Effects of Task Difficulty on Sibling Teaching in Middle Childhood

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Teaching styles were investigated in 28 middle-class sibling dyads (older sibling $M_{\text{age}} = 8.2$ yrs; younger sibling $M_{\text{age}} = 5.11$ yrs) using two sets of block design tasks (five easy; five hard). Older siblings employed a greater number of strategies (i.e. physical demonstrations, scaffolding, corrective feedback) in the hard than in the easy tasks, thus demonstrating the ability to adjust teaching strategies according to task difficulty. Teachers also employed more frequent strategies when learners were younger indicating that they may be sensitive to developmental differences. In the hard tasks, learners responded positively to teacher guidance, but were also more likely to reject the teacher’s help, perhaps demonstrating responsibility for their own learning. Findings are discussed in light of current social-cognitive approaches highlighting the important roles of both teacher and learner during episodes of sibling teaching in middle childhood. Copyright © 2006 John Wiley & Sons, Ltd.

Key words: siblings; teaching; middle childhood; social-cognitive development

INTRODUCTION

Relationship models of development (Dunn, 2002; Hartup & Laursen, 1999) are predicated on the notion that social-cognitive development is facilitated within the context of close, intimate relationships with significant others (e.g. family, friends). Sibling relationships afford many opportunities for different kinds of collaborative interactions that promote young children’s development (Dunn, 2002). Research has focused on siblings’ reciprocal interactions such as play and conflict (Howe, Rinaldi, Jennings, & Petrakos, 2002), but less attention has been paid to complementary interactions such as teaching (Azmitia & Hesser, 1993; Göncü & Rogoff, 1998). Socioconstructivist approaches to cognitive development (Rogoff, 1998; Vygotsky, 1978) focus on the processes of teaching during adult–child and peer interactions, but sibling teaching has garnered less attention. Yet, the sibling relationship is a rich context in which to study

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children’s approaches to teaching due to the long history of shared, affective, and co-constructed experiences siblings have together (Carpendale & Lewis, 2004; Dunn, 2002). The purpose of the present study was to examine older siblings’ use of teaching strategies when introducing a novel cognitive task, and to determine whether these strategies varied as a function of (a) siblings’ ages, (b) dyadic gender composition, (c) learner’s responses, and (d) level of task difficulty.

**The Sibling Relationship as a Context for Development**

The notion that close relationships provide important contexts that facilitate young children’s social–cognitive development is the conceptual framework for the present study (Carpendale & Lewis, 2004; Dunn, 1996, 2002; Hinde, 1979). Siblings play a particularly important role in one another’s development partly because they spend more time with one another than with parents or peers in the early years (Dunn, 1993). As they engage in frequent, affectively-laden, and intense interactions, siblings develop specific patterns of relational dynamics that endure over time (Dunn, 1993; Parke & Buriel, 1998). These interaction patterns provide opportunities for children to practice skills and develop greater social understanding in the context of a safe but typically intense relationship.

Sibling interactions are characterized by both reciprocal (equal, returned) interactions typical of peer relations and complementary (hierarchical) types of interactions characteristic of parent–child relations (Hinde, 1979). Reciprocal sibling interactions have been studied during play and conflict (e.g. Howe, Petrukos, & Rinaldi, 1998; Howe et al., 2002), often in relation to children’s understanding of their social worlds (Dunn, 2002). Less work has addressed complementary interactions in which one sibling (typically the older) takes the lead in teaching, caretaking, or helping due to their greater knowledge or experience (Brody, Stoneman, MacKinnon, & MacKinnon, 1985; Garner, Jones, & Miner, 1994). In fact, there has been relatively little attention devoted to children’s teaching strategies or understanding (Strauss & Ziv, 2004). Nevertheless, recent conceptualizations of cognitive development (Rogoff, 1998) provide a framework for furthering our understanding of sibling influence on children’s development in the context of teaching.

**Socioconstructivist Approaches to Teaching**

Rogoff’s (1990, 1993, 1998) socioconstructivist approach to cognitive development highlights the social and collaborative nature of children’s exchanges and is based on the premise that children have an active role in facilitating their own development. Guided participation involves interpersonal communication conveyed verbally (e.g. hints, corrective feedback) via an individual’s emotional tone, and physically by setting the stage for activities (e.g. teacher retrieving an out-of-reach object for learner). Specifically, the processes of guided participation include: building bridges between what children know and new information yet to be learned, structuring and supporting children’s efforts, and giving children responsibility for carrying through problem-solving. Teachers must manage the situation for learners in ways that facilitate their developing skills and provide challenges, constraints, and support in the process of posing and solving problems. This kind of support allows learners to observe and participate at a comfortable but optimally challenging level (Rogoff, 1998). Thus, successful
teaching and learning depends on establishing a shared understanding between participants as teaching progresses (LeBlanc & Bearison, 2004; Rogoff, 1993). Given their long and intense history together, we would expect siblings to be in a unique position to develop a shared understanding regarding effective strategies for teaching and learning.

