



HAL
open science

High and low theory-of-mind scores of child-teachers: Which teaching strategies are efficient?

Leïla Bensalah, Stéphanie Caillies

► **To cite this version:**

Leïla Bensalah, Stéphanie Caillies. High and low theory-of-mind scores of child-teachers: Which teaching strategies are efficient?. *Cognitive Development*, 2020, 55, pp.100920. 10.1016/j.cogdev.2020.100920 . hal-03014048

HAL Id: hal-03014048

<https://hal.science/hal-03014048>

Submitted on 18 Jul 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

High and low theory-of-mind scores of child-teachers:

Which teaching strategies are efficient?

Leïla Bensalah, Stéphanie Caillies

University of Reims Champagne-Ardenne, C2S, EA 6291, 57 rue Pierre Taittinger,

51096 Reims, France

Wordcount: 7 492

Display items: 1 figure, 3 tables

Address correspondence to:

Leila Bensalah

C2S (EA 6291) – Université de Reims Champagne-Ardenne

57 rue Pierre Taittinger

51096 Reims, France

Phone: +33 3 26 91 37 02

Fax: +33 3 26 91 37 19

E-mail: leila.bensalah@univ-reims.fr

Stéphanie Caillies

E-mail: stephanie.caillies@univ-reims.fr

1 High and low theory-of-mind scores of child-teachers:

2 Which teaching strategies are efficient?

3 Abstract

4 While some authors investigating teaching in children suggest that teaching strategies are
5 more efficient in terms of learners' performances when child-teachers have achieved false-
6 belief understanding, others argue that even before they reach this point, children already use
7 efficient teaching strategies. To test these two hypotheses, we investigated the efficiency of
8 teaching strategies adopted by child-teachers who had either succeeded or failed on false-
9 belief (FB) tasks. A total of 26 5-year-old child-teachers were divided into two groups
10 according to their FB score (FB+ vs. FB-) and paired with 3-year-old learners who had not yet
11 acquired FB understanding. The learners were asked to perform a jigsaw task. Teaching
12 strategies displayed by the child-teachers included conveying information, giving verbal
13 explanations coupled with demonstrations, and engaging in nonverbal
14 demonstration/modelling. FB understanding was measured with classic FB tasks, and a
15 composite verbal score was calculated as a control measure. Results showed that child-
16 teachers who successfully performed the FB tasks above all used conveying information and
17 verbal explanation coupled with demonstrations strategies. However, correlations revealed
18 that conveying information, which was more frequently used in the FB+ group, was
19 significantly and positively correlated with learners' performances in both groups. This
20 finding lessens the impact of child-teachers' FB understanding in the tutoring situation.

21 **Keywords:** Teaching; Tutoring; Theory of mind; False belief; Preschoolers

23 1. Introduction

24 Teaching is consensually viewed as a critical condition for promoting learning (e.g.,
25 Bidell, 1988; Bruner, 1966; Csibra & Gergely, 2009; LeBlanc & Bearison, 2004; Strauss,

1 Calero, & Sigman, 2014; Tudge & Scrimsher, 2003; Vygotsky, 1978). It requires learners'
2 mental states (e.g., ignorance and false belief) to be continually taken into account (Kruger &
3 Tomasello, 1996; Strauss & Ziv, 2012), so that teaching strategies can be adapted to the
4 learners' needs (Bensalah & Stefaniak, 2014). The ability to take learners' mental states such
5 as ignorance or false belief into account refers to *theory of mind* (ToM), which is defined as
6 the ability to explicitly attribute mental states to self and others (Premack & Woodruff, 1978).
7 This ability is usually assessed via the well-known *false-belief (FB) tasks* (e.g., Bartsch &
8 Wellman, 1989; Perner, Leekam, & Wimmer, 1987; Wimmer & Perner, 1983) that probe
9 one's own or others' false-belief understanding and, for some of them, ignorance
10 understanding (Bartsch & Wellman, 1989). Accordingly, when children successfully perform
11 a battery of FB tasks, we can assume that they understand both ignorance and FB, and would
12 thus be able to identify the mental states of learners in a tutoring situation and adjust their
13 teaching strategies accordingly, thereby improving the learners' performances. However,
14 studies in young children (e.g., Scott & Baillargeon, 2014; Warneken & Tomasello, 2013)
15 have suggested that even before they are able to successfully complete these tasks, child-
16 teachers already use efficient teaching strategies, in terms of learners' performances, thus
17 generating controversy regarding the impact of ToM on teaching by children.

