	(8) Below Median	(9) Interaction	(10) Above Median	(11) Below Median	(12) Interaction
Panel A: Telementoring						
Authoritative parenting	0.60*** (0.09)	0.45*** (0.12)	0.14 (0.15)	0.52*** (0.09)	0.54*** (0.11)	-0.02 (0.14)
Authoritarian parenting	-0.04 (0.09)	-0.12 (0.11)	0.08 (0.14)	-0.09 (0.09)	-0.06 (0.10)	-0.02 (0.14)
Permissive parenting	-0.25** (0.10)	-0.13 (0.10)	-0.13 (0.14)	-0.16 (0.10)	-0.26** (0.10)	0.10 (0.14)
Test Score	0.80*** (0.09)	0.77*** (0.11)	0.03 (0.14)	0.73*** (0.09)	0.84*** (0.10)	-0.11 (0.14)
Panel B: IVR Audio lesson						
Authoritative parenting	0.22** (0.07)	0.30*** (0.08)	-0.08 (0.10)	0.27*** (0.06)	0.23** (0.08)	0.06 (0.10)
Authoritarian parenting	-0.16* (0.07)	-0.19* (0.08)	0.03 (0.10)	-0.16* (0.07)	-0.19* (0.08)	0.04 (0.10)
Permissive parenting	-0.19* (0.07)	-0.24** (0.08)	0.07 (0.11)	-0.21** (0.07)	-0.22** (0.08)	0.02 (0.11)
Test score	0.58*** (0.07)	0.67*** (0.07)	-0.10 (0.10)	0.51*** (0.06)	0.75*** (0.07)	-0.23* (0.10)

Notes: This table presents the heterogeneous treatment effects of the interventions on parenting style scores and children's test scores. Coefficients are estimated using OLS regressions. The dependent variable for each regression is listed in the first column. All specifications include a set of controls for household and child characteristics. Children's grade fixed effects are included in all regressions. Boy = dummy variable for boy participant; above-median = dummy (1 if the corresponding value is above the median); interaction = interaction term between treatment and gender or above median variable. Robust standard errors, presented in parentheses, are clustered at the individual level for the telementoring intervention and at the village level for the IVR audio-lesson intervention. Significance levels are denoted as follows: * for 10%, ** for 5%, and *** for 1%.

4.4 Mediation Analysis

Table 5 exhibits the effect of each treatment on test scores mediated through authoritative parenting scores. We present the mediation role of the authoritative parenting scores while controlling for other types of parenting scores. As indicated in Table 3, authoritarian parenting scores significantly reduce children's test scores in both programs. By controlling for the other parenting scores, the analysis ensures a more precise representation of the contribution of authoritative parenting scores to children's test scores.

Table 5: Mediation Effect of Authoritative Parenting Scores on Test Scores

	Without Control and FEs	With Controls and FEs
Panel A: Telementoring		
Average causal mediation effect	0.06	0.03
95% CI [lower upper]	[0.02 0.10]	[-0.00 0.07]
Share of total effect mediated	7.31%	4.04%
95% CI [lower upper]	[0.06 0.09]	[0.03 0.05]
Corr (ε_i, u_i) for ACME=0	0.11	0.07
Panel B: IVR Audio lesson		
Average causal mediation effect	0.05	0.04
95% CI [lower upper]	[0.03 0.08]	[0.02 0.06]
Share of total effect mediated	8.67%	6.55%
95% CI [lower upper]	[0.08 0.10]	[0.06 0.08]
Corr (ε_i, u_i) for ACME=0	0.23	0.18

Notes: 95% confidence intervals are in square brackets.

Table 5 shows that in both interventions, authoritative parenting scores causally mediate the effect of the treatment on children's test scores. Notably, the average causal mediation effect is proportionately larger in the IVR audio-lesson intervention than in the telementoring one. Under the telementoring intervention, authoritative parenting scores, acting as a mediator, causally increase children's test scores by 0.03 SD, on average, when additional controls are included in the model. This effect accounts for 4.04% of the total treatment effect on test scores. Similarly, under the IVR audio-lesson intervention, authoritative parenting scores mediate a 0.04 SD increase in children's test scores, on average, when additional controls are included in the model. This effect accounts for 6.55% of the total treatment effect on test scores. The share of the total effect mediated through authoritative parenting scores is statistically different from zero, as indicated by the 95% confidence intervals, for both interventions. Our sensitivity analysis shows that the rho (ρ) value at which the average causal mediation effect (ACME) is zero is 0.07 for the telementoring intervention and 0.18 for the IVR audio-lesson intervention when additional controls are included in the model. These values for ρ indicate that the mediating effects remain significant until a correlation (ρ) of 0.07 and 0.18 between the error terms of Equations (1) and (2) for the telementoring and the IVR audio-lesson interventions, respectively. As ρ is much larger for the IVR audio-lesson intervention, the ACME is potentially less sensitive and more likely to be nonzero for the IVR audio-lesson intervention than the telementoring intervention.

4.5 Robustness Check

Self-reported survey responses, such as those used to gauge parenting styles, can sometimes be influenced by social desirability bias (SDB) (Krumpal 2013). This bias arises when respondents provide answers that they believe are socially acceptable or favorable rather than based on their genuine beliefs or behaviors. Hassan et al. (2024) and Wang et al. (2024) adopted the methodology utilized by Dhar, Jain, and Jayachandran (2022) to measure mothers' social desirability biases using the 13-item Marlowe-Crowne scale. This scale assesses the likelihood that respondents might provide socially desirable answers (see Table A4). A higher score on this scale suggests a stronger inclination towards giving socially desirable responses. Our robustness analysis focused on mothers with lower SDB scores, who are less likely to provide socially desirable responses. The rationale behind this focus is to ascertain whether the observed effects on authoritative parenting scores persist even when the potential influence of SDB is minimized.

Table 6 presents the results of this analysis. Column 4 is of particular interest as it displays the effects of the interventions on authoritative parenting scores for mothers with low SDB tendencies. The results indicate significant positive effects of both interventions on authoritative parenting scores within this specific group. Given the significant positive impacts among mothers with low SDB tendencies, we conclude that potential respondents' social desirability bias is unlikely to confound the estimated treatment effects.

Table 6: Impact of Interventions on Authoritative Parenting Scores by Parental Social Desirability Bias (SDB) Scores

Variables	Authoritative Parenting Score			
	(1) Above Median SDB	(2) Above Median SDB	(3) Below Median SDB	(4) Below Median SDB
Panel A: Telementoring				
Treatment effect	0.64*** (0.10)	0.62*** (0.10)	0.47*** (0.10)	0.43*** (0.10)
Controls and FEs	No	Yes	No	Yes
Sample size	425	425	356	354
Panel B: IVR Audio lesson				
Treatment effect	0.10 (0.08)	0.11 (0.07)	0.42*** (0.10)	0.43*** (0.09)
Controls and FEs	No	Yes	No	Yes
Sample size	1,016	1,015	686	686

Notes: The treatment effects are estimated using OLS regression, both with and without control variables and grade fixed effects. Robust standard errors, presented in parentheses, are clustered at the individual level for the telementoring intervention and at the village level for the IVR audio-lesson intervention. Significance levels are denoted as follows: * for 10%, ** for 5%, and *** for 1%.

5. DISCUSSION AND CONCLUSION

This research reveals a significant positive impact of phone-based telementoring and IVR audio lessons on the parenting styles of mothers with primary school-aged children in rural Bangladesh. The telementoring program leads to a 0.53 SD increase in the mothers' authoritative parenting scores, while the IVR audio-lesson program results in a 0.24 SD increase. Furthermore, authoritative parenting scores mediate a 0.03 and

0.04 SD increase in children's test scores in the telementoring and the IVR audio-lesson programs, respectively.

Our findings suggest that distance educational interventions aimed at improving children's learning outcomes, which also engage their mothers in the interventions, can effectively enhance the participating mothers' authoritative parenting tendencies. As the main target of the interventions is the homeschooling activities of the children, these interventions generate positive spillovers on the parenting styles of the mothers, who are required to be involved in the programs with their children. Observing and engaging with contemporary child management and pedagogical methods for nearly three months, the treated mothers seem to have internalized these methods. Previous findings related to parental training programs are in line with these results, showing that parents' active participation in educational interventions and consistent adoption of positive methods enhance their parental behaviors (e.g., Bierman et al. 2008; Kaminski et al. 2008; Lundahl, Risser, and Lovejoy 2006). Our findings are also consistent with research showing that parents who consistently apply positive parenting strategies over months exhibit improvement in their parenting behaviors (Webster-Stratton and Hammond 1997).

While this study provides valuable insights into the impact of phone-based educational interventions on parenting styles and children's cognitive development in rural Bangladesh, some potential limitations are worth noting. First, the parenting style scores examined are based on mothers' responses, making them susceptible to social desirability biases. While we have validated our findings among mothers less prone to these biases, it is not possible to rule out all potential confounds due to social desirability biases. Second, the interventions were implemented during the unprecedented circumstances of the COVID-19 pandemic, which might have affected parental behaviors and children's learning experiences in unique ways. Thus, future research would benefit from investigating the effects of such interventions on parenting styles in other contexts. Third, we cannot rule out the possibility that mothers' parenting styles endogenously respond to their children's learning instead of the interventions. Nonetheless, to the extent that less well-educated parents are less likely to identify their children's abilities and learning levels, the lack of heterogeneous treatment effects of both interventions on parenting styles by parental educational level suggests that this possibility is highly unlikely to be present in both interventions.

This study demonstrates that mobile phone-based distance learning interventions can improve children's academic performance through two channels. First, they directly improve children's test scores. Second, they foster authoritativeness in the mothers' parenting styles, which in turn promotes children's cognitive growth. The observed shift towards an authoritative parenting style among participating mothers and the resulting positive impact on their children's cognitive development suggest that these interventions provide another promising avenue for strategic investments to improve human capital in resource-poor settings. From a policymaking perspective, the efficacy of mobile phone-based interventions in reshaping parenting styles offers a potentially cost-effective solution. In low-resource settings similar to Bangladesh, where mobile phone penetration is high, and active parental involvement in children's education is low, leveraging such interventions can lead to an opportunity to facilitate human capital accumulation.

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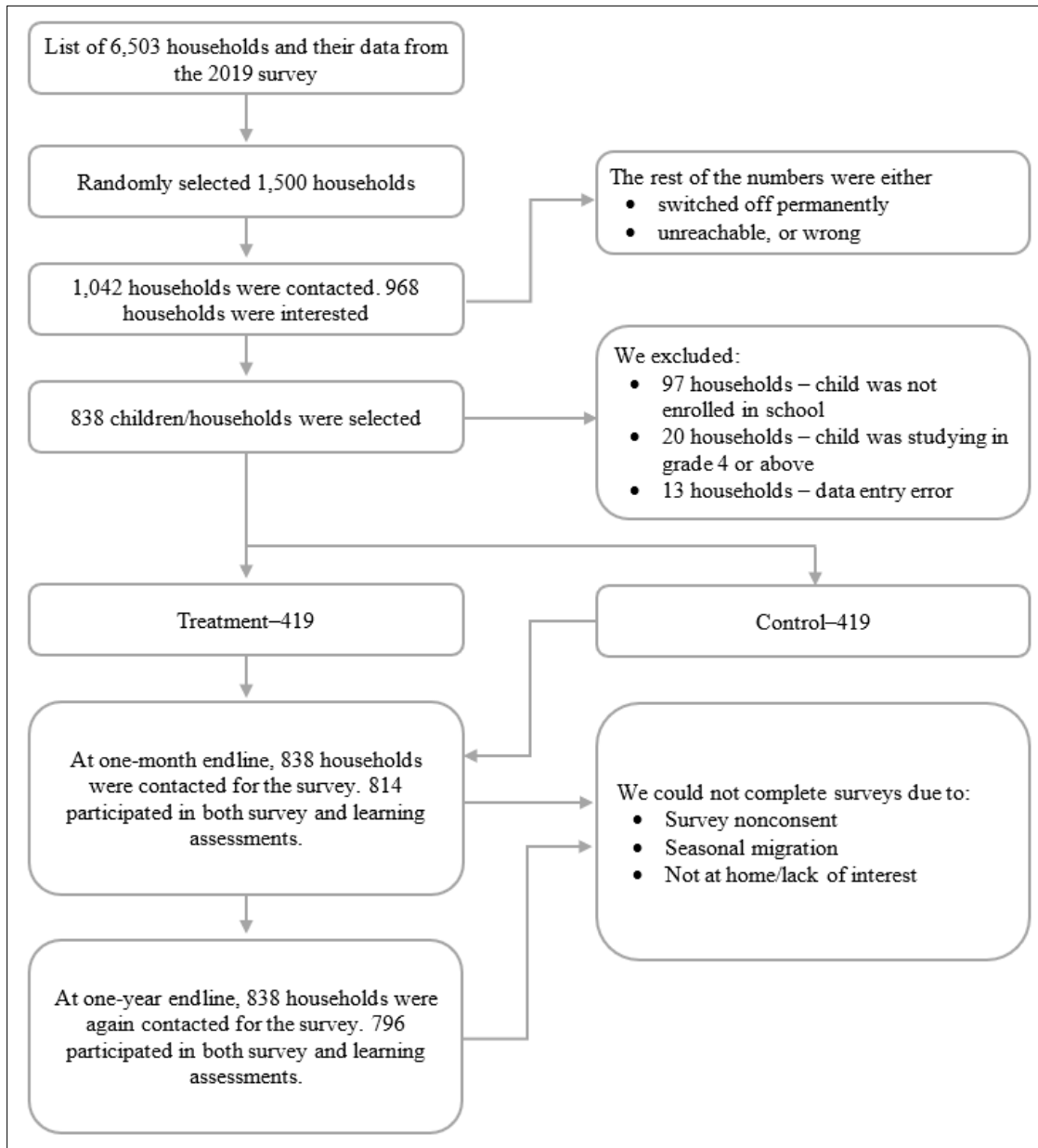
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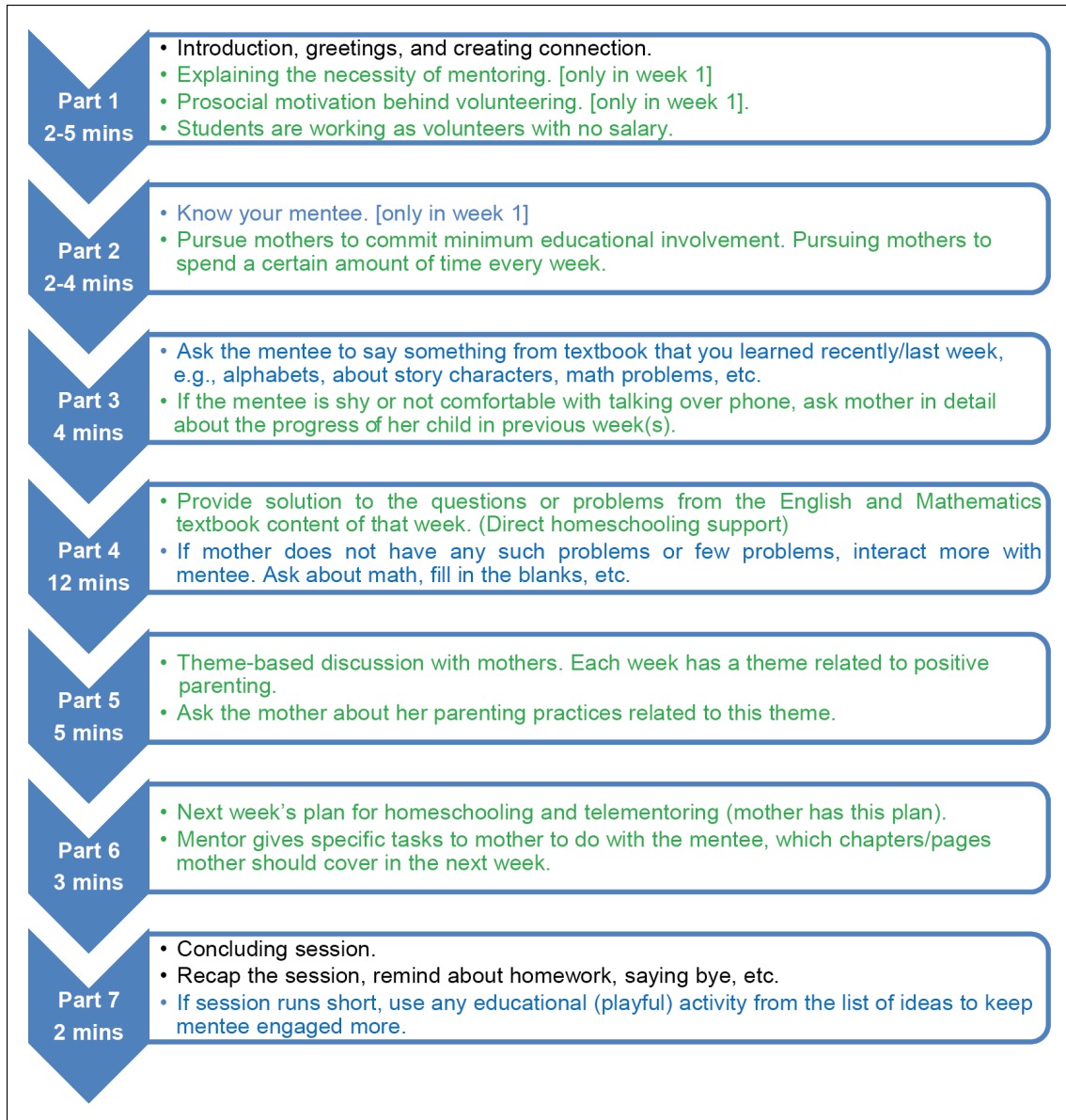
APPENDIX: ADDITIONAL FIGURES AND TABLES

Figure A1: CONSORT Flow Diagram of the Telementoring Program



Source: Hassan et al. (2024).

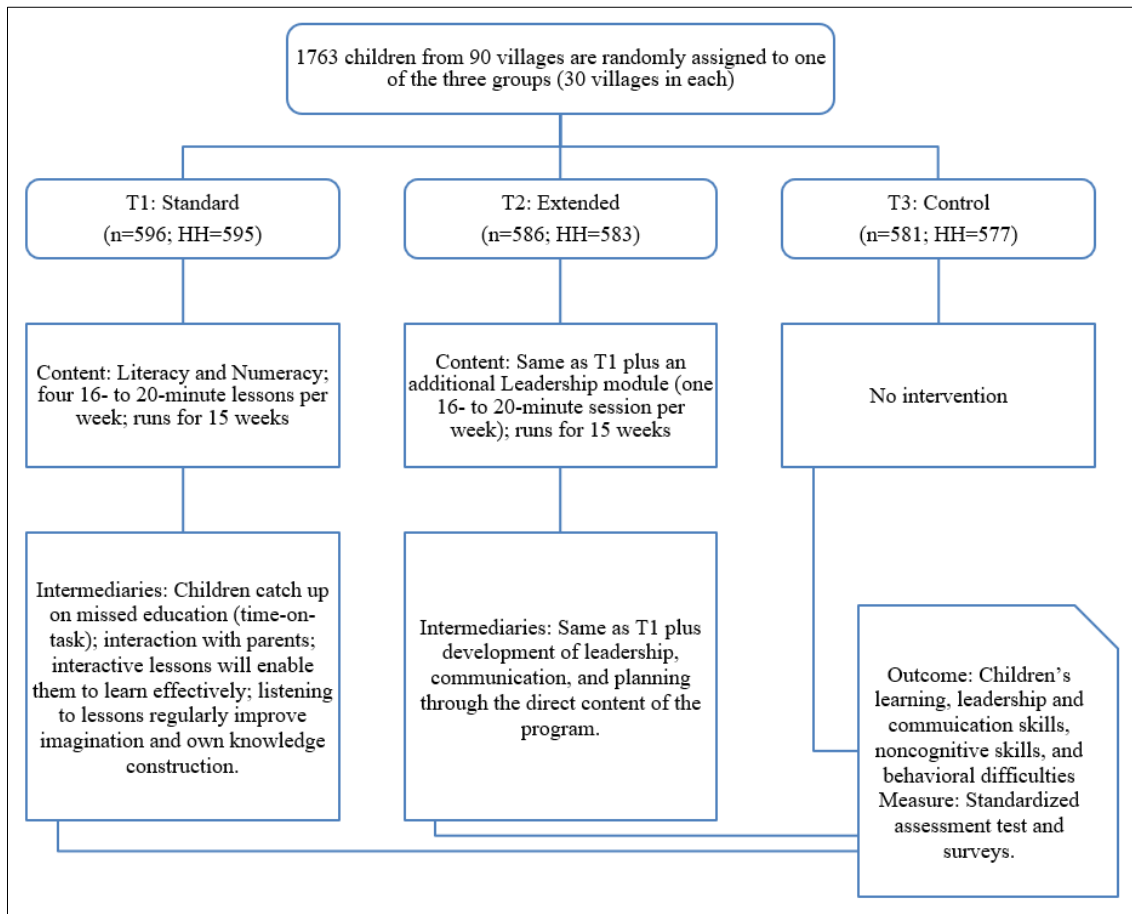
Figure A2: Process Flow of Each Telementoring Session



- The green-colored text indicates activities with the mother.
- The blue-colored text indicates activities with the child.
- The black-colored text indicates activities with the mother-child dyad.

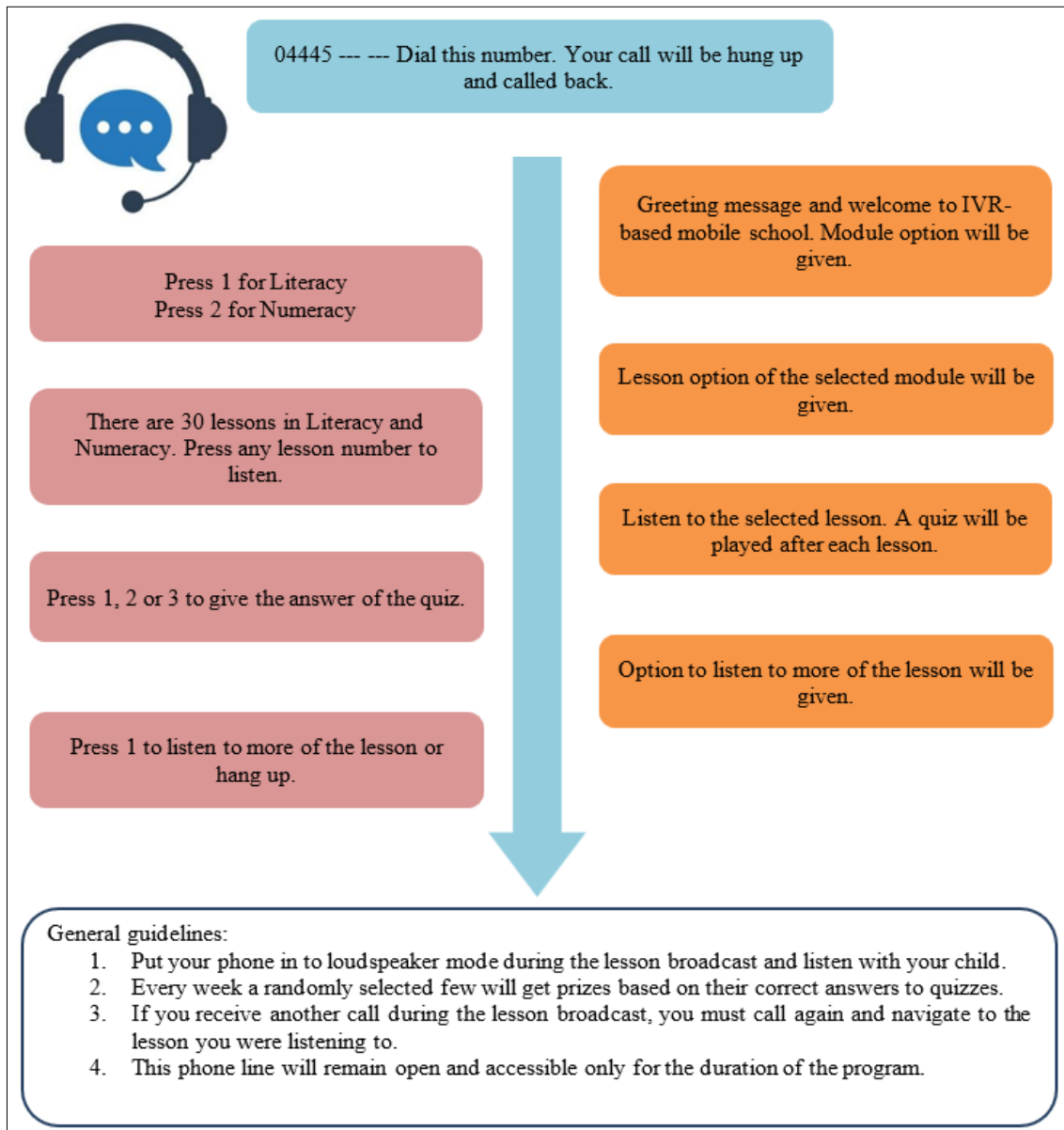
Source: Hassan et al. (2024).

Figure A3: Research Design of the IVR Audio-Lesson Program



Source: Wang et al. (2024).

Figure A4: Flow Diagram for IVR Audio Lesson



Source: Wang et al. (2024).

Table A1: Descriptive Statistics of Volunteer Mentors

Variables	Mean	Min	Max
Age in years	21.80	18.29	27.69
Gender (male=1)	0.48	–	–
Cognitive Flexibility Scale (CFS) [Scale range – 12 to 72]	55.35	37	72
Difficulties in mental health (PHQ) [Scale range – 0 to 27]	6.78	0	23
Dummy responses below are % of all mentors			
From urban background		61.81%	
From public universities or colleges		95.48%	
Business and social sciences discipline		85.93%	
Postgraduate level or graduated		15.58%	
Currently earn money from a part-time tutoring job		61.83%	
Prior tutoring experience		76.02%	
Paid tutoring experience with the primary graders		76.38%	
Past volunteering		74.85%	

Source: Hassan et al. (2024).

Table A2: Weekly Themes of the Telementoring Program

Week No.	Theme No.	Weekly Theme	SMS Campaign
1	-	None	02/09/2020: Notification of selection 08/09/2020: Second notification
2	-	None	No SMS
3	1	Promoting social responsibility	21/09/2020: Notifying the social responsibility of the mentors
4	2	Maintaining daily routine	25/09/2020: Importance of routine 29/09/2020: Repeat
5	3	Restraining abusive parenting	02/10/2020: Request to stop beating and scolding with abusive language
6	4	Encouraging gender quality in homeschooling	09/10/2020: Explaining why both boys and girls need basic education
7	5	Teaching your child to share	16/10/2020: Tips to teach sharing behavior to the child
8	6	Encouraging them to read books (stories)	23/10/2020: Information and advice about reading practice
9	7	Promoting parents' aspiration about offspring's education	30/10/2020: Motivating parents to remain positive about their child's performance
10	8	Stimulating parents' confidence in providing educational support to the kids	06/11/2020: Explaining the role of parents as teachers
11	9	Believing in the kids and letting them know	13/11/2020: Tips about how to let children know that parents have faith in them 16/11/2020: Advice on positive competition
12	10	Broadening the educational planning horizon of the parents, i.e., shifting their concentration from a role model	20/11/2020: Explaining return on education
13	-	None	27/11/2020: Concluding message

Source: Hassan et al. (2024).

Table A3: Parenting Style and Dimension Questionnaire (PSDQ)

Question: Rate how often you exhibit this behavior with your child. Probable responses are: 1. Never, 2. Occasionally, 3. About half of the time, 4. Very often, 5. Always

No	Statement
Panel A. Authoritative domain	
1.	I encourage our child to talk about his/her troubles.
2.	I know the names of our child's friends.
3.	I give praise when our child is good.
4.	I show sympathy when our child is hurt or frustrated.
5.	I am easy-going and relaxed with our child.
6.	I tell our child our expectations regarding behavior before (s)he engages in an activity.
7.	I show patience with our child.
8.	I am responsive to our child's feelings or needs.
9.	I give our child reasons why rules should be obeyed.
10.	I tell our child that we appreciate what (s)he tries or accomplishes.
11.	I take our child's desires into account before asking him/her to do something.
12.	I am aware of problems or concerns about our child in school.
13.	I express affection by hugging, kissing, and holding our child.
14.	I talk it over and reason with our child when (s)he misbehaves.
15.	I have warm and intimate times together with our child.
16.	I encourage our child to freely express him/herself even when disagreeing with his/her parents.
17.	I explain to our child how we feel about his/her good and bad behavior.
18.	I take into account our child's preferences in making plans for the family.
19.	I explain the consequences of the child's behavior.
20.	I emphasize the reasons for rules.
B. Authoritarian domain	
1.	I guide our child by punishment more than by reason.
2.	I slap our child (s)he misbehaves.
3.	I punish by taking privileges away from our child with little if any explanation.
4.	I yell or shout when our child misbehaves.
5.	I scold and criticize to make our child improve.
6.	I appear to be more concerned with my own feelings than with our child's feelings.
7.	I disagree with our child.
8.	I use threats as punishment with little or no justification.
9.	I demand that our child does things.
C. Permissive domain	
1.	I find it difficult to discipline our child.
2.	I spoil our child.
3.	I am afraid that disciplining our child for his/her behavior will cause him/her not to like his/her parents.
4.	I ignore our child's misbehavior.
5.	I give into our child when (s)he causes a commotion about something.
6.	I allow our child to interrupt others.

Notes: Following Robinson et al. (1995), Hassan et al. (2024) and Wang et al. (2024) used the above set of parenting style dimension questions for parents at the endline of both interventions.

Table A4: Social Desirability Scales – Questionnaires

No.	Questions	Desired Answer
1.	It is sometimes hard for me to go on with my work if I am not encouraged.	False
2.	I sometimes feel resentful when I don't get my way.	False
3.	On a few occasions, I have given up doing something because I thought too little of my ability.	False
4.	There have been times when I felt like rebelling against people in authority even though I knew they were right.	False
5.	No matter whom I'm talking to, I'm always a good listener.	True
6.	There have been occasions when I took advantage of someone.	False
7.	I'm always willing to admit it when I make a mistake.	True
8.	I sometimes try to get even rather than forgive and forget.	False
9.	I am always courteous, even to people who are agreeable.	True
10.	I have never been irked when people expressed ideas very different from my own.	True
11.	There have been times when I was quite jealous of the good fortune of others.	False
12.	I am sometimes irritated by people who ask favors of me.	False
13.	I have never deliberately said something that hurts someone's feelings.	True

Notes: Following Dhar, Jain, and Jayachandran (2022), Hassan et al. (2024) and Wang et al. (2024) used the 13-item short form of the Marlowe-Crowne Social Desirability Scale for parents.