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Individual Differences in Sibling Teaching in Early and Middle Childhood

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Research Findings: Sibling teaching and learning behaviors were investigated in 2 studies of children in early and middle childhood. Study 1 addressed individual differences in teaching/learning and associations with dyadic age, age gap, gender, birth order, and relationship quality in 71 middle-class dyads (firstborns M age = 81.54 months; second-borns M age = 56.27 months). Half of the firstborn and half of the second-born siblings were assigned the role of teacher. Regression analyses indicated that dyadic age and age gap made unique contributions to teacher and learner behavior. Few birth order differences in approaches to teaching/learning were revealed. Findings highlight the reciprocal nature of sibling teaching and learning. Study 2 investigated longitudinal associations between sibling relationship quality and teaching in a second sample (at Time 1 firstborns = 46.8 months; second-borns = 14 months). Positive sibling interaction (including play) at Time 1 was associated with teaching/learning behaviors 4 years later.

Practice or Policy: Findings are discussed in light of recent social constructivist notions that children’s development is facilitated in the context of intimate relationships.

Recent social constructivist approaches are predicated on the notion that social relationships have a critical role in facilitating children’s social and cognitive development (Carpendale & Lewis, 2004; Rogoff, 1998; Vygotsky, 1978). Recent research on young siblings has examined the reciprocal aspects of their relationship, in particular play and conflict (Dunn, 2002; Howe, Petrakos, Rinaldi, & LeFebvre,
siblings also interact in complementary (i.e., hierarchical) ways when one child takes the lead in directing the exchanges and the other child follows (Hinde, 1979); such exchanges are characteristic of teaching and caretaking, but they have been studied to a lesser extent. Rogoff (1990, 1998) provided a useful framework for examining individual differences in young siblings’ approaches to teaching and learning from one another. Specifically, a careful analysis of the patterns of interaction during sibling teaching may illuminate how children collaborate (or not) in completing a task. Because teaching is a bidirectional process that assigns active roles to both the teacher and learner (Rogoff, 1998), an effective teacher must consider the task from the learner’s point of view and use strategies to guide the learner to complete the task. The learner also has an active role in the process by becoming involved, asking questions, and demonstrating understanding. Moreover, the quality of the sibling relationship may influence the nature of these interactions (Volling, 2003) but has been relatively neglected in the teaching literature.

We present two studies designed to address important gaps in the literature and advance our understanding of sibling teaching and learning. Study 1 provides a unique examination of individual differences in the processes of sibling teaching and learning. Specifically, we investigated associations between individual differences in siblings’ approaches to teaching/learning and (a) dyadic age and age gap, (b) gender, (c) birth order, and (d) relationship quality. Many studies have confounded teacher age and birth order; thus, to clarify this issue, we assigned both older and younger siblings to the teaching role. The antecedents of sibling teaching and learning in the early years, particularly the question of how earlier relationship quality may be associated with later teaching and learning behaviors, have not been investigated. Thus, Study 2 provided an opportunity for a more fine-grained analysis of sibling relationship quality over time rather than a concurrent examination as in Study 1. Thus, Study 2 assessed longitudinal associations between sibling relationship quality and teaching and learning strategies over a 4-year period in a second sample of sibling dyads.

SOCIAL CONSTRUCTIVIST APPROACHES TO TEACHING AND LEARNING

Rogoff’s (1990, 1998) socioconstructivist model of cognitive development provides a framework for considering how children’s development is facilitated within the context of close social relationships. She advances the notion of guided participation as one way that a more skilled individual (adult, child, or sibling) may guide the learning of a less skilled or knowledgeable partner. Guided participation is a means for both adult and child teachers to convey information verbally via hints, descriptions, corrective feedback, scaffolding, or physically by arranging the context to assist the learner in achieving the common goal; learners can observe
and participate at a level that is comfortable but optimally challenging (Rogoff, 1998). In the process, both participants develop a shared understanding of the problem (LeBlanc & Bearison, 2004). In sum, guided participation consists of three main processes: building bridges for the learner between known and unknown information, structuring and supporting the learner’s attempts, and giving the learner responsibility for problem solving.

THE SIBLING RELATIONSHIP AS A UNIQUE CONTEXT FOR STUDYING TEACHING AND LEARNING

The sibling relationship affords children many opportunities to foster one another’s cognitive development due to their intense, highly affective, and long common history (Dunn, 2002). As a result, siblings know one another intimately and gain an understanding of how prior shared experiences, knowledge, beliefs, and emotional history may be used to infer one another’s cognitive styles (Flavell & Miller, 1998). In the present case, children may demonstrate their knowledge by employing effective teaching and learning strategies. For example, in one of the only studies of individual differences of sibling teaching/learning, Howe, Recchia, and Alexander (2009) demonstrated that teachers who provided more detailed instructions were more likely to involve the learner in the task and encourage the learner to correct his or her own errors. In contrast, the majority of sibling teaching studies have focused exclusively on structural variables (e.g., age, gender).

Sibling Teaching and Age

This research is predicated on the notion that older teachers may employ more sophisticated instruction than younger teachers due to their more advanced cognitive skills (Brody, 1998; Klein, Feldman, & Zarur, 2002). Specifically, older teachers may be more likely to use scaffolding strategies (e.g., provide hints, physically arrange materials) that structure and guide the learner to achieve the goal (Recchia et al., in press; Wood, Bruner, & Ross, 1976). In fact, 3-year-old teachers favor demonstration strategies, 5-year-old teachers engage in greater verbal discourse (Klein et al., 2002; Maynard, 2002), and 7-year-olds employ more frequent contingent strategies such as assistance and feedback (Koester & Johnson, 1984; Pérez-Granados & Callanan, 1997; Strauss & Ziv, 2004).

By middle childhood, sibling teachers adjust their use of strategies (e.g., scaffolding, physical demonstrations, corrective feedback, explanations) according to task difficulty, demonstrating sensitivity to the parameters of the teaching task and learners’ abilities (Howe, Brody, & Recchia, 2006). Furthermore, older versus younger sibling teachers provided more (a) instruction, (b) structuring of the situation, and (c) positive guidance when teaching preschool-age siblings (Poris &
Volling, 2001). Recently, Howe et al. (2006) reported that older school-age teachers (age 9) were more likely to employ explanations/descriptions than younger teachers (age 7). Although these studies suggest that older school-age siblings may be sensitive to the developmental level of their younger sibling, it is unclear whether the differences reported by Poris and Volling (2001) were related to teacher age or to the age gap between siblings. Thus, we investigated the unique effects of both development and age gap on children’s teaching strategies. Our study is one of the first to compare siblings’ strategies over a wide developmental period and, as discussed below, clarifies the role of birth order in teaching and learning.

Sibling Teaching and Birth Order

By virtue of the hierarchical nature of teaching/learning exchanges, the firstborn child in a dyad typically assumes the teaching role, thus confounding age and birth order effects. Do sibling teachers employ particular approaches because of their developmental abilities or because as firstborns they have higher status as perceived by both siblings? Second-borns may accept guidance from older firstborns more easily than from younger firstborns, because they are perceived to be more competent and powerful (Buhrmester & Furman, 1990; Furman & Buhrmester, 1985; Howe et al., 2006; Vandell, Minnett, & Santrock, 1987). Nevertheless, it is likely that there are situations when second-born siblings act as teachers; however, this question has not been addressed in the literature. Studying second-borns’ teaching styles may provide insight into the process of how siblings create a shared understanding about a task via negotiations that define goals and clarify teaching and learning roles (LeBlanc & Bearison, 2004). Do second-born siblings approach teaching in similar or different ways as firstborns, and do they look to the firstborn for guidance? We were able to disentangle the issue of dyadic age and teacher birth order because in Study 1 the teaching role was assigned to the firstborn in half of the dyads and to the second-born in the other half. Furthermore, these issues were investigated across the preschool and middle childhood periods.

Sibling Teaching and Gender

Gender differences in sibling teaching are inconsistent, as some authors have reported no differences (Azmitia & Hesser, 1993; Cicirelli, 1973; Maynard, 2002) and others have reported differences (Cicirelli, 1972, 1975). For example, older preschool-age brothers were more likely than were sisters to employ strategies highlighting key characteristics of objects while teaching 2- to 3-year-old younger brothers (Klein et al., 2002). During middle childhood, sisters engage in more frequent teaching and positive guidance than brothers (Minnett, Vandell, & Santrock, 1983; Poris & Volling, 2001), particularly when teaching younger sisters (Brody, Stoneman, MacKinnon, & MacKinnon, 1985; Stoneman, Brody, & MacKinnon,
Younger sisters were more likely to participate in learning when taught by older sisters than older brothers (Stoneman et al., 1986).

**Sibling Teaching and Relationship Quality**

The quality of the sibling relationship that children coconstruct over their history together may also play a role in how the teaching/learning process unfolds. When siblings have a more positive or warmer relationship, they may be more likely to interact than when they have a cooler relationship (Brody, 1998); therefore, opportunities for siblings to observe and learn from one another are enhanced (or not). Thus, we expected that children who perceive their sibling relationship as warm would be more likely to engage in effective teaching strategies or become more actively involved in the learning process. Of course, the highly affective nature of the sibling relationship may sometimes work against the delivery of effective teaching and impede the partner’s learning. For example, in highly conflictual dyads, older sibling teachers were less likely to provide structure and positive guidance (Poris & Volling, 2001). However, few published studies have examined concurrent associations between teaching/learning and sibling relationship quality.

To our knowledge, no study has addressed the question of possible antecedents, particularly sibling relationship quality, that may be associated with individual differences in children’s propensity to engage in later sibling teaching/learning. Sibling relationship quality is relatively stable over early and middle childhood and is linked with later social–cognitive understanding and adjustment in early adolescence (Dunn, 2002; Dunn, Slomkowski, & Beardsall, 1994; Pike, Coldwell, & Dunn, 2005). Given this stability, we might expect sibling relationship quality in the preschool years to be associated with later teaching and learning behaviors. Thus, using a second sample, Study 2 explored how earlier positive and negative sibling relationship quality was associated with teaching/learning behaviors 4 years later.

**THE PRESENT STUDY**

Following a social constructivist framework (Carpendale & Lewis, 2004; Rogoff, 1998), we report on two studies investigating individual differences in siblings’ teaching and learning during a semistructured novel task (i.e., building a tractor from a constructivist toy). In Study 1, individual differences in teaching/learning behaviors and associations with gender, dyadic age, age gap, birth order, and relationship quality were assessed in dyads ranging from 3 to 9 years old. Based on Klein et al. (2002) and Poris and Volling (2001), we expected that teachers in older dyads would be more likely to employ cognitive strategies and physical demonstrations than younger teachers, who would be more likely to rely on descriptions.
Based on Howe et al. (2006), we also predicted that when there was a larger age gap between siblings, teachers would engage in more frequent cognitive strategies and feedback than when the siblings were close in age. We also predicted that first-born teachers would employ more cognitive strategies than second-born teachers due to their familiarity with the teaching role and by virtue of the greater knowledge and power that is vested in their dyadic position (Furman & Buhrmester, 1985; Volling, 2003). We expected second-born teachers to turn to their older siblings more often for assistance and perhaps allow them a more active role. Finally, we predicted that children who reported a positive relationship would be more effective teachers and learners. Given inconsistent findings regarding gender and teaching, no hypotheses were advanced.

Study 2 was a 4-year longitudinal study employing a second sample that provided an opportunity to explore the antecedents of sibling teaching. At Time 1 (T1), firstborns (3–4 years) and second-born siblings (14 months) were observed during naturalistic home observations, and the positive and negative sibling-directed behaviors of both children were recorded. Four years later, siblings were observed during the same semistructured novel teaching task used in Study 1. We predicted an association between positive sibling interaction at T1 and more frequent use of teaching strategies, physical demonstrations, learner questions and descriptions, and positive learner responses during a teaching session 4 years later, whereas we expected T1 negative behaviors to be inversely associated with teaching 4 years later.

**METHOD**

**Study 1**

*Participants*

Seventy-one middle-class sibling dyads participated: older siblings (*M* age = 81.54 months, *SD* = 14.47, range = 59–119) and younger siblings (*M* age = 56.27 months, *SD* = 13.16, range = 35–81). Dyads were balanced for gender (20 girl–girl, 15 boy–boy, 20 girl–boy, 16 boy–girl pairs). Families lived in a large metropolitan, bilingual (English, French) city (population 3 million); English was the mother tongue of all children. Dyads were recruited via kindergartens, day care centers, and recreation programs and by word of mouth.

*Procedure*

Dyads participated in a videotaped teaching session in the home setting and were interviewed about the quality of the sibling relationship. Pilot testing indicated that the tractor task was appropriate for the age range of the children. The
teaching role was counterbalanced across dyads and assigned to half of the first-born and half of the second-born siblings. A research assistant privately instructed the teacher on how to construct a tractor from a plastic construction toy (produced by LASY, Germany) while at the same time the learner was privately interviewed about the sibling relationship. The research assistant used a standard script to instruct the teacher on how to build the tractor. Construction included 20 pieces, and, for many of the steps, the function and manner of assembly was not immediately apparent without instruction. First the task was introduced (e.g., “Today we are going to learn how to make a tractor”). Then the research assistant engaged the child in identifying the pieces and taught the steps in construction (“First we need two long white tubes. I have one tube. Can you find the other one? Now we need to find the four yellow A-shapes and the four green A-shapes. Which color do you want? See how the A-shapes slide onto the long white tube. Put all the green A-shapes on your tube in the middle and I will put all the yellow A-shapes on my tube…”). After completing the steps with the child’s participation, the researcher asked the child to construct the tractor on his or her own and gave assistance only as needed. Once the child teacher successfully constructed the tractor, he or she was asked to teach the sibling. Finally, the teacher was privately interviewed about his or her perceptions of the quality of the sibling relationship.

Measures

Teaching sessions. The language and actions of the teaching sessions were transcribed verbatim; the language was parsed into subject–verb phrases, and the associated actions were also included on the transcripts. The occurrence of one specific teacher or learner behavior was coded for each phrase of the transcript (see the Appendix for definitions and examples). Behaviors were mutually exclusive. Teacher behaviors included (a) physical demonstrations, (b) cognitive strategies, (c) descriptions, (d) questions, (e) control/negative feedback, (f) positive feedback, and (g) off-task. Learner behaviors included (a) descriptions, (b) questions, (c) control/negative feedback, (d) positive feedback, and (e) off-task.

Sibling relationship quality. Perceptions of relationship quality were assessed with a modified version of the Sibling Behavior and Feelings Questionnaire (Mendelson, Aboud, & Lanthier, 1994). Because of the age of the youngest children in our sample, the original 7-point answer scale was reduced to 3 points: 1 =

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1The teacher-by-dyad gender composition was as follows. For firstborn sibling teachers: 17 same-gender dyads (11 female, 6 males) and 18 mixed-gender dyads (10 older females, 8 older males). For second-born sibling teachers: 18 same-gender dyads (9 female, 9 male) and 18 mixed-gender dyads (10 older female, 8 older male).
not very often/much, 2 = sometimes, 3 = very often/much. Children pointed to one of three circles of graduated size when responding to the questions. Practice questions were asked to ensure that children understood the task (e.g., “How much do you like ice cream? Broccoli?”). Then children were asked for their perception of the levels of companionship, closeness, support, and positive feelings (e.g., “How much do you and your sister play together?”) and sibling conflict (e.g., “How much do you fight with your sister?”). Conflict items were reverse scored. Mendelson et al. (1994) reported high internal consistency of these relationship constructs, and validity was assessed by strong associations with measures of children’s popularity and friendship. In the present study, 19 of 53 items were selected to best reflect each of these relationship constructs based on a factor analysis performed by Mendelson et al. (personal communication, June 20, 1988). Cronbach’s alphas suggested adequate internal consistency of the scale (older siblings = .65, younger siblings = .86).

Study 2

Participants

Sibling dyads and their mothers from Caucasian, English-speaking, middle-class, two-parent families living in a southern Ontario, Canada, city (population 200,000) participated. Families were visited two times over a 4-year period. At T1, 32 dyads participated: Firstborn siblings’ $M$ age = 3.9 years ($SD = 6.8$ months); all second-borns were 14 months ($\pm 2$ weeks). Dyads were balanced for gender composition (see Howe & Ross, 1990). Families were recruited through birth announcements in the local newspaper and via word of mouth. At the 4-year follow-up (T2), 24 dyads participated (75% of the original sample): firstborn $M$ age = 8.2 years ($SD = 7.26$ months); second-born $M$ age = 5.3 years ($SD = 2.32$ months). Gender composition of dyads at T2 was 6 girl–girl, 6 boy–boy, 7 girl–boy, and 5 boy–girl pairs.

Procedure

At T1, families were observed for two 40-min sessions in the home setting to capture ongoing maternal and sibling interaction. Specific discrete behaviors (e.g., smile, remove objects) were coded using a paper-and-pencil recording system; all language was tape-recorded and later transcribed verbatim. At T2, the 24 families were visited at home and children received the same teaching task as described for Study 1; however, given the small number of dyads in Study 2 and the fact that older siblings have typically been observed to be teachers (e.g., Brody et al., 1985), only the firstborn sibling was assigned to the role of teacher.
Measures

**T1 sibling interaction.** At T1, three sibling-directed behaviors were coded (based on Dunn & Kendrick, 1982) during live observations (see the Appendix for definitions): (a) hostility: frequency of negative behaviors, (b) positive: frequency of positive behaviors, and (c) play (i.e., number of 15-s intervals during which children played together). The positive behavior and play measures were highly correlated ($r = .73, p < .05$) and were combined into a single measure of positivity.

**T2 sibling interaction.** The teaching sessions were coded as described in “Teaching Sessions” for Study 1.

Reliability for Studies 1 and 2

Two coders independently coded a random sample of 22% (21/95) of the teaching sessions for Studies 1 and 2 to determine intercoder reliability; one coder (research assistant) was unfamiliar with the study’s goals and completed the coding once reliability was established. Reliability was determined by computing percent agreements for each specific category of teacher and learner behavior as well as overall kappas. Teacher behaviors included strategies (.88), descriptions (.79), questions (.97), control/negative feedback (.84), positive feedback (.89), off-task (.93), and an overall kappa = .90. Learner behaviors included questions (.90), descriptions (.67), control/negative feedback (.65), positive feedback (.90), off-task (.76), and an overall kappa = .92. The same two observers conducted reliability coding for 25% (16/64) of the home observations in Study 2; one observer (research assistant) was unfamiliar with the study’s goals and completed the coding once reliability was established. Reliability was calculated for the percent agreements of the specific categories (positive behavior = .85, play = .91, negative behavior = .77) and overall kappa = .79.

RESULTS

Study 1

Descriptive statistics for teacher and learner behavior are presented in Table 1. Both teacher and learner off-task behavior occurred infrequently and so were dropped from the analyses.

**Dyadic Age, Age Gap, and Birth Order Effects**

To analyze the first hypothesis regarding the effects of dyadic age (i.e., average age of children in a dyad), age gap (i.e., difference in age between siblings), and teacher birth order (i.e., firstborn vs. second-born child assigned to the teaching
role) on teacher and learner behavior, we conducted a series of hierarchical multiple regression analyses. Overall speech by the relevant actor was entered in the first step as a control variable. Following this, dyadic age, age gap, and birth order (firstborn and second-born teachers scored as 1 and 0, respectively) were standardized and entered in the second step. The two-way interactions between these variables were entered in the third step, and the three-way interaction in the last step. One teacher or learner behavior was entered as the outcome variable in each regression.

The first two steps of regression analyses examining age and birth order effects on teaching behaviors are presented in Table 2. The overall amount of speech by the teacher was related to all of the teaching variables. With this effect controlled, there were also significant effects of dyadic age on strategies and descriptions. Teachers from older dyads used more strategies but fewer descriptions. There was also a main effect of age gap on teachers’ use of strategies: When the age gap was smaller, teachers used more strategies (regardless of which child was teaching). Finally, there was only one significant effect of birth order: Second-born teachers gave more positive feedback than firstborn teachers.

Of 18 two-way interactions entered in the third step of the regression analyses, only one was significant. Specifically, there was a significant interaction between dyad age and age gap in predicting negative feedback ($\beta = .27, p < .01$). When children were closer in age (i.e., below the mean for age gap), the inverse relationship between dyad age and negative feedback was stronger ($r = -.53, p < .01$) than when

### TABLE 1
Descriptive Statistics for Teacher and Learner Behavior

<table>
<thead>
<tr>
<th>Variable</th>
<th>M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teacher behavior</strong></td>
<td></td>
</tr>
<tr>
<td>Overall talk</td>
<td>52.58 (26.65)</td>
</tr>
<tr>
<td>Physical demonstrations</td>
<td>8.59 (8.38)</td>
</tr>
<tr>
<td>Strategies</td>
<td>17.42 (12.98)</td>
</tr>
<tr>
<td>Descriptions</td>
<td>9.31 (6.66)</td>
</tr>
<tr>
<td>Questions</td>
<td>4.34 (3.90)</td>
</tr>
<tr>
<td>Negative feedback</td>
<td>9.28 (7.83)</td>
</tr>
<tr>
<td>Positive feedback</td>
<td>3.17 (3.63)</td>
</tr>
<tr>
<td><strong>Learner behavior</strong></td>
<td></td>
</tr>
<tr>
<td>Overall talk</td>
<td>28.08 (25.72)</td>
</tr>
<tr>
<td>Descriptions</td>
<td>4.11 (4.76)</td>
</tr>
<tr>
<td>Questions</td>
<td>8.58 (9.35)</td>
</tr>
<tr>
<td>Negative feedback</td>
<td>4.32 (5.75)</td>
</tr>
<tr>
<td>Positive feedback</td>
<td>3.04 (3.04)</td>
</tr>
<tr>
<td>Step</td>
<td>Physical Demonstrations</td>
</tr>
<tr>
<td>------</td>
<td>-------------------------</td>
</tr>
<tr>
<td></td>
<td>β</td>
</tr>
<tr>
<td>Step 1</td>
<td>Overall talk</td>
</tr>
<tr>
<td>Step 2</td>
<td>Overall talk</td>
</tr>
<tr>
<td>Dyad age</td>
<td>.07</td>
</tr>
<tr>
<td>Age gap</td>
<td>.23†</td>
</tr>
<tr>
<td>Birth order</td>
<td>.11</td>
</tr>
</tbody>
</table>

* p < .10, ** p < .05, *** p < .01.
the age gap between siblings was larger ($r = -0.15, ns$). There were no significant three-way interactions between dyad age, age gap, and birth order in predicting teacher behavior.

Similarly, results from the first and second steps of the regressions predicting learner behavior are presented in Table 3. Again, overall speech by the learner was positively associated with all learner behaviors. With this variable controlled, dyad age was positively associated with learner questions. Age gap was negatively associated with learner questions: When the age gap was larger, learners asked fewer questions. Finally, positive feedback was positively associated with age gap such that when the difference between siblings’ ages was larger, learners responded more positively to teachers’ actions and instructions. Surprisingly, neither of these age gap effects was moderated by teacher birth order. In fact, no significant two-way or three-way interactions between dyad age, age gap, and teacher birth order predicted learner behavior.

**Gender Effects**

A series of 2 (teacher gender) × 2 (learner gender) between-subjects ANOVAs were used to examine dyadic gender effects on teacher and learner behaviors. Of 20 possible main effects, only one was significant. There was an effect of teacher gender on teacher positive feedback, $F(1, 67) = 4.56, \eta^2 = .06, p < .05$, such that female teachers gave more positive feedback than male teachers ($M_s = .07$ and .04, respectively). Furthermore, of 10 possible interactions between teacher and learner gender, the only significant effect was for gender to predict teacher negative feedback, $F(1, 67) = 4.76, \eta^2 = .07, p < .05$. Female teachers provided positive feedback equally to male and female learners ($M_s = .17$ and .14, respectively). On the other hand, male teachers provided more positive feedback if the learner was male than female ($M_s = .25$ and .16, respectively). Given the number of tests conducted, neither of these findings was interpreted.

**Relationships Between Teacher and Learner Behaviors**

**Correlations between teacher behaviors.** Partial correlations (controlling for dyadic age, age gap, teacher birth order, and overall teacher speech) were computed between each of the six teacher behaviors (see Table 4). Physical demonstrations were positively associated with questions. Strategies were negatively associated with descriptions and positively associated with positive feedback. In turn, descriptions were positively associated with questions. Teacher questions were negatively associated with positive feedback. Finally, positive and negative feedback were negatively associated.

**Correlations between learner behaviors.** Partial correlations (controlling for dyadic age, age gap, teacher birth order, and overall learner speech) between
TABLE 3
Dyadic Age, Age Gap, and Teacher Birth Order as Predictors of Sibling Learner Behaviors

<table>
<thead>
<tr>
<th>Step</th>
<th>Descriptions</th>
<th>Questions</th>
<th>Positive Feedback</th>
<th>Negative Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\beta$</td>
<td>$sr$</td>
<td>$R^2$</td>
<td>$\Delta R^2$</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall talk</td>
<td>.69*</td>
<td>.69*</td>
<td>.47*</td>
<td>.60**</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall talk</td>
<td>.61*</td>
<td>.55*</td>
<td>.04</td>
<td>.69**</td>
</tr>
<tr>
<td>Dyad age</td>
<td>-.11</td>
<td>-.10</td>
<td>.34**</td>
<td>.33**</td>
</tr>
<tr>
<td>Age gap</td>
<td>-.01</td>
<td>-.01</td>
<td>-.18*</td>
<td>-.17*</td>
</tr>
<tr>
<td>Birth order</td>
<td>-.17†</td>
<td>-.16†</td>
<td>-.06</td>
<td>-.06</td>
</tr>
</tbody>
</table>

†$p < .10$, *$p < .05$, **$p < .01$. 

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the four learner behaviors are presented in Table 5. Descriptions were positively related to learner questions and negative feedback. No other associations were significant.

**Associations between teacher and learner behavior.** Partial correlations (controlling for dyadic age, age gap, teacher birth order, and overall teacher speech) were computed between the six teacher and four learner behaviors. Of 24 possible correlations, 5 were significant. Teacher strategies were positively associated with learner descriptions ($r = .42, p < .001$) and learner positive feedback ($r = .35, p < .01$). Furthermore, teacher and learner negative feedback were positively associated ($r = .35, p < .01$). Finally, teacher positive feedback was positively associated with both learner descriptions ($r = .29, p < .01$) and learner questions ($r = .45, p < .001$).

**Associations Between Behavior During Teaching Sessions and Sibling Relationship Quality**

Finally, we examined associations between teacher and learner behaviors and sibling relationship quality. Neither of two regressions predicting teacher and learner behaviors were significant.

**TABLE 4**
Partial Correlations Between Teacher Behaviors (Dyadic Age, Age Gap, Teacher Birth Order, and Overall Teacher Talk Controlled)

<table>
<thead>
<tr>
<th>Behavior</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Physical demonstrations</td>
<td>—</td>
<td>.04</td>
<td>.17</td>
<td>.33**</td>
<td>−.12</td>
<td>−.06</td>
</tr>
<tr>
<td>2. Strategies</td>
<td>—</td>
<td>−.32**</td>
<td>.03</td>
<td>−.18</td>
<td>.24*</td>
<td></td>
</tr>
<tr>
<td>3. Descriptions</td>
<td>—</td>
<td></td>
<td>.32**</td>
<td>.10</td>
<td>−.13</td>
<td></td>
</tr>
<tr>
<td>4. Questions</td>
<td>—</td>
<td></td>
<td></td>
<td>.09</td>
<td>−.24*</td>
<td></td>
</tr>
<tr>
<td>5. Negative feedback</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td>−.29*</td>
<td></td>
</tr>
<tr>
<td>6. Positive feedback</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

**TABLE 5**
Partial Correlations Between Learner Behaviors (Dyadic Age, Age Gap, Teacher Birth Order, and Overall Learner Talk Controlled)

<table>
<thead>
<tr>
<th>Behavior</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Descriptions</td>
<td>—</td>
<td>.26*</td>
<td>.34**</td>
<td>.15</td>
</tr>
<tr>
<td>2. Questions</td>
<td>—</td>
<td></td>
<td>.20</td>
<td>−.02</td>
</tr>
<tr>
<td>3. Negative feedback</td>
<td>—</td>
<td></td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>4. Positive feedback</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05. **p < .01.
learner reports of sibling relationship quality from the six teaching behaviors was significant, nor were there significant unique associations with any of the individual teaching behaviors. Similarly, neither of two regressions predicting teacher and learner reports of sibling relationship quality from the four learner behaviors was significant, nor were any of the individual unique associations between learner behaviors and sibling relationship quality.

Study 2

**Longitudinal Findings**

The purpose of Study 2 was to examine whether the quality of positive and negative sibling-directed behavior at T1 was associated with teacher and learner behaviors 4 years later. Given some associations between T2 behaviors and age, we controlled for the age of both children in these analyses. As predicted, T1 positivity was significantly associated with T2 behaviors (physical demonstrations: \( pr = .38, p < .05 \); teacher questions: \( pr = .30, p = .09 \); and learner questions: \( pr = -.34, p = .06 \)). Finally, T1 hostile behavior was only associated with T2 learner negative behavior (\( pr = -.29, p = .10 \)).

**DISCUSSION**

The present study addressed questions concerning individual differences in sibling teaching during early and middle childhood, as well as longitudinal predictors of sibling teaching in a second data set. We first focus on Study 1 age and birth order differences, followed by a discussion of the concurrent and longitudinal associations with sibling relationship quality.

**Age and Birth Order Differences in Sibling Teaching and Learning**

The findings of Study 1 regarding age differences in approaches to teaching are generally consistent with the literature (Brody, 1998; Klein et al., 2002). Namely, teachers from older dyads were more likely to employ cognitive strategies that reflect scaffolding or guidance techniques (e.g., hints, explanations) but were less likely to use descriptions. In contrast, Howe et al. (2006) reported that 9-year-old teachers were more likely than 7-year-old teachers to use explanations/descriptions. The difference between the present study and Howe et al. (2006) regarding findings for descriptions may be related to coding definitions: We included explanations as a type of cognitive strategy, whereas explanations and descriptions were combined into a single category in the Howe et al. (2006) study. Overall, our find-
ings are in line with the literature indicating that by age 7, teachers are increasingly likely to use contingent strategies such as assistance and feedback (Koester & Johnson, 1984; Pérez-Granados & Callanan, 1997; Strauss & Ziv, 2004). Poris and Volling (2001) and Howe et al. (2006) also reported that during middle childhood, older (vs. younger) firstborn sibling teachers were more likely to provide instruction, structure the task, and provide positive guidance when teaching preschool-age siblings.

In addition, when the age gap between siblings was smaller, both first- and second-born teachers were more likely to employ cognitive strategies. This finding is contrary to our hypothesis, but it may be that when children are closer in age they have a longer history of shared interaction and perhaps have a more reciprocal relationship and thus act more like peers. The nature of this more peer-like relationship may facilitate children’s understanding of their sibling’s learning style and ability to handle the cognitive demands of the task. Teacher negative feedback was associated with an interaction between age gap and dyad age. When the age gap was small, there was a negative association between dyad age and teacher negative feedback, whereas when the age gap was large, there was no association between dyad age and negative feedback. In other words, as teachers aged, they gave less negative feedback when they were teaching someone close in age to themselves (but there were no age differences when the age gap was large). Again, it may be that the more peer-like relationship of siblings who are close in age may create a context in which the teacher was less likely to engage in negative feedback and correct the learner, particularly as the teacher becomes older.

Given the reciprocal nature of teaching, it is important to consider the learner’s behavior, a subject that has received little attention in the literature. Our findings demonstrate that dyad age was positively associated with learner questions, indicating that in older dyads learners were more likely to ask questions, perhaps reflecting their overall greater cognitive skills and desire to be involved in the learning process. However, when the age gap between siblings was larger, the learner was less likely to ask questions but was more likely to respond positively to the teacher’s actions. Perhaps the teacher’s instructions were clearer and provided appropriate structure for the learner (Recchia et al., in press), thus there was less need for the learner to ask questions. Thus, when the age gap was larger, the behavior of firstborn and second-born teachers was similar, but this may be due to different underlying processes. In sum, our findings suggest that age gap and not birth order is the critical factor in explaining Poris and Volling’s (2001) reports that older versus younger teachers provided more instruction, structuring, and positive guidance when teaching preschool-age siblings.

The sibling teaching literature has frequently confounded teacher age and birth order, making it difficult to disentangle the effects of these two variables. One of the unique advantages of Study 1 was its ability to examine this question in some detail. It is interesting that there was only one effect of teacher birth order: Sec-
second-born teachers gave more positive feedback than firstborn teachers. No significant effects were revealed for the birth order of the learner. Although second-borns in some dyads were assigned the less familiar role of teacher and their counterparts were assigned the role of learner, this did not appear to influence the nature of their interactions in significant ways beyond the variability accounted for by age. Although this was not as we had predicted, perhaps younger siblings may be more skilled in the process of teaching than has been previously suspected. Younger siblings may have observed their older siblings teaching with enough detailed attention to engage in successful strategies when called upon to teach themselves. Thus, younger siblings may have acquired teaching skills if their older siblings have used a guided participation approach to teaching that relies on a joint contribution of both children and a shared understanding with the learner. In fact, the lack of birth order differences may suggest that sibling dyads have coconstructed a shared understanding of teaching/learning roles and effective strategies (LeBlanc & Bearison, 2004); furthermore, this shared knowledge may be flexible enough to withstand a reversal of typical role assignments (e.g., firstborn sibling as teacher and second-born as learner). Prior literature has generally examined sibling teaching in semistructured contexts and has always assigned the teaching role to the older sibling; thus, there is a lack of knowledge about the frequency and skill of younger siblings as teachers. An investigation of naturalistic sibling teaching during ongoing interactions in the home setting might provide further clarification of this issue and may be a fruitful avenue for future research.

**Teaching and Learning Behaviors**

Some teaching behaviors were positively associated and may provide evidence that some sibling pairs employed a guided participation approach to constructing a shared understanding regarding the task (Rogoff, 1998). Specifically, teachers who employed physical demonstrations were also likely to ask questions, perhaps to ascertain whether learners understood the task. Furthermore, teachers who employed more frequent cognitive strategies such as hints or explanations were more likely to provide positive feedback and were less likely to engage in descriptions. Based on the coding definitions, we know that when teachers employed descriptions of the ongoing activity, learners were passively watching rather than being actively involved in constructing the tractor. Thus, the more frequent use of descriptions may imply a more teacher-centered approach in which the learner assumes a passive observational role. Yet descriptions and questions were positively associated, which again might be interpreted as a means for the teacher to ascertain whether the learner has understood the task. A more detailed analysis of the kinds of questions posed by the teacher might clarify the associations of questions with descriptions, physical demonstrations, and positive feedback.
It is interesting that the significant associations between learner behaviors indicates that the more the learner described the construction steps, the more likely he or she was to respond negatively to the teacher and to ask questions. In contrast to when teachers employed description techniques (and the learner had a passive role), it would appear that when learners used description that they were actively engaged in at least noting and understanding the steps involved in construction. Perhaps in this way, learners were attempting to understand the task by describing teachers’ actions and by asking questions when they were unclear about the steps in the task. This may have been an attempt on the learners’ part to develop a shared understanding regarding the steps of construction. Under such circumstances it seems reasonable that learners may have been more likely to respond negatively to the teachers’ instructions, perhaps due to some frustration. Unfortunately, we did not include a direct assessment of the learners’ understanding of the task (e.g., asking learners to put the tractor together independently). Thus, future work should include a method to assess how well children learned the task and if some teaching behaviors were more effective than others in helping learners achieve the goal of the task.

Our interpretation of the learners’ behavior is corroborated by the pattern of associations between the teacher and learner behaviors. It is interesting that negative feedback by both the teacher and learner was positively associated but was not associated with any other behaviors. However, use of teaching strategies was positively associated with both learner descriptions and positive responses by the learner. Similarly, when teachers responded positively, learners were more likely to ask questions and describe the ongoing construction. However, negative feedback by both the teacher and learner were positively associated, but were not associated with any other behaviors.

These findings suggest that use of guidance techniques (e.g., clues, explanations, instructions) during teaching creates a context for positive and reciprocal interactions between the more and less knowledgeable partners. The reciprocal nature of these interactions suggests that both children had a role to play in structuring the learning and successfully completing the task. It may also suggest that both children were trying to build bridges between known and unknown information so as to complete the task successfully. This interpretation of the findings provides support for Rogoff’s (1990, 1998) description of the processes involved in guided participation, namely building bridges between known and unknown information and structuring and supporting the learner’s attempts in the task. As Rogoff (1998) has argued, successful teaching is very much a bidirectional process that emphasizes the roles of both teacher and learner. Thus, our findings that focus on both partners add to our understanding of individual differences in the hierarchical dynamics of sibling teaching and learning interactions.

The reciprocal nature of our findings suggests that there may be implications for understanding the nature of peer teaching/learning in school settings. In light
of recent efforts to increase cooperative and constructivist approaches to learning in classrooms, our findings indicate that a careful analysis is warranted of the kinds of teaching and learning behaviors that occur between school-age peers. Given that some sibling dyads demonstrated an ability to engage in a guided participation approach to teaching/learning, it would seem highly likely that peers in an academic setting could also employ such strategies. Adults can model cognitive strategies (e.g., demonstrations, descriptions, questions, hints, positive feedback) that guide children to build bridges between known and unknown information, support learning, and help children to assume responsibility for their further engagement in learning. Then children can actively employ these strategies in their own attempts at teaching peers or, alternatively, when acting in the role of learner. Future research could (a) examine if the quality of friendships between peers enhances the likelihood children will employ a guided participation approach, as well as (b) investigate the role of gender in peer teaching. Our findings also suggest that the age gap between peer teachers and learners should be examined to determine if this has a similar influence as in the present study. If so, this would have implications for the use of peer teachers in the classroom and would suggest that closer-in-age peers would be more effective teachers in such contexts.

Sibling Relationship Quality: Current and Longitudinal Findings

Contrary to expectations, there were no associations between relationship quality and teaching/learning behaviors in Study 1. The reasons for this are not immediately apparent, and it is unclear if this is due to methodological issues (i.e., low internal consistency or validity of measures) related to the quality measure or to more conceptual issues (i.e., a true lack of association between constructs of interest). More interesting are the Study 2 findings, which, although based on a small sample, do provide some suggestions that the quality of sibling relations is important over time. Specifically, earlier positive sibling behaviors (including play) were associated with teacher and learner behavior over 4 years. These findings suggest that the quality of sibling interactions established during the toddler and preschool years may set the stage for later interactions that reflect behaviors conducive to coconstructing a shared understanding during a teaching task. The earlier behaviors demonstrating the siblings’ interest in each other and the desire to engage in joint play may have translated into the firstborn’s ability to engage in guided participation during teaching, although learners were less likely to ask questions (perhaps because the teaching was clearly presented). Others have demonstrated longitudinal links between social relations and siblings’ later social–emotional understanding (Dunn, 1999; Dunn et al., 1991), yet to our knowledge this is the first study to demonstrate associations between early social relations and later teach-
ing/learning behaviors. Certainly, our findings must be taken cautiously; however, they do suggest questions for future research.

Conclusions

There are some limitations to both studies, such as the small, Caucasian, middle-class samples and the structured nature of the teaching task. Our findings are in line with the extant literature and yet add to the small body of work on individual differences in complementary sibling interactions. Moreover, the findings have implications for both parents and educators by indicating that both younger and older siblings are capable of assuming both teaching and learning roles. Encouraging child teachers to employ cognitive strategies that convey critical information about the task to learners apparently may enhance the positive tone of the interactions and makes the learners active participants in the task. Thus, both parents and educators should be cognizant of the kinds of role models that they are for children when engaged in teaching themselves. Our findings suggest that a guided participation approach that verbally and physically highlights the critical features and steps in the teaching task provides a structure for the learner that encourages him or her to describe and participate in the task, take on an active role, and presumably take on some responsibility for his or her own learning. One outcome is that as the teacher builds bridges between the known and unknown information, he or she may enhance a shared understanding of the task with the learner. Certainly, a shared understanding may be a basic assumption for effective learning and, if missing, suggests that the learner may be less motivated to participate in active ways to acquire new knowledge. Thus, teaching/learning experience may provide young children with the opportunity to enhance their cognitive skills, especially those children who are relatively close in age.

There are a number of unanswered questions that are prompted by our studies, such as the concurrent associations between teaching/learning and children’s social cognitive skills and a detailed assessment of the learner’s knowledge (e.g., demonstrating independent construction of the tractor). Moreover, we know little about the frequency and approaches to teaching/learning and the coconstruction of knowledge that occurs naturally between siblings during ongoing interaction in the home setting. Further work on these issues would continue to illuminate our understanding of how children’s sibling relationships are related to their social and cognitive development.

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REFERENCES


APPENDIX
Definitions and Examples of Teacher and Learner Behaviors (Studies 1 and 2)

**Teacher Behaviors**

(a) *Physical demonstrations*: Overt physical actions demonstrating how to construct the tractor, how pieces work, where to place pieces (e.g., sticking wheels onto axle, slipping A-shaped pieces onto long tube).

(b) *Cognitive strategies*: Teacher provides hints or clues; prompts, guides, or instructs learner to build the tractor independently; provides explanations; or prompts to stay on task (e.g., “It’s yellow,” “Remember what comes next?”). Teacher explains why the tractor is constructed in a particular way or how to complete a part of the tractor (e.g., “You put all of these together like this so that the wheels will turn,” “You put the ladder piece here, so that the driver can climb on”). Teacher makes statements that allow the learner to take over some or all of the building (e.g., “Now it’s your turn to build,” “You put the green pieces on your rod”).

(c) *Descriptions*: Teacher narrates own actions in the process of building (e.g., “I’m putting on the wheels now”); learner is watching and not actively building.

(d) *Questions*: Teacher asks learner questions to determine if he or she understands or wants to participate. May include tags (e.g., “Do you see what to do?” “This is the way the A-shapes fit on the tube, ok?” “Do you want to help?”).

(e) *Control/negative feedback*: Teacher identifies and corrects errors (“You forgot the round part”) or directs learner in a bossy, impatient, or dominating tone of voice (e.g., “No, don’t put it like that!”) and may use physical actions to correct or stop actions (e.g., puts out hand and stops learner from participating).

(f) *Positive feedback*: Teacher provides positive feedback, encouragement, or praise in a friendly or neutral tone of voice (e.g., “Yes, that’s right!”) and via physical actions (points to a problem with construction).

(g) *Off-task*: Teacher is not paying attention to task or is playing or fiddling with pieces.

**Learner Behaviors**

(a) *Descriptions*: Learner narrates own actions in the process of building (e.g., “I’m putting on the wheels now”).
(b) **Questions:** Learner asks questions to clarify building process, asks questions about materials, or requests to participate (e.g., “Is this how I do it?” “Do I use this piece next?” “Can I put the steering wheel together?”).  
(c) **Control/negative feedback:** Learner corrects (“That’s wrong”), directs, or resists teacher’s direction in a bossy, impatient, or dominating tone of voice (e.g., “No, don’t help me! I know how to do it”) and may use physical actions to stop actions (e.g., puts out hand and stops teacher from constructing).  
(d) **Positive feedback:** Learner responds positively to teacher, praises teacher, or complies with instructions (“That’s right”; “You did a neat job building the tractor”; teacher tells learner to slide all green pieces to middle and learner says, “Ok”).  
(e) **Off-task:** Learner is not paying attention to teacher or is playing or fiddling with pieces, and so on.

**Study 2 Measures (T1)**

(a) **Positive behavior:** Frequency of sibling-directed positive behaviors (e.g., laugh, smile, approach, touch affectionately).  
(b) **Play:** Siblings engage in verbal and/or physical play or conventional games (e.g., peek-a-boo) during each 15-s interval.  
(c) **Negative behavior:** Frequency of sibling-directed negative behavior: Prohibit/protest, touch negatively (e.g., hit, poke).