18 Our goal was to investigate how FB understanding influences child-teachers' use of
19 teaching strategies and child-learners' performances. To the best of our knowledge, no study
20 had previously probed the efficiency of the teaching strategies exhibited by child-teachers
21 who can successfully perform FB tasks, and none had examined the efficiency of these
22 strategies when child-teachers are unable to perform such tasks. This research is important for
23 several reasons. First, it could shed light on the impact of FB understanding, defined as a high
24 level of understanding of mental states, including ignorance, on children's teaching abilities,
25 and more generally it could contribute to our understanding of teaching strategy development

1 in children. Second, it could be informative for teachers. Teachers can use tutoring between
2 pupils to efficiently complement their teaching in the classroom, and train pupils to adopt
3 more efficient teaching strategies to help learners succeed. If teachers do not realize that their
4 pupils are using inefficient teaching strategies, they may eventually abandon tutoring practice
5 in the classroom. Finally, knowing which teaching strategies are efficient could inform adult-
6 teachers' practices.

7 In tutoring between children, the issue of teaching strategy efficiency raises the
8 question of how these strategies vary according to whether child-teachers can successfully
9 perform FB tasks. Currently, what little findings available are mixed. We therefore set out to
10 document the teaching strategies employed by child-teachers and their impact on learners'
11 performances during the acquisition of FB understanding.

12 *1.1. How do child-teachers' teaching strategies change with FB understanding?*

13 Despite substantial literature on tutoring between children (e.g., Bensalah & Berzin,
14 2009; Cohen, Kulik, & Kulik, 1982; Hartup, 1983) and ToM in preschoolers (e.g., Astington,
15 2003; Miller, 2000; Wellman et al., 2011), and a growing interest in the impact of ToM on
16 how children approach teaching (e.g., Bensalah, Olivier, & Stefaniak, 2012; Ziv & Frye,
17 2004; Ziv, Solomon, Strauss, & Frye, 2016), few studies have probed how child-teachers'
18 strategy use changes as a result of acquiring FB. Moreover, while a qualitative analysis by
19 Bensalah (2011) showed that child-teachers gradually become more interested in learners'
20 needs, other studies (Davis-Unger & Carlson, 2008; Strauss et al., 2002; Wood, Wood,
21 Ainsworth, & O'Malley, 1995; Ziv et al., 2016) have reported mixed findings concerning the
22 three main types of teaching strategies probed, namely conveying information (e.g., verbal
23 explanations, repetitions, rule explanations, instructions), giving verbal explanations coupled
24 with demonstrations (e.g., showing learners how to perform the task based on verbal
25 explanations), and engaging in nonverbal demonstration/modelling (e.g., simply showing

1 learners how to perform the task). Several studies have demonstrated that once children have
2 understood FB at around 4-5 years and are enrolled in a teacher role, they display more
3 *conveying information* strategies than 3-year-olds who cannot yet successfully perform FB
4 tasks, providing more verbal explanations and repetitions (i.e., reminding learners of tools and
5 instructions; Davis-Unger & Carlson, 2008; Strauss et al., 2002), and more rule explanations
6 (Ziv, et al., 2016). Conversely, Ziv et al. (2016)'s study showed that 3- to 4-year-olds provide
7 instructions more often than 5-year-olds do, and another study found no significant difference
8 between these two age groups on verbal instruction use (e.g., "Get a bigger one"; Wood et al.,
9 1995). Mixed results regarding *verbal explanations coupled with demonstrations* (i.e.,
10 explicitly showing learners how to perform the task, and doing it instead of them) have also
11 been reported. Davis-Unger et al. (2008) found that 3-year-olds who failed on FB tasks
12 displayed less verbal explanations coupled with demonstrations strategies than 5-year-olds
13 who succeeded on FB tasks, whereas Ziv et al. (2016) reported that 5-year-olds made less use
14 of demonstrations with verbalizations than 3-year-olds. Here again, two other studies showed
15 that this strategy use remained stable during this period (Strauss et al., 2002; Wood et al.,
16 1995). Regarding nonverbal demonstration, Strauss et al. (2002) and Ziv et al. (2016) also
17 found that 5-year-olds with FB understanding made less use of nonverbal
18 demonstration/modelling (i.e., when a teacher actively shows a learner what to do, carrying
19 out the task without any verbalizations) than 3-year-olds. Once again, however, Wood et al.
20 found no such significant difference between these two age groups (Wood et al., 1995). The
21 mixed findings of these scant studies in this area are probably due to the fact that in every
22 case, the child-teachers were each associated with a same-age peer (3- vs. 5-year-old dyads),
23 hence a high variability in the teaching strategies collected. At least two other methodological
24 flaws limited these studies' scope: either the effects of the child-teachers' FB understanding
25 and age were probed concurrently (Davis-Unger & Carlson, 2008; Strauss et al., 2002; Ziv et

1 al., 2016), or only the age effect was examined, but it was interpreted in terms of ToM ability
2 (Wood et al., 1995). It was therefore impossible to disentangle the specific effect of
3 FB/ignorance understanding on the development of teaching strategies.