Children’s Approaches to Teaching Peers and Siblings

Guided participation during instructional activities has been documented in adult-child and peer dyads in different cultures (Gönçü & Rogoff, 1998; Mulvaney, 2001; Rogoff, 1993). Developmental changes in teaching behaviours with peers and siblings indicate that 3-year-olds mainly demonstrate during instruction, whereas 5- and 6-year-olds employ more frequent verbal strategies to guide the learner (Klein, Feldman, & Zarur, 2002; Maynard, 2002; Strauss, Ziv, & Stein, 2002). By age 7 children are more adept at employing contingent teaching strategies that reflect the learner’s need for help and feedback (Koester & Johnson, 1984; Perez-Granados & Callanan, 1997; Strauss & Ziv, 2004).

Only a small literature has investigated sibling teaching, typically in comparison to mothers or peers. For example, Perez-Granados and Callanan (1997) demonstrated that 7-year-old sibling teachers offered informatives (i.e. hints) particularly to 3- but not 4-year-old younger siblings, whereas 6-year-old teachers did not provide informatives to either group of younger siblings. The strategies used by 7-year-old teachers were similar to their mother’s scaffolding approach and suggest that teachers were taking account of the learner’s abilities. Koester and Johnson (1984) compared sibling and peer teaching styles and reported that 6-year-old teachers were more involved, more likely to correct, and provided more feedback to their younger sibling than to younger peer learners (both 3-years-old). Azmitia and Hesser (1993) compared the teaching of older siblings and their friends in middle childhood (both 9-years-old) as they instructed the younger sibling (aged 7). Sibling teachers provided more frequent explanations, positive feedback, and offered younger sibling learners more control than peer teachers. Younger siblings were also more active with their older sibling than with the peer teacher and demanded more frequent explanations and greater involvement. Apparently, both siblings were active collaborators while older siblings demonstrated sensitivity to the learners’ skills. Similarly, in a study of the processes of teaching of 6- to-10-year-old firstborn siblings, Poris and Volling (2001) reported that older compared to younger school-aged sibling teachers provided more instruction and used a more sophisticated style (i.e. structuring and positive guidance) when teaching their 4-year-old secondborn siblings.

In an early study, Cicirelli (1973) compared the effect of sibling age gap (2 versus 4 years) on the teachers’ (grades 2, 4, or 6) categorization skills with two groups of learners (kindergarten or grade 2). Overall, when sibling teachers were 4 as opposed to 2 years older, their younger siblings were more successful in the categorization task. Apparently older teachers facilitated the learner’s performance, perhaps because teachers had more sophisticated cognitive abilities and could guide the learner to achieve a goal that was unattainable on their own. This behaviour may reflect evidence of scaffolding (Wood, Bruner, & Ross, 1976). Additionally, learners in dyads with older teachers may have been more likely to accept help because they viewed the teacher as a powerful and knowledgeable
model (Furman & Buhrmester, 1985). Conversely, learners in dyads with a 2-year age gap may have been less likely to accept help because the similarity in age makes the teaching skill of the older sibling less pronounced and there may be greater opportunities for conflict and rivalry. In this vein, Poris and Volling (2001) reported that older first-born siblings in more conflictual dyads were less likely to provide positive guidance during teaching.

Investigations of the role of gender in teaching reveal either no effects (Azmitia & Hesser, 1993; Cicirelli, 1973; Maynard, 2002), or that school-aged girls are more likely to teach and provide positive guidance than boys (Minnett, Vandell, & Santrock, 1983; Poris & Volling, 2001). Cicirelli (1972) reported that 8-year-old older sisters were more likely to use a deductive method (i.e. explaining rules or providing descriptions followed by examples), particularly with younger brothers (aged 6), whereas older brothers were more likely to use an inductive method (i.e. providing examples for learners to abstract the rules on their own with varying degrees of teacher guidance). However, older sisters provided less feedback, perhaps because their approach made feedback less relevant.

In sum, the literature supports the notion that developmental differences are important in teaching approaches and there is evidence that older siblings adjust their teaching and conversational skills depending on the younger sibling’s age and the cooperative or competitive nature of a task (Howe, Aquan-Assee, & Bukowski, 1997; Poris & Volling, 2001). However, the question of how sibling teachers may adjust their teaching strategies to account for task difficulty has not been investigated and forms the focus of the present study.

The Present Study

The present study investigated sibling teaching during easy and hard tasks to examine the notion of guided participation. The sibling pairs included 7- to 9-year-old teachers and their younger siblings, aged 4–7 years. Given the literature indicating that first-borns typically assume the teaching role during sibling interactions in middle childhood and may be more effective teachers due to their greater experience (Brody et al., 1985), we chose to observe only first-born siblings teaching their younger siblings. Teachers taught their younger sibling ten block designs divided into five easy and five hard tasks. We investigated differences in teaching strategies and learner responses according to the age of both of the siblings, gender, and task difficulty. First, we hypothesized that older teachers would use more frequent teaching strategies (i.e. physical demonstrations, explanations/descriptions, corrective feedback, scaffolding, arrangement of materials) than younger teachers given their more sophisticated cognitive skills (Perez-Granados & Callanan, 1997; Strauss & Ziv, 2004). Second, we predicted that teachers would employ more frequent teaching strategies when the learners were younger rather than older, because the former may need more help to succeed in the task than the latter (Koester & Johnson, 1984). In turn, we expected younger learners would seek more help and be more accepting of the teacher’s guidance. Third, although the literature is inconsistent regarding gender effects during sibling teaching, based on Minnett et al. (1983), we predicted that older sisters would employ a greater number of strategies (i.e. physical demonstrations, explanations/descriptions, scaffolding, arrangement of materials), but less corrective feedback. Whereas, older brothers would employ more corrective feedback, but fewer explanations/descriptions, physical
demonstrations, and scaffolding hints. Finally, based on findings indicating that 7-year-old sibling teachers show early signs of contingent teaching strategies (Perez-Granados & Callanan, 1997), we predicted that sibling teachers would be more likely to employ a greater number of strategies during the hard than easy block designs. We also expected learners to ask for more clarification with the hard designs due to the increased challenge of the task.

METHOD

Participants

Participants were recruited through French-language primary schools, and included 28 sibling pairs from French-speaking middle-class families living in an urban, bilingual, Canadian city (population = 3 000 000). In each sibling dyad, teachers ranged in age between 7.3 and 9 yrs ($M = 8.2$ yrs, $S.D. = 6.4$ mos) and learners’ age ranged from 4.1 to 7.7 yrs ($M = 5.11$ yrs, $S.D. = 10.1$ mos). The age difference between siblings ranged from 1.3 to 3.6 yrs ($M = 2.3$ yrs, $S.D. = 7.0$ mos). The sample was balanced for dyadic gender composition (i.e. 7 female–female). Years of parental education indicated a middle-class sample ($M = 18.5$ yrs, $S.D. = 3.8$ yrs, range = 12–30 yrs of schooling).

Procedure

The videotaped teaching sessions took place in the children’s homes. Mothers were present and completed a short demographic questionnaire. Siblings sat next to one another at a table and first participated in a 5-minute warm-up session with a farm set to become comfortable with the experimenter and the video camera. Then the experimenter taught the older sibling the ten block tasks in a separate room and answered any questions. Once the older sibling successfully completed all the tasks, he/she rejoined their younger sibling and was told to teach them the task (i.e. matching the blocks correctly to the card designs). The teacher explained the different coloured sides of the blocks, demonstrated how the blocks matched the designs on the cards, and then instructed the learner to complete each design as he/she monitored their progress.

Materials

The ten block designs were derived from the Weschler Preschool and Primary Scale of Intelligence—Revised (WPPSI-R) and the Weschler Intelligence Scale for Children Revised (WISC-R) (Weschler, 1974, 1989). These developmentally normed tests were used to ensure that the designs were age-appropriate for the sibling dyads. The children could use up to four wooden cubic blocks (3.5 cm) with the same design on each block: two red sides, two white sides, and two sides diagonally separated by red and white. The children were also given 10 cards ($10 \times 10$ cm) depicting the ten geometric designs drawn in red and white. Siblings were asked to place the blocks over the corresponding designs to complete each task successfully. The ten designs were divided into two groups: the first five cards (i.e. easy tasks) involved the use of block sides that were either completely white or red, whereas the last five cards (i.e. hard tasks) included at least one 2-coloured side. The five easy cards were always presented first so as not to discourage the children.
Measures

Teacher and Learner Behaviours

Teacher and learner behaviours were coded according to a scheme (see Appendix for definitions and examples) based on Koester and Bueche (1980) and Poris and Volling (2001). Coding categories included explicit teaching strategies during the presentation of the ten designs, which consisted of instances when the teacher was focused on the task (Perez-Granados & Callanan, 1997). Teaching strategies included: physical demonstrations, corrective feedback, explanations/descriptions, scaffolding (hints/prompts/questions), and arrangement of materials. The categories were mutually exclusive, however if two codes occurred simultaneously, both were coded (e.g. physical demonstration and explanation). Learner behaviours were coded only in response to a teaching strategy and included neutral acceptance, active acceptance, refusal, and questions/clarifications. Teaching sessions were divided into easy and hard tasks and a frequency count was calculated for each teaching strategy and learner behaviour.

Reliability

A random selection of 25% (7/28) of dyads was coded by two persons one of whom was unfamiliar with the purposes of the study. Percent of agreements/(agreements + disagreements) was employed to calculate reliability for teacher and learner behaviours. Teacher behaviours were: physical demonstrations (0.80), corrective feedback (0.83), explanations/descriptions (0.76), scaffolding (0.77), arrangement of materials (0.85); learner behaviours were: neutral acceptance (0.88), active acceptance (0.93), refusal (0.83), questions/clarifications (0.72). Overall Cohen’s kappas = 0.74 for teacher behaviours and 0.79 for learner behaviours.

RESULTS

Age and Gender Effects

Teacher Age

Siblings’ ages were strongly positively correlated (r=0.73), therefore partial correlations were computed with learner age controlled. Teacher age was positively related to explanations/descriptions (\(pr=0.43, p=0.03\)) and the association with corrective feedback approached significance (\(pr=0.38, p=0.06\)). A trend also suggested a positive association between age and scaffolding strategies (\(pr=0.33, p=0.10\)). Both forms of learner acceptance responses (i.e. neutral and active) were positively related to teacher age (\(prs =0.60\) and 0.80, respectively, \(ps <0.001\)).

Learner Age

After controlling for teacher age, learner age was negatively related to the teacher’s use of scaffolding strategies (\(pr=-0.55, p <0.01\)), arrangement of materials (\(pr=-0.51\)), and corrective feedback (\(pr=-0.63, p <0.001\)); a negative association with teacher physical demonstrations approached significance (\(pr=-0.37, p=0.06\)). Learner age was also negatively related to their active acceptance responses (\(pr=-0.72, p <0.001\)) and asking questions/clarifications (\(pr=-0.51, p <0.01\)).
Gender effects

Dyadic gender effects on teacher and learner behaviours were examined using a series of 2 (teacher gender) × 2 (learner gender) between-subjects ANOVAs. Of all possible main effects and interactions, only the main effect of teacher gender on neutral acceptance by the learner was significant, $F(1, 24) = 4.99, p = 0.03, \eta^2 = 0.17$, such that learners were more likely to accept older sisters’ instructions in a neutral way ($M = 2.29, S.D. = 3.34$) than older brothers’ instructions ($M = 0.21, S.D. = 0.43$).

Associations between Teaching Strategies and Learner Behaviours

Teaching Strategies

Partial correlations between the various teaching strategies (controlling for children’s ages) are presented in Table 1. Physical demonstrations were positively related to scaffolding strategies and corrective feedback. Arrangement of materials was positively related to explanations/descriptions and scaffolding strategies, and a positive trend was apparent with corrective feedback. Finally, scaffolding strategies and corrective feedback were positively associated.

Learner Behaviours

Partial correlations between the four learner behaviours (controlling for children’s ages) are presented in Table 2. Only the positive associations between neutral and active acceptance and between active refusal and questions/clarifications were significant.

Links Between Teachers’ and Learners’ Behaviours

Partial correlations (controlling for children’s ages) examined the associations between teaching strategies and learner behaviours (see Table 3). In general, neither active refusal nor questions/clarifications were strongly associated with...
Table 3. Partial correlations between teaching strategies and learner behaviours controlling for ages of siblings

<table>
<thead>
<tr>
<th></th>
<th>Neutral accept</th>
<th>Active accept</th>
<th>Active refuse</th>
<th>Questions/clarifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical demonstrations</td>
<td>0.52**</td>
<td>0.55**</td>
<td>0.19</td>
<td>0.05</td>
</tr>
<tr>
<td>Explain/describe</td>
<td>0.50*</td>
<td>0.10</td>
<td>-0.21</td>
<td>-0.37(a)</td>
</tr>
<tr>
<td>Scaffolding strategies</td>
<td>0.76**</td>
<td>0.81**</td>
<td>0.11</td>
<td>0.15</td>
</tr>
<tr>
<td>Arrange materials</td>
<td>0.68**</td>
<td>0.28</td>
<td>-0.18</td>
<td>-0.14</td>
</tr>
<tr>
<td>Corrective feedback</td>
<td>0.59**</td>
<td>0.76**</td>
<td>0.07</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Note. \(a\)\(p<0.10, \*p<0.05, \**p<0.01\) (2-tailed). Correlations for physical demonstrations are based on \(N=27\), as one outlier was eliminated from these analyses.

Table 4. Means and standard deviations for teacher and learner behaviours in easy and hard tasks

<table>
<thead>
<tr>
<th></th>
<th>Easy tasks</th>
<th>Hard tasks</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching strategy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical demonstrations</td>
<td>0.37 (0.79)</td>
<td>1.15 (2.44)</td>
<td>1.52 (2.78)</td>
</tr>
<tr>
<td>Explain/describe</td>
<td>0.79 (1.45)</td>
<td>0.18 (0.55)</td>
<td>1.11 (1.59)</td>
</tr>
<tr>
<td>Scaffolding strategies</td>
<td>12.54 (12.05)</td>
<td>18.14 (19.06)</td>
<td>30.68 (29.65)</td>
</tr>
<tr>
<td>Arrange materials</td>
<td>12.32 (5.64)</td>
<td>11.18 (4.83)</td>
<td>23.50 (9.72)</td>
</tr>
<tr>
<td>Corrective feedback</td>
<td>12.11 (10.02)</td>
<td>23.14 (17.89)</td>
<td>35.25 (26.50)</td>
</tr>
<tr>
<td>Total strategies</td>
<td>41.00 (28.39)</td>
<td>62.61 (44.41)</td>
<td>103.61 (69.05)</td>
</tr>
</tbody>
</table>

| Learner behaviour        |                  |                 |                 |
| Neutral accept           | 0.57 (1.20)      | 0.68 (1.49)     | 0.22 (2.56)     |
| Active accept            | 9.29 (4.86)      | 13.39 (9.27)    | 22.68 (12.77)   |
| Active refuse            | 0.46 (1.07)      | 2.89 (3.44)     | 3.36 (4.12)     |
| Questions/clarifications | 1.11 (1.52)      | 1.36 (1.99)     | 2.46 (2.66)     |

Note. Means for physical demonstrations are based on \(N=27\), as one outlier was eliminated from these analyses.

the teaching strategies. Neutral acceptance was positively associated with all teaching strategies, however active acceptance was positively associated only with physical demonstrations, scaffolding strategies, and corrective feedback.

**Teaching Strategies and Learner Behaviour as a Function of Task Difficulty**

**Teaching Strategies and Task Difficulty**

The effect of task difficulty on the use of the teaching strategies was examined using a 2 (Task) \(\times\) 5 (Teaching Strategy) within-subjects ANOVA. The main effects for both task, \(F(1, 26)=11.99, p<0.01, \eta^2=0.32\), and strategy, \(F(4, 104)=30.11, p<0.001, \eta^2=0.54\), were significant. In general, teachers used more strategies in the hard than in the easy tasks; corrective feedback was the most frequent teaching strategy, followed by scaffolding strategies, arrangement of materials, physical demonstrations, and explanations/descriptions (see Table 4). All differences between means were significant \((ts>2.96, ps<0.01)\), except those between corrective feedback and scaffolding, scaffolding and arranging materials, and physical demonstrations and explanations/descriptions.

These effects were also qualified by an interaction between Task and Strategy, \(F(4, 104)=19.62, p<0.001, \eta^2=0.43\). Teachers were equally likely to arrange
materials in the easy and hard tasks, and were only somewhat more likely to use explanations/descriptions in the easy than the hard tasks, \(t(27)=2.01, p<0.06\). On the other hand, teachers were more likely to use physical demonstrations, scaffolding strategies, and corrective feedback in the hard than the easy tasks, \(ts>2.05, ps<0.05\). See Table 4 for means and standard deviations.

Learner Behaviours and Task Difficulty

The relationship between task difficulty and learner behaviour was examined using a 2 (Task) x 4 (Learner Behaviour) within-subjects ANOVA. The main effects for both task, \(F(1, 27)=17.00, p<0.001, \eta^2=0.39\), and behaviour, \(F(3, 81)=72.42, p<0.001, \eta^2=0.73\), were significant. Learners made more responses in the hard than the easy tasks. Overwhelmingly, their most frequent response was to actively accept direction from the teacher, with the other three responses occurring much less frequently, \(ts>7.92, p<0.001\). Active refusal occurred more frequently than neutral acceptance, \(t(27)=2.16, p<0.05\), but none of the differences between neutral acceptance, active refusal, or questions/clarifications approached significance. Means and standard deviations are presented in Table 4.

These main effects were also qualified by the interaction of Task and Behaviour, \(F(3, 81)=5.95, p<0.01, \eta^2=0.18\) (see Table 4). Both active acceptance and refusal occurred more frequently in the hard tasks than the easy tasks, \(ts>2.90, ps<0.01\). However, neutral acceptance and questions/clarifications were equally likely to occur in the two tasks.

DISCUSSION

The purpose of the present study was to investigate the process of teaching and learning by school-aged children and their younger brothers or sisters. Specifically, we examined the effect of task difficulty on the teacher’s instructional strategies and the response of learners during a novel game. We discuss (a) associations between teacher and learner behaviours, (b) findings related to age and gender, and (c) the effects of task difficulty on teaching and learning.

Associations between Teaching and Learning Behaviours

Findings indicated that teachers employed a consistent pattern of behaviours during instruction. When teachers used scaffolding techniques and physical demonstrations, they were more likely to engage in corrective feedback, perhaps to inform the learner of whether or not they had followed their guidance correctly. The arrangement of materials, namely laying out the blocks and designs in an organized way was associated with more frequent explanations/descriptions, scaffolding, and a trend was apparent with corrective feedback. This pattern suggests that some teachers were more engaged in planning out their approach to instruction in logical and thoughtful ways so as to aid the learner (Gardner & Rogoff, 1990). Overall, teachers used corrective feedback most frequently, followed by scaffolding strategies, and the arrangement of materials. These teaching behaviours may help both children to establish a shared understanding regarding the nature of the task (LeBlanc & Bearison, 2004). That is, by pointing out errors or noting successful moves, providing clues or hints
that guide the learner in positive directions, and arranging materials to facilitate an organized approach to the task, the teacher highlights the critical processes so that the learner can understand the nature of the task and have the means to succeed. As noted below, when learners accept this kind of direction, they were more likely to become collaborative partners.

Learners also behaved in consistent ways, specifically the two types of acceptance (neutral and active) were positively associated, as were active refusal and questions/clarifications. The association between the two types of positive responses is not surprising and may indicate that some learners were generally more accepting of the teacher’s instruction, at least in this context. However, the association between refusal and questioning/clarification responses is more challenging to interpret. Underlying both of the latter responses may be a desire by the learner to establish control and independence (refusing guidance) or to clarify their understanding of the task so as to solve it successfully. It may be when learners did not understand that they sought clarification or asked questions, thus demonstrating the active role that they took for themselves. Certainly these speculations require further investigation.

Finally, there were clear associations between teaching strategies and learner behaviours. Although the learner behaviours were coded in response to teacher behaviours and thus would naturally be expected to occur more frequently when teachers used many strategies, the specific pattern of findings suggests that children were responding in qualitatively different ways depending on the teacher’s behaviour. Specifically, both neutral acceptance of instruction, and to a lesser extent, active acceptance, were positively associated with teaching strategies, whereas refusals and questions/clarifications were not related. Thus, when younger children observed and followed the verbal instructions and physical actions of the teacher, they were more likely to be the recipient of teaching behaviours. As such, it is possible that the positive quality of children’s responses may have in turn encouraged and reinforced the teachers to continue providing guidance. In this way, the observed associations between teachers’ and learners’ behaviours may reflect a collaborative approach to the situation and highlights the important role for each player in the teaching process (Rogoff, 1998). On the other hand, the lack of association between learner refusals, clarifications/questions and teacher behaviours may indicate that such behaviours were not conducive to collaboration. Yet, these patterns are qualified by considering age, gender, and task difficulty, as noted below.

**Age of Siblings and Teacher/Learner Behaviours**

As predicted, with the learner’s age controlled, older teachers were more likely to use explanations/descriptions, while trends were apparent for corrective feedback and scaffolding strategies. These findings are generally in line with the literature and suggest that older school-aged teachers possessed greater cognitive skills that may allow them to employ a variety of teaching strategies (Poris & Volling, 2001). It may be that certain levels of social cognitive skills are necessary for particular types of teaching, for example Ziv and Frye (2004) demonstrated that developmental changes in preschoolers’ understanding that the act of teaching depends on knowledge and belief was linked to their theory of mind ability. Such developmental changes are likely to influence how siblings approach the task of teaching and the kinds of strategies that they may employ (Strauss & Ziv, 2004). In fact, we know that 5-year-olds employ more verbal
instruction than younger children who are more likely to rely on physical demonstrations, whereas by age 7, children are more contingent teachers and show sensitivity to the learner’s skill (Klein et al., 2002; Koester & Johnson, 1984; Maynard, 2002; Perez-Granados & Callanan, 1997). These findings suggest that children’s teaching strategies are closely linked to their social cognitive skills (Strauss et al., 2002).

As Cicirelli (1973) reported, older school-aged teachers may be more powerful and competent models than younger teachers. In fact, in the present study, secondborn learners were more accepting of instruction from older teachers suggesting that the higher status and power of older sibling teachers (versus younger firstborn teachers) may create a context in which learners were more willing to accept direction (Furman & Buhrmester, 1985; Vandell, Minnett, & Santrock, 1987). Interestingly, when the teacher was a girl rather than a boy, learners were more likely to respond in neutral ways, suggesting that they were more likely to passively accept instruction offered by sisters than by brothers. Given the number of gender analyses conducted, this single effect must be treated cautiously, and in fact, the lack of gender findings in the present study is generally consistent with recent literature (Azmitia & Hesser, 1993; Maynard, 2002).

As predicted, younger learners elicited more extensive instruction from teachers than older learners (after controlling for teacher age). Specifically, teachers provided more scaffolding, corrective feedback, and arranged materials more with younger learners, while the use of physical demonstrations approached significance. Younger learners were more likely to respond positively to instruction and also to ask questions or for clarification, as expected. These patterns of teaching and learning indicate that sibling teachers may be sensitive to the developmental level of their younger brother or sister and were able to adjust their instructional strategies accordingly. Perhaps, when learners are quite young (e.g. age 3), teachers understand the need to employ more explicit and concrete strategies such as corrective feedback and arranging materials. By engaging in these behaviours, the teacher may facilitate learning by structuring and supporting the situation (Rogoff, 1990). Interestingly, teachers employed more frequent scaffolding strategies with younger siblings; perhaps by employing hints, clues, and guidance they were helping learners to build links with new information in supportive and constructive ways (Rogoff, 1990). Perez-Granados and Callanan (1997) also reported 7-year-old sibling teachers provided more hints to younger than older secondborn learners, thus our findings support the literature. In sum, the teaching context was a highly social and collaborative effort with the teacher providing extensive instruction while giving the learner responsibility for completing the tasks (LeBlanc & Bearison, 2004; Recchia, Howe, & Alexander, 2006).

The Effects of Task Difficulty on Teaching and Learning

The hypothesis that sibling teachers would use more overall strategies during the hard than the easy designs was supported, in particular physical demonstrations, corrective feedback, and scaffolding strategies. There was no difference in the arrangement of materials in the two tasks, but a trend suggested that teachers were more likely to employ explanation/description during the easy tasks. Anecdotal evidence suggested that even after teachers introduced the game that learners were sometimes still unsure of what they were expected to
do during the easy tasks; therefore the teacher engaged in further explanation/description. Whereas by the time the hard tasks were introduced, the learner understood the concept of the game and less teacher explanation was required. Yet, when the demands of the task became more challenging with the addition of designs including half red and half white blocks, teachers stepped in to provide more guidance, as noted above.

Overall, learners also responded to task difficulty by being more active in the hard than easy tasks. Although this may reflect the greater number of strategies that teachers used during the hard tasks, the selective increase in certain types of learner responses was interesting. Specifically, learners often accepted the direction of their older sibling in positive ways, but also refused their help during the hard tasks. We speculate that the increase in refusals may be due to the learner’s desire to complete the designs independently without teacher interference or guidance and may also reflect attempts to regulate the teacher’s behaviour (LeBlanc & Bearison, 2004). In such a scenario, learners would be demonstrating both independence and responsibility for their own learning (Rogoff, 1998). Certainly, these speculations require further study.

In sum, our study of sibling teaching and learning provides some novel and interesting findings suggesting that this is a particularly rich context in which to study young children’s social cognitive skills. Moreover, our findings illuminate ways in which youngsters may influence one another’s development through their interactions. The often patient approach of older siblings to teaching and their use of developmentally appropriate strategies to take account of the age, and thus the ability of the learner, was striking in this particular experimental context. Yet, it was clear that learners were not merely passive recipients of learning but were frequently active and generally positive partners. They asked questions that would lead to greater understanding and success in the task and positively accepted the teacher’s moves and instructions. The observed dynamics were quite remarkable within the context of a relationship that is frequently highly affectively laden and highlights the potential for the kinds of enduring influence that siblings may have on one another’s development. Future research should address the question of whether these patterns would be evident during on-going sibling interaction at home when children are either less closely supervised by adults or, alternatively, when parents actively encourage and facilitate opportunities for sibling teaching.

CONCLUSIONS

Certainly there are a number of limitations to the present study including the middle class and small sample. Although the sample size was small, power was generally sufficient to reveal the expected pattern of effects. Nevertheless, caution is warranted in generalizing our findings to other populations and some small effects may not have been detected. Teaching role and birth order were also confounded and recent work suggests that birth order may influence children’s approach to teaching. Specifically, Recchia et al. (2006) reported that firstborn teachers (independent of age) employed a more collaborative teaching style than second-born teachers and were more likely to take account of the second-born learner’s abilities, errors, and to allow them to problem-solve and correct their errors. Although birth order and the teaching role were not counterbalanced in the present study, our findings are in line with the literature suggesting that
firstborn siblings may be effective teachers, perhaps due to their long and shared history of interaction. Finally, the order of presentation of the easy and hard tasks was not counterbalanced, because we did not wish to discourage the learner’s attempts to solve the more difficult tasks. It is possible that this influenced the children’s behaviour and requires further investigation.

In conclusion, the rich nature of the data provided interesting findings that support and extend the literature. Notably, our findings highlight the shared understanding that is required by the teacher and learner for successful teaching to occur (LeBlanc & Bearison, 2004). The detailed investigation of both the teacher and learner contrasts with a number of studies focusing mainly on the teacher (e.g. Klein, Feldman, & Zarur, 2002) and highlights the complementary nature of dyadic sibling interaction in this context. Additionally, we gain further insight into interactional patterns between siblings who know each other very well and who presumably use this knowledge to best advantage during teaching, in contrast to peers who may be less informed about one another (Parke & Buriel, 1998).

The findings also have a number of implications. Siblings are typically the first children close in age that youngsters encounter. It may be that the skills siblings develop when interacting with each other may later transfer to other social interactions with peers in the day care or school environment, although the evidence for this is inconsistent (Dunn, 2002). Nevertheless, parents should encourage these kinds of activities, because they allow siblings opportunities to practice their social–cognitive and emotional skills and influence one another’s development in positive ways. In conclusion, our study may be a stepping stone to future research that should consider how sibling teaching may encourage the development of positive and diverse skills for both children and, therefore, strengthen sibling bonds.

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APPENDIX

Sibling Teacher and Learner Coding Scheme

<table>
<thead>
<tr>
<th>Type of teaching strategy</th>
<th>Definition and examples</th>
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<tbody>
<tr>
<td>Physical demonstrations</td>
<td>Teacher physically shows learner how to place a block (e.g. places block(s) on card while learner watches).</td>
</tr>
<tr>
<td>Corrective feedback</td>
<td>Teacher corrects learner or provides praise indicating success/failure: (a) verbal (e.g. ‘No that’s not right’; ‘Well done! You got it!’), or (b) physical (e.g. teacher removes block incorrectly placed or points to correct block).</td>
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</tbody>
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Explanations/descriptions
Teacher explains game, describes blocks or card designs (e.g. "You have four blocks. They all have two red sides, two white sides and two sides with half and half").

Scaffolding strategies
Teacher provides suggestions or statements to prompt, guide, or help learner to do the task or make the next response (e.g. ‘Put the block on the other side’, ‘Look closely how it is on the card’, ‘Now do number eight’).

Arrangement of materials
Teacher physically arranges space/materials to make task easier for learner (e.g. brings card closer so learner can see design better, removes completed cards).

Learner behaviour
Definition and examples
Neutral accept
Learner actively watches teacher and accepts suggestions without verbal agreement or protest.
Active accept
Learner actively accepts teacher’s direction: (a) verbal (e.g. ‘yes, I understand’) or (b) physical (teacher adjusts placement of block and learner nods in agreement).
Active refusal
Learner actively refuses teacher’s suggestion: (a) verbal (e.g. ‘No, I don’t need your help!’) or (b) physical (e.g., pushing teacher’s hand aside).
Questions/clarifications
Learner asks for clarifications, seeks information or poses questions (e.g. ‘How do you do it?’, ‘What did you say?’).

REFERENCES


