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New brief temperament guidance program for parents of infants: A pilot evaluation

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Abstract

Problem: Intensive temperament guidance programs have been successfully utilized to improve caregiver understanding of temperament and teach strategies for appropriately responding to temperament traits. However, the effects of providing brief psychoeducational temperament information to parents have not been previously examined.

Methods: Mothers of 3–12-month infants ($n = 35$) participated in an intervention examining the impact of a comprehensive temperament brochure on temperament knowledge, program attitudes, and parent–child interactions.

Findings: Mothers demonstrated increased temperament knowledge and were generally accepting of the program. Behavioral changes in mother–child interactions were observed. Sensitivity increased, and interactions shifted from more parent-directed to more balanced following the intervention. Infant gender functioned as a moderator of intervention effects for two mother–infant interaction dynamics. A significant increase in reciprocity was observed between mothers and boys, largely as a function of significantly lower levels of reciprocity preintervention. Child gender also interacted with directedness, in that interactions became more balanced for girls, but remained more mother-directed with boys. Finally, maternal education functioned as a moderator of tempo, as mothers in the higher education group shifted from slower to moderate tempo following the intervention.

Conclusions: Promising results suggest the need for continued implementation and evaluation of brief temperament interventions.

KEYWORDS
mother–infant interactions, parent guidance, temperament

1 | INTRODUCTION

From early infancy, significant variability in reactions to the environment and the ability to modulate these responses, linked to an underlying temperament, can be observed, and these differences persist into adulthood (Zentner & Shiner, 2012). Rothbart's psychobiological model of temperament, the most widely accepted temperament framework today, defines temperament as constitutionally based individual differences in reactivity and self-regulation (Rothbart, 2012; Rothbart & Derryberry, 1981). Temperament is relatively enduring and predictive of problems with socialization (Hasenfratz, Benish-Weisman, Steinberg, & Knafo-Noam, 2015), risk for psychopathology (Hankin et al., 2017; Scheper et al., 2017), and academic achievement (Al-Hendawi, 2013).

Child temperament functions as part of a transactional, developmental process, wherein parenting can alter trajectories of individual differences (Bates, Schermerhorn, & Petersen, 2012). A caregiver's

ability to respond sensitively to their child, successfully adapting parenting approaches based on their child's temperament, directly promotes positive adjustment (Lengua, Wolchik, Sandler, & West, 2000). Sufficient empirical evidence concerning child temperament exists to provide accurate information and meaningful recommendations to parents about how to positively influence its development (e.g., Bridgett, Laake, Gartstein, & Dorn, 2013). Aiming temperament guidance at understanding individual differences, and improving parenting strategies, can lead to enhanced child regulation and adjustment (Barone, Ozturk, & Lionetti, 2019).

It has been suggested by The Research and Policy Report on Early Childhood that materials and promotion-based programs geared toward positive social–emotional development can benefit parents by increasing knowledge of typical development and positive interactions with their children (Cohen, Onunaku, Clothier, & Poppe, 2005). However, few studies addressing the distribution of information to parents regarding social–emotional concerns have been conducted to determine the impact of such materials. It should also be noted that between 24% and 50% of pediatric office visits are estimated to involve behavioral, emotional, or educational issues (Cooper, Valleley, Polaha, Begeny, & Evans, 2006), and that temperament differences underlie many of the problems in infancy and early childhood that cause families to seek help (Carey & McDevitt, 1989). Unfortunately, little information about temperament or social–emotional development is incorporated into routine pediatric care (Carey, 2016). Temperament impacts daily parent–child interactions (e.g., Kirchhoff, Desmarais, Putnam, & Gartstein, 2019; Lengua, 2006), predispositions to sleeping and feeding problems (Haycraft, Farrow, Meyer, Powell, & Blissett, 2011; Moore, Slane, Mindell, Burt, & Klump, 2011), and responses to illness and medical care (Helgadóttir & Wilson, 2004; Young, 2005). A lack of parental and clinician knowledge of temperament may lead to incorrect diagnoses of presenting problems, unnecessary referrals to specialists or other professionals (e.g., psychologists), and implementation of inappropriate treatments. Providing parents with guidance about temperament has the potential to impact the utilization of clinical and medical care, improve family functioning, and reduce the risk of negative developmental outcomes. Parents who understand temperament and its development are likely to promote secure attachment, and their offspring can be expected to experience fewer adversities (e.g., maltreatment), given links between these outcomes and temperament attributes (e.g., Ding, Xu, Wang, Li, & Wang, 2012; Gartstein & Iverson, 2014).

Existing temperament-based programs for caregivers, delivered in-person, have shown promise in increasing temperament knowledge (Franyo & Hyson, 1999; Sheeber & Johnson, 1994), improving child behavior problems (e.g., McClowry, Snow, & Tamis-LeMonda, 2005), and increasing confidence in the parenting role (Sheeber & Johnson, 1994). Four studies utilized individualized written temperament feedback for parents, informing caregivers about their infant's unique temperament based on parent-report questionnaires (Cameron & Rice, 1986; Cameron, Rice, Sparkman, & Neville, 2013; Ostergren, 1997). Results indicated that parents found temperament information valuable, useful, and important for understanding their child's behaviors, with lower parent education predicting higher utility. Providing parents with temperament information also resulted in significantly fewer medical visits for boys in the intervention group, compared to controls. Despite these promising outcomes, few programs have attempted to integrate temperament information into parent training or pediatric care. This may be a function of past individualized and in-person interventions being intensive, costly, and/or challenging to disseminate, partially due to a lack of qualified practitioners with sufficient temperament knowledge.

To address this gap in research, our program provided current, comprehensive educational temperament information via brochures distributed to parents of infants as a cost-effective alternative, increasing caregiver knowledge. We conducted a pilot evaluation, examining the relational impact of comprehensive psychoeducational temperament materials by directly observing several aspects of mother–child interactions to determine the extent of behavioral changes, not attempted in prior research. Sensitivity is known to foster healthy social–emotional trajectories for infants and children (van der Voort, Juffer, & Bakermans-Kranenburg, 2014; Zeegers, Colonnesi, Stams, & Meins, 2017), and other interaction dynamics are also important. Mothers who were more positive (Ainsworth, Blehar, Waters, & Wall, 1978), involved (Fuertes, Faria, Beeghly, & Lopes-dos-Santos, 2016), and paced their interactions more appropriately (Egeland & Farber, 1984; Miyake, Chen, & Campos, 1985) had more securely attached infants. Positive emotional tone involves displays of enjoyment, affection, and enthusiasm, and is closely related to the quality of parental warmth, associated with child self-regulation and compliance (Colman, Hardy, Albert, Raffaelli, & Crockett, 2006; Dennis, 2006). Infants of mothers who interacted with their offspring in a more synchronous manner (Feldman, 2007), and allowed for more infant exploration in the environment by supporting autonomy (Whipple, Bernier, & Mageau, 2011), were more securely attached and demonstrated higher self-regulation. Mother–child interaction domains including reciprocity, tempo, intensity, emotional tone, and child versus parent directedness were linked to temperament development (Gartstein, Hancock, & Iverson, 2018; Gartstein, Iverson, Desmarais, & Hancock, 2017) and thus considered in this study.

It was hypothesized that changes in mother–child interactions, increased sensitivity/responsiveness in particular, would be observed following the program, as other brief psychoeducational parenting interventions were shown to enhance sensitivity (e.g., Halford & Petch, 2010). Exploratory analyses were conducted with other mother–infant interaction factors: reciprocity/synchrony, tempo, intensity, emotional tone, parent versus child directedness. Further, educational level and child gender were expected to play a role of moderators in the present study, shaping the strength/direction of treatment effects, as greater treatment efficacy was demonstrated for a written temperament intervention at lower levels of parental education (Ostergren, 1997), and temperament education was more effective for parents of boys than girls (Cameron et al., 2013).

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2 | METHODS

2.1 | Participants

English speaking mothers with infants 3–12 months of age were recruited in a rural area of the Pacific Northwest beginning in fall of 2011. Families received a $10 gift certificate upon completion of the project. A total of 35 mothers agreed to participate in the study and were included in the analyses. Of these 35 participants, two mothers failed to complete portions of the initial preintervention questionnaires. Two mothers discontinued participation before follow-up data collection, with additional eight mothers missing some of the postintervention questionnaires, and one mother not completing the final home visit and postintervention observations.

The mean age of participanting mothers was 29.8 years (range = 21–35.5 years, *SD* = 3.59). The sample was predominantly Caucasian (94.3%), with 5.7% identifying as Asian, consistent with local demographics. All women reported being married or cohabitating. The mean level of education for mothers was 16.97 (range = 12–24 years, *SD* = 2.83) and 57.1% of the infants were male (see Table 1 for additional information).

TABLE 1 Descriptive statistics

Variable	*n*	*Mean*	*SD*	Range	Percentage
Maternal age	32	29.8	3.59	21–35.5	
Race/ethnicity	35				
Caucasian	33				
Asian	2				
Partnership status	35				
Married/living together					91.4
Remarried					8.6
Maternal education	33	16.97	2.83	12–24	
Family income	32				
$10,001–$13,000					3.1
$16,001–$20,000					6.3
$20,001–$30,000					12.5
$30,001–$50,000					18.8
$50,001–$75,000					28.1
Over $75,000					31.3
Infant gender	35				
Male					57.1
Female					42.9
Infant age (months)	34	8.12	2.76	3–11	
Birth order	34				
1					47.1
2					26.5
3					5.9
4					8.8
5					11.8
Infant negative emotionality	33	4.84	2.91	−0.1 to 13.68	

2.2 | Procedures

The study was approved by the Washington State University IRB (# 12645-011). Once mothers agreed to participate, initial home visits were scheduled, and consent forms and questionnaires were mailed. Mothers were asked to complete the packet of questionnaires before the first home visit, to be collected by research assistants at that time. Home visits lasted approximately 15–20 min and included a structured teaching task, which was video-recorded for later coding. Following the first home visit, individuals received a packet of comprehensive temperament information, entitled "Knowing Your Baby Matters" (Supporting Information Appendix A; Gartstein, Erickson, Potapova, Cuevas, & Desmarais, 2010), which described temperament according to Rothbart's psychobiological model (Gartstein, Putnam, Aaron, & Rothbart, 2016; Rothbart, 2012). Brochures were mailed to mothers within 2 weeks of the initial home visit, providing information regarding each of the three overarching temperament factors (i.e., negative emotionality, positive affectivity, regulatory capacity), risk and protection afforded by these attributes, describing the latter in probabilistic, rather than absolute terms. Information about goodness-of-fit, defined as the match between parental expectations and the child's temperament profile, was also included, along with guidance for navigating temperament profiles likely to challenge caregivers. Temperament guidance materials described how temperament relates to feeding and sleeping—two common parent-reported areas of difficulty in infancy influenced by reactivity and regulation. Parents were also encouraged to enjoy interactions with their baby regardless of potential challenges posed by different temperament characteristics, focusing on more opportune moments for social exchanges.

Following the temperament information dissemination portion of the project, a second packet of questionnaires was mailed within 2 weeks, to allow mothers time to review the temperament brochures before the second wave of data collection. Final home visits, with the same teaching interaction observations as completed in the first visit, were also scheduled. On average, visits were completed 1.5 months after the final questionnaire packets were mailed. Due to variability in scheduling, completion time of the intervention varied from 2 to 4.5 months (*M* = 2.86 months) from the time of enrollment.

2.3 | Measures

A demographic questionnaire was administered, with mothers providing information about age, relationship status, race/ethnicity, education, occupation, and income. Mother–child interaction episodes were conducted in the home in a standardized manner, as previously described (Gartstein et al., 2018). Mothers were provided with a list of activities (e.g., squeak a frog, scribble on a paper) and asked to choose one that their infant could not yet accomplish independently. They were instructed to teach their child to complete the selected task and inform the examiner when they were finished (up to a maximum of 10 min). Interactions were video-recorded with ratings provided by trained coders blind to the condition (i.e., pre- or

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TABLE 2 Parent–infant interaction coding scheme

	Codes/descriptions		
Scales	**1**	**4**	**7**
Sensitivity/responsiveness	Extremely nonresponsive/sensitive: lacks genuine empathy and interest in infant. Parent does not (a) initiate play; (b) reinforce infant activities; (c) draw infant into joint activity; (d) give encouragement; (e) allow infant independent activity; (f) effectively extends infant activity	Moderately responsive/sensitive: moderate empathy and interest in infant. Parent periodically (a) initiates play (b) reinforces infant activities; (c) draws infant into joint activity; (d) gives encouragement; (e) allows infant independent activity; (f) effectively extends infant activity	Extremely responsive/sensitive: prompt, regular, genuine empathy and interest in infant. Parent consistently (a) initiates play; (b) reinforces infant activities; (c) draws infant into joint activity; (d) gives encouragement; (e) allows infant independent activity; (f) effectively extends infant activity
Reciprocity/synchrony	Extremely asynchronous/ nonreciprocal: (a) low frequency of simultaneous movement; (b) low tempo similarity; (c) low coordination/smoothness	Moderately synchronous/reciprocal: (a) moderate frequency of simultaneous movement; (b) moderate tempo similarity; (c) moderate coordination/ smoothness	Extremely synchronous/reciprocal: (a) high frequency of simultaneous movement; (b) high tempo similarity; (c) high coordination/smoothness
Tempo	Extremely slow paced: (a) low frequency of changing objects/ activity; (b) low levels of physical activation; (c) low levels of verbal/ vocal expression	Moderately paced: (a) moderate frequency of changing objects/ activity; (b) moderate levels of physical activation; (c) moderate levels of verbal expression	Extremely fast paced: (a) high frequency of changing objects/ activity; (b) high levels of physical activation; (c) high levels of verbal/ vocal expression
Intensity	Extremely low intensity: (a) very quiet verbal/vocal exchange; (b) low levels of complexity; c) low parental exuberance	Moderate intensity: (a) moderately audible verbal/vocal exchange; (b) moderate complexity; (c) moderate parental exuberance	Extremely high intensity: (a) very loud verbal/vocal exchange; (b) high levels of complexity; (c) high parental exuberance
Emotional tone	Extremely negative emotional tone: (a) frequent critical/negative comments; (b) frequent expressions of distress; (c) frequent negative physical displays	Neutral emotional tone: (a) mostly neutral verbal exchanges; (b) few, if any, expressions of affect; (c) few, if any, physical displays of affect	Extremely positive emotional tone: (a) frequent enthusiastic and positive comments; (b) frequent expressions of positive emotion, joy, pleasure; (c) frequent positive physical displays

Note: All coding scales based on 7-point Likert scales (1–7).

postintervention) and demonstrating adequate inter-rater reliability (ICC's > 0.60). Global ratings using a 7-point Likert scale, as in prior research (Gartstein, Crawford, & Robertson, 2008; Gartstein et al., 2017, 2018), were provided for sensitivity/responsiveness, reciprocity/synchrony, tempo, intensity, emotional tone, and child versus parent directedness (Table 2).

Several questionnaires were developed specifically for the purposes of this study (Supporting Information Appendix B), which represents their pilot implementation. The Knowledge and Mastery Quiz was designed to evaluate maternal knowledge of the temperament concepts introduced in the psychobiological model information pamphlet, administered postintervention only. It contained eight multiple-choice questions addressing the three temperament factors, the importance of goodness-of-fit, and related concepts. The Program Usability Inventory was developed to determine whether the information was sufficiently comprehensible (i.e., easy to read and understand) and contained nine items asking mothers about they perceptions of accessibility, with all questions utilizing a 5-point Likert scale: 1 being "very difficult" to 5 being "very easy." The Program Attitude Inventory was adapted from the Therapy Attitude Inventory (Brestan, Jacobs, Rayfield, & Eyberg, 1999), a measure of consumer satisfaction for parent-training programs, to assess for maternal attitudes regarding participation after reviewing the temperament guidance materials. Eleven items utilizing a 5-point Likert scale ascertained attitudes toward the information presented in our temperament brochure (Gartstein et al., 2010).

2.4 | Analytic strategy

Items contained in the Knowledge and Mastery Quiz, The Program Usability and the Program Attitude Inventories were considered individually. To evaluate answers to the knowledge/mastery questionnaire, frequencies and percent correct calculations were performed to reflect the accuracy of responses. For the usability and attitude questionnaires, means and frequencies were examined to determine accessibility and acceptability of temperament brochure, respectively. Matched-pair *t* tests were conducted to determine if statistically significant changes occurred in mother–child interactions pre–post program participation. One-within/one-between analyses of variance (ANOVAs) were additionally conducted to examine changes, determining whether infant gender or maternal education moderated intervention effects. Significant interactions were graphed and tests of simple effects (Aiken & West, 1991) were conducted to elucidate

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TABLE 3 Temperament Knowledge and Mastery Quiz results

		Frequency of response				
Question	*n*	A	B	C	D	Percentage correct
1	23	–	–	2	**21**	91.3
2	23	1	–	–	**22**	95.7
3	23	4	–	**19**	–	82.6
4	23	4	4	2	**13**	56.5
5	23	**18**	1	4	–	78.3
6	23	1	1	**21**	–	91.3
7	23	–	5	–	**18**	78.3
8	23	4	–	–	**19**	82.6

Note: Bolded numbers represent the correct response.

the nature of the moderation. Effect sizes were examined using partial η^2, with small, medium, and large effects operationalized as 0.01, 0.06, and 0.14 in turn (Cohen, 1988).

3 | RESULTS

For the Temperament Knowledge and Mastery Questionnaire, results indicated generally moderate to high levels of temperament knowledge, with item responses ranging from 56.5% to 95.7% correct (Table 3). The most difficult item, with a correct response rate of only 56.5%, addressed the importance of goodness-of-fit. The accuracy for the remainder of the questions were about 80% or higher. For the Program Usability Inventory, "Somewhat easy" was the most frequently occurring response for each of the nine usability questions, with the exception of one question ascertaining comprehensibility of presented links between temperament traits, feeding/eating, and sleeping, which had an equal number of answers in the "somewhat easy" and "very easy" categories (Table 4). None of our participants were very dissatisfied or had very poor attitudes toward the program based on the Program Attitude Inventory responses, with the majority of responses indicating attitudes that were neutral to very positive. "Somewhat positive attitudes" were indicated with regard to the usefulness of the temperament information overall, information regarding the three broad temperament factors, improvement of parental management strategies, the temperament program being worth participants' time, and general satisfaction with the program. "Neutral" responses were more frequently provided regarding benefits related to getting along with the child, approaches to interactions and daily activities with the child, confidence in the ability to understand the infant, the degree to which the program helped with other general personal or family problems not directly related to the child, and recommendation of the program to friends/relatives with infants (Table 4).

Matched-pair *t* tests were performed to determine differences pre and post temperament guidance program for each of the six mother–child interaction factors: sensitivity/responsiveness, reciprocity/synchrony, tempo, intensity, emotional tone, and parent versus child directedness (Table 5). Results indicated a significant difference in the sensitivity/responsiveness domain, with higher observed sensitivity postintervention, $t(31) = -2.20$, $p = .035$. There was also a significant difference in directedness, with interactions rated as more mother-directed before the intervention, and more balanced following the program, $t(31) = 3.16$, $p < .01$.

One-within/one-between ANOVAs were utilized to address interactions between moderators (infant gender, maternal education) and time of assessment (pre and post) for the mother–infant interaction indicators (Table 6). For infant gender, analyses revealed a significant interaction with reciprocity/synchrony, $F(1, 30) = 8.75$, $p < .01$, $\eta^2 = 0.23$, with a large effect size. Tests of simple effects indicated that there was a significant difference between boys and girls before the intervention ($p = .03$), with exchanges between mothers of boys showing significantly less reciprocity at that time (Figure 1). Although reciprocity/synchrony of interactions between mothers and girls did not change significantly over time, there was a statistically significant increase in reciprocity/synchrony of mother-son dyads during the teaching task from pre- to postintervention

TABLE 4 Program Usability Inventory and Program Attitude Inventory results

		Usability frequency of response						
Question	*n*	1	2	3	4	5	Mean	*SD*
1	25	1	2	7	8	7	3.72	1.10
2	25	1	3	4	11	6	3.72	1.10
3	25	–	3	4	11	7	3.88	0.97
4	25	–	4	6	9	6	3.68	1.03
5	25	–	3	2	18	2	3.76	0.78
6	25	–	2	5	9	9	4.00	0.96
7	25	–	3	2	15	5	3.88	0.88
8	25	–	3	5	12	5	3.76	0.93
9	25	–	3	4	12	6	3.84	0.94
		Attitude frequency of response						
Question	*n*	1	2	3	4	5	Mean	*SD*
1	25	–	1	9	15	–	3.56	0.58
2	23	–	1	9	10	3	3.65	0.76
3	23	–	–	17	5	1	3.17	0.87
4	24	–	–	13	9	2	3.54	0.66
5	24	–	–	8	9	7	3.96	0.81
6	23	–	–	13	5	5	3.65	0.83
7	22	–	–	11	8	3	3.64	0.73
8	24	–	–	9	14	1	3.67	0.56
9	25	–	1	6	14	4	3.84	0.75
10	25	–	–	8	9	8	4.00	0.82
11	25	–	–	9	8	8	3.96	0.82

Note: All questions were on a 1–5 Likert scale, including the following responses: Usability: 1 = *very difficult*, 2 = *somewhat difficult*, 3 = *in-between*, 4 = *somewhat easy*, and 5 = *very easy*; Attitude: 1 = *mostly negative attitude*, 3 = *neutral attitude*, and 5 = *mostly positive attitude toward the program*. "–" represents zero responses.

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TABLE 5 Descriptive statistics and *t*-test results for parent–child interactions teaching task

Outcome	Pretest		Posttest		*n*	*t*	*df*	*p*
	M	*SD*	*M*	*SD*				
Teaching task								
Sensitivity/responsiveness	5.31	0.90	5.72	1.05	32	−2.20*	31	.035
Reciprocity	5.28	1.16	5.47	1.27	32	−1.00	31	.33
Tempo	3.50	1.57	3.80	1.24	32	−0.96	31	.34
Intensity	3.97	1.26	4.03	1.20	32	−0.24	31	.82
Emotional tone	5.13	0.94	5.38	1.04	32	−1.25	31	.22
Directedness	5.47	1.34	4.38	1.52	32	3.16**	31	.00

**p* < .01.
p < .05.

TABLE 6 Interaction effects of baby gender and maternal education with respect to pre-postintervention changes

Source	Time × Gender (*F*)	Time × Education (*F*)
Teaching task	–	–
Sensitivity/ responsiveness	2.71	0.62
Reciprocity	8.75**	0.77
Tempo	0.43	4.23*
Intensity	0.84	0.07
Emotional tone	3.19#	0.02
Directedness	4.18*	1.34

Note: One-within/one-between analyses of variance (ANOVAs), examining moderation of intervention effects over time.
**$p < .01$.
*$p < .05$.
#$p < .10$.

($p < .01$). A significant interaction between infant gender and directedness, $F(1, 30) = 4.23$, $p < .05$, $\eta^2 = 0.12$, was associated with a medium effect size (Figure 2). Tests of simple slopes indicated that although there were no significant changes in directedness of maternal interactions with boys, interactions with girls became significantly more balanced following the intervention ($p < .01$).

Maternal education was dichotomized using a median split (median = 16), with 18 mothers in the lower education group, and 14 mothers in the higher education group. A significant interaction between maternal education and tempo during the teaching task, $F(1,30) = 4.23$, $p = .05$, $\eta^2 = 0.12$, was associated with a medium effect size (see Figure 3). Although no significant changes in tempo were observed in the lower educational attainment group, there was a significant increase in tempo pre- to postintervention for higher-educated mothers, with teaching interactions moving from somewhat lower to a more moderate tempo ($p = .04$).

4 | DISCUSSION

The present study represents a pilot evaluation of a brief intervention that provided comprehensive temperament guidance brochures based on Rothbart's psychobiological model (Gartstein et al., 2016; Rothbart, 2012) to mothers of infants. Overall, results indicated that mothers gained knowledge of temperament and related concepts following this minimal low-cost intervention, as measured by the temperament knowledge/mastery quiz. Although previous in-person temperament interventions have demonstrated improvements in temperament knowledge (Franyo & Hyson, 1999; Sheeber & Johnson, 1994), studies of written temperament guidance programs have not directly examined parental mastery of temperament information to date. As anticipated, the results of this study indicated that it is possible for parents to gain temperament knowledge from written materials. Some difficulty was observed with understanding goodness-of-fit, indicating this content, in particular, should be simplified and made more accessible going forward (Stossel, Segar,

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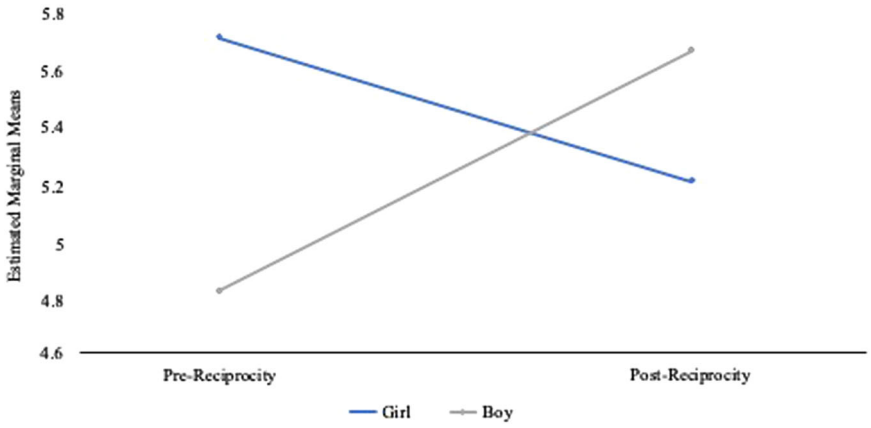

FIGURE 1 Moderation of changes in observed reciprocity by gender during a teaching task

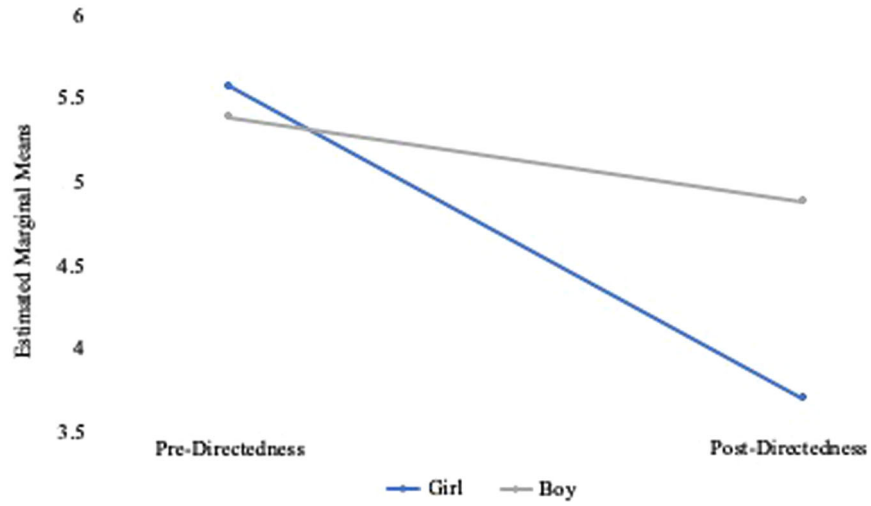

FIGURE 2 Moderation of changes in observed parent versus child directedness by gender during a teaching task

Gliatto, Fallar, & Karani, 2012), using pictures and lowering the literacy level as much as possible (Ferguson & Pawlak, 2011). Variability in levels of temperament knowledge gained in this study suggests that it is also important for future temperament guidance programs to consider monitoring the acquisition of knowledge as a way to ensure that key concepts are understood and retained.

On a related note, the information in the brochure was generally rated as being "somewhat easy" for mothers to understand. A small number of participants reported some difficulty with comprehension, yet there were more mothers who indicated very high ease of understanding the information than those who reported difficulty. As expected, the information in the temperament brochure was thus largely suitable for the participants in this study in terms of accessibility, although some alterations are going to be required before further dissemination, especially for samples with lower educational attainment.

In examining attitudes, mothers primarily reported neutral to very positive attitudes toward the temperament program. Areas in which the program was most well received by parents included the usefulness of temperament information and parent management strategies, feeling

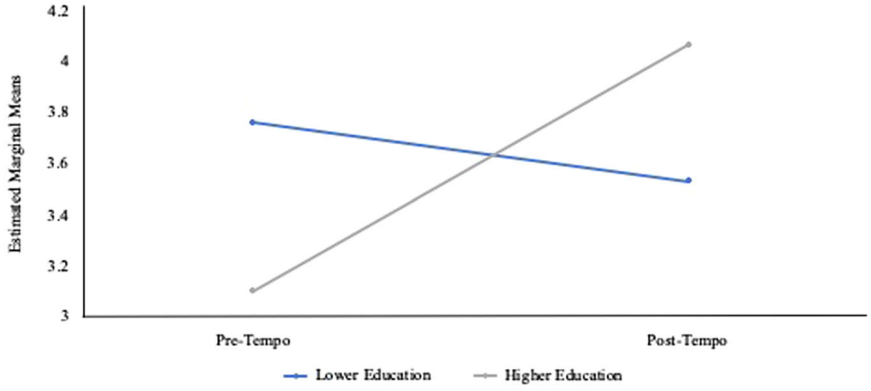

FIGURE 3 Moderation of changes in observed tempo by maternal education during a teaching task

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that the program was worth the time invested, and general satisfaction with the program. This pattern of results is consistent with existing studies addressing written temperament guidance that report parents find temperament materials and related behavior management tips helpful (Cameron & Rice, 1986; Cameron et al., 2013; Ostergren, 1997). Somewhat in contrast to hypotheses, however, parents reported being generally neutral about their desire to recommend the program to friends or relatives with infants, and neutral toward their confidence in their ability to understand their child as a result of the program. These discrepancies with previously written guidance programs may be a function of earlier studies providing individualized information and recommendations (e.g., De Bourdeaudhuij & Brug, 2000; Keen, Couzens, Muspratt, & Rodger, 2010), whereas only general temperament information was provided herein. It is also possible that the requirement of home visits and observations was taxing for mothers, creating reluctance to refer others.

Another important contribution of the present study was our examination of differences in observed mother–child interactions pre and post the temperament guidance program. First, higher sensitivity was seen after the intervention, consistent with hypotheses and past research. It has been demonstrated that parents who have more positive representations of their children's attributes engage in more sensitive interactions with their child (Seifer et al., 2014), which could account for the observed pattern of results. Increased maternal sensitivity following the intervention represents a promising result, as this interactional dynamic has been consistently highlighted as a critical component of a healthy parent–child relationship and goodness-of-fit (e.g., Leerkes, 2011). It should also be noted the change in sensitivity was unlikely a function of maturation effects, as a recent latent growth curve modeling investigation of mother–infant interactions revealed a flat linear trajectory for sensitivity/responsiveness across the first year of life in the context of bimonthly assessments (Gartstein et al., 2017).

An additional significant difference was found in directedness, specifically in that interactions went from being more mother-directed to more balanced following the intervention. This shift represents a positive interactional change, as supporting infant autonomy has been linked with positive developmental outcomes (Whipple et al., 2011). One possible reason for this change is that as mothers increased their understanding of children's temperament characteristics, they felt less compelled to shape or challenge the infant's behavior, and allowed their babies to "drive" the teaching exchange more. It is also possible that these changes occurred as a result of the longitudinal design, as infants move from more passive to more active participation in play due to advancements in both motor and social development in the first year of life (Nomikou, Leonardi, Radkowska, Rączaszek-Leonardi, & Rohlfing, 2017). It has been suggested that as infants attain a more active role in interactions, mothers become less directive (Evans & Porter, 2009). It should also be noted that additional analyses showed the observed reduction in directedness during the teaching task was moderated by infant gender, described in more detail below.

Infant gender emerged as a moderator of intervention effects for two mother–infant interaction outcomes: reciprocity and directedness. Before the program, interactions between mothers and infant boys were less synchronized than teaching exchanges between mothers and girls. Following the intervention, however, this difference became non-significant, as there was an increase in reciprocity/synchrony observed in the interactions between mothers and their sons. This enhanced synchrony specifically with boys is consistent with differential effects found in past temperament-intervention studies (Cameron et al., 2013), wherein treatment effects were stronger for boys than girls. Early gender differences in temperament may be responsible, as for example, boys have demonstrated lower levels of regulatory capacity, and greater surgency than their female counterparts (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006). Higher infant surgency and associated activity level often demand more parental energy, and lower regulatory capacity can create challenges in teaching activities. These challenging behaviors, seen more frequently in boys, were framed through a temperament lens via our program, and it may be that parents of boys viewed such attributes in a less judgmental manner, which allowed them to engage in more synchronous/reciprocal exchanges after reviewing temperament information provided in this study.

An additional interaction emerged with infant gender moderating the effect of the intervention on directedness. Whereas there were no significant changes in directedness for interactions with boys over the course of the intervention, interactions with girls were observed to be significantly more balanced following the program. The parent–child interaction task used required mothers to attempt to teach their infants a yet unmastered skill. As noted, girls demonstrate lower surgency and activity level on average, as well as higher regulatory capacity (Else-Quest et al., 2006). It is possible that girls were more able to slow down and tolerate the demands of the teaching task, whereas boys required more parental control to sustain focus, with parents appreciating these differential capabilities to a greater extent following the intervention, thus demonstrating greater goodness-of-fit after participating in the program.

Maternal education was found to moderate tempo during the teaching interaction. Although no significant changes in tempo emerged between time points for the lower educational attainment group, there was a significant increase in tempo for mothers with higher education, as interactions moved from somewhat lower tempo to faster-paced exchanges. This result was somewhat unexpected, though deemed positive, insofar as infants were shown to prefer play at a moderate or quicker pace (Arco, 1983), and show less positive affect during slower-paced interactions (Arco & McCluskey, 1981). In addition, the faster tempo was protective with respect to infant fearfulness and positive affectivity, contributing to decreases in fear reactivity and increases in smiling and laughter across the first year of life (Gartstein et al., 2018). Results of the present study did not suggest more beneficial intervention effects for less-educated mothers, as one previous temperament-based program (Ostergren, 1997) had demonstrated. This discrepancy is likely a function of differences between samples, as primarily college-educated (or higher) caregivers participated in this study, whereas the previous study

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included more mothers with lower levels of education (i.e., some high school, high school diplomas, technical degrees, and some college).

Thus, it appears that learning about temperament through the comprehensive temperament guidance brochure contributed to the behavioral changes observed over the course of the study, with greater knowledge of temperament and related parenting strategies also reported. The present findings, positive changes in mother–child interactions, in particular, support continued implementation and evaluation of temperament-based interventions in the future.

There were a number of limitations in the present study that should be addressed in future research. Characteristics of the sample represent one such limitation, as predominately Caucasian, highly educated caregivers and in-tact families were included. Mothers in this low-risk sample were also generally sensitive, responsive, and "in-tune" with their infants before the temperament guidance program. Thus, the results of this study should be generalized with care, and additional research is required with families of more diverse racial/ethnic backgrounds, lower educational levels, and adverse circumstances. Reading level of the written materials including the temperament brochure was calculated as "difficult to read" on The Flesh-Kincaid Reading Ease test (based on number of syllables per word and average sentence length), which suggests the need to modify these before introducing to a higher-risk sample will less education.

Attrition occurred due to the longitudinal nature of the project. This, in combination with the relatively small sample size, may have resulted in insufficient power to detect differences resulting from program effects. Additionally, the present study lacked a control group, which led to an inability to rule out maturation effects. Future studies addressing the benefits of temperament guidance should aim to recruit larger samples, including control groups as well. Finally, the pilot implementation of the instruments developed to examine temperament knowledge/mastery, usability, and program-related attitudes, represents a limitation, and future research should consider test–retest reliability, and provide tests of validity for these newly developed measures.

The present study was novel in examining the use of a comprehensive temperament brochure ("Knowing your Baby Matters") as a brief, cost-effective intervention with mothers of infants. It was also the first temperament intervention to introduce Rothbart's psychobiological model of temperament—currently the most widely utilized framework in the study of individual differences. Improvements in temperament knowledge and positive attitudes toward the program warrant further dissemination of temperament information to parents. Important behavioral changes observed herein suggest that parent–child interactions may be altered and improved as a result of a brief temperament-based psychoeducational intervention. No previous evaluation of temperament-based programs utilized parent–child interaction observations and the current study supports future use of such measures in this treatment outcome context. An iterative implementation of this innovative temperament intervention is required to further hone the approach and should be conducted, as helping parents to understand the underlying temperament characteristics that drive their child's behavior is important for promoting positive interactions and healthy relationships.

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CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

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