4 To shed light on these mixed results concerning possible changes in teaching strategies
5 as a result of improvements in FB understanding, we investigated the three above-mentioned
6 strategies: conveying information, giving verbal explanations coupled with demonstrations,
7 and engaging in nonverbal demonstration/modelling. To address the three methodological
8 flaws, we studied child-teachers at 5 years, as this is the age when children start to
9 successfully perform FB tasks, but it is still possible to find some with low FB task scores. To
10 reduce dyadic variability, we paired these 5-year-old teachers with 3-year-old learners who
11 failed on FB tasks.

1.2. Efficiency of teaching strategies adopted by child-teachers with or without FB understanding

13 While authors have assessed gains resulting from tutoring among children (e.g.,
14 Bensalah & Berzin, 2009), they have so far neglected the issue of teaching strategy efficiency
15 in terms of learners' performances, depending on whether the child-teacher has understood
16 FB. Several findings suggest that more efficient teaching strategies are adopted after FB
17 acquisition, but the question of strategy efficiency in child-teachers who cannot yet
18 successfully perform FB tasks has so far been tackled separately. Studies investigating
19 teaching strategies after FB acquisition have highlighted correlations between the FB scores
20 of 5-year-old child-teachers and both verbal explanation strategies (Strauss et al., 2002) and
21 the number of different teaching strategies used (Davis-Unger & Carlson, 2008). Given the
22 methodological limitations mentioned earlier, these sparse findings need to be further
23 documented, focusing on learners' performance.

24 Researchers have yet to explore the question of teaching strategy efficiency before
25 children have acquired mental states related to teaching, as measured with the usual FB tasks,

1 including ignorance questions. Although the findings described above suggest that children
2 without FB understanding do not adopt efficient teaching strategies, there is growing evidence
3 that this is not the case. Studies have shown that, from an early age, children experiment with
4 strategies, especially conveying information to unknowledgeable persons, and are also able to
5 attribute false belief to others in nonverbal implicit FB tasks, suggesting that their strategies
6 can be efficient. In line with authors arguing in favor of the early emergence of teaching
7 (Koster & Kartner, 2019; Strauss et al., 2002), studies examining the teaching strategies of
8 young children who are able to attribute FB to others in implicit FB tasks have shown that
9 children as young as 12 months are able to convey information to an unknowledgeable
10 person, pointing to the location of an object in order to inform an unknowing adult
11 (Liszkowski, Carpenter, Striano, & Tomasello, 2006). At 2 years, toddlers more often supply
12 information to a parent who does not know where a toy is than to a parent who does know
13 (O'Neill, 1996), and can spontaneously hand over an out-of-reach object to an adult
14 (Warneken & Tomasello, 2013). These findings are consistent with those yielded by an
15 ecological design (Verba, 1994), which showed that toddlers aged 18-24 months who have
16 mastered a specific activity spontaneously facilitate the activity of a child who has not yet
17 done so (e.g., handing the correct object to the partner, taking away an object that is hindering
18 the partner's activity). This early ability to convey information to an unknowledgeable person
19 continues to develop in preschoolers, who also start to display demonstration strategies.
20 Children aged 3; 6 years have been found to convey more explicit information about what
21 should or should not be done in a task than their younger counterparts aged 2;6 or 3 years do
22 (Ashley & Tomasello, 1998). They also more actively show learners how to perform the task.
23 These findings are supported in the recent literature on infants. For although the issue is still
24 subject to some debate (e.g., Allen, 2015), there is growing evidence that infants are able to
25 implicitly attribute FBs to others, as assessed with nonverbal FB tasks, before they can

1 successfully perform the usual explicit FB tasks (Baillargeon, Buttelmann, & Southgate,
2 2018; Scott & Baillargeon, 2014). As early as 15 months, infants can predict the action of an
3 actor on the basis of the latter's FB (Onishi & Baillargeon, 2005), and at 18 months, they
4 understand that an actor's FB can serve as the basis for their own helping behavior
5 (Buttelmann, Carpenter, & Tomasello, 2009) or can be corrected by appropriate
6 communication involving words and gestures (Song, Onishi, Baillargeon, & Fisher, 2008).
7 Toddlers aged 18-24 months can spontaneously inform an adult who falsely believes that a
8 toy is in a particular place (Knudsen & Liszkowski, 2012). During their third year of life,
9 children seem able to understand others' FBs, as measured both with implicit FB tasks (He,
10 Bolz, & Baillargeon, 2011) and with an adapted version of a classic verbal FB task (Rubio-
11 Fernandez & Geurts, 2013). Taken together, these findings show that before 3 years, children
12 can already convey tuned information to an unknowledgeable person and exhibit an implicit
13 FB understanding. This suggests that after 3 years, both abilities continue to improve,
14 becoming more explicit, and therefore making the children's teaching strategies more
15 efficient.

16 To further document previous findings (Davis-Unger & Carlson, 2008; Strauss et al.,
17 2002), we examined the effect of child-teachers' FB task success (including on ignorance
18 questions) on learners' performances. More specifically, to address the question of the
19 efficiency of teaching strategies implemented by child-teachers with or without successful FB
20 task performances, we explored whether teaching strategies can be identified as efficient in
21 terms of learners' performances. More specifically, we used learners' performances during the
22 tutoring session to gauge the immediate effect of teaching strategies, and scrutinized their
23 performances on a posttest in which they were asked to perform the task on their own.

24 First, to further extend the scant literature on the implications of FB and ignorance
25 understanding in a tutoring situation, we set out to shed light on previous mixed findings by

1 examining two groups of dyads in which 5-year-old child-teachers with either a low (FB-) or
2 a high (FB+) score on FB/ignorance tasks were each paired with a 3-year-old learner-child
3 without FB/ignorance understanding. We then looked at differences in teaching strategies
4 (conveying information, nonverbal demonstration/modelling, and verbal explanations coupled
5 with demonstrations) between the FB- and FB+ dyad groups. Second, we examined whether
6 learners performed better when they were associated with a child-teacher who had acquired
7 FB/ignorance understanding, rather than a child-teacher who had not. Third, we looked at
8 whether some teaching strategies were more closely linked to learners' performances in the
9 FB+ group than in the FB- group. Fourth and last, we controlled for the effect of the child-
10 teachers' verbal abilities.

11 **2. Method**

12 *2.1. Participants*

13 We recruited 58 French preschoolers from a middle-class district of Reims (France).
14 The majority of the children came from middle-class families. All their parents provided their
15 written informed consent, in accordance with the Declaration of Helsinki. Six children were
16 excluded, as they did not meet the matching criteria. The final sample therefore comprised 26
17 3-year-olds (12 girls, 14 boys; $M_{\text{age}} = 39$ months, range = 36-42 months) and 26 5-year-olds
18 (12 girls, 14 boys; $M_{\text{age}} = 60$ months, range = 57-63 months).

19 *2.2. Materials*

20 *Jigsaw task.* We chose a jigsaw that would elicit both information-telling and
21 demonstrations, in order to elicit a range of instructional strategies among the preschoolers
22 (Bensalah, 2011). The jigsaw, representing a clown, was made up of 12 blocks that fitted
23 together and were painted on one side.

24 *FB tasks.* We administered three FB tasks to participants: two unexpected-content
25 tasks (Band-Aid box task including an ignorance test question; Bartsch & Wellman, 1989; and

1 Candies task; Perner et al., 1987) and a change-of-location task (Wimmer & Perner, 1983).
2 French versions of all three had previously been used by Caillies and Le Sourn-Bissaoui
3 (2008). The maximum overall score was 9.

4 *Verbal tasks.* We administered three subtests drawn from the Wechsler Preschool and
5 Primary Scale of Intelligence (WPPSI-III; Wechsler, 2004) to establish a composite verbal
6 score (CVS). The Receptive Vocabulary subtest assessed participants' knowledge of the
7 names of objects that might be involved in the task, such as the parts of the jigsaw or its
8 colors. The Verbal Reasoning subtest assessed their ability to infer words from verbal cues
9 and thence their ability to reason from verbal information, such as that provided by learners
10 about performing a task. The Information subtest appraised academic and cultural acquisition,
11 and included questions about everyday life, such as the bodily characteristics featured in our
12 clown jigsaw task (e.g., "How many ears do you have?").

13 2.3. Procedure

14 First, all the participants were individually pretested by an experimenter to see
15 whether they could complete the jigsaw. Second, we randomly administered the three FB
16 tasks to all the children, in order to form two groups of teachers and make sure that none of
17 the 3-year-olds understood FB. Third, we administered the verbal tasks to the 5-year-olds.
18 Fourth, we randomly paired the 5-year-old child-teachers with same-sex 3-year-old child-
19 learners to obtain 12 dyads (i.e., seven girl dyads and five boy dyads) for the FBU+ group,
20 and 14 dyads (i.e., five girl dyads and nine boy dyads) for the FB- group, in order to
21 videotape a dyadic tutoring session.

22 *Pretesting the jigsaw task.* All the children were pretested with the jigsaw task. They
23 were shown the completed clown jigsaw by the experimenter, who turned it over so that they
24 could see it was only painted on one side. The experimenter then took the blocks apart and
25 jumbled them up. The children were given up to 5 minutes to put the jigsaw back together.

1 This period could be curtailed if the older children completed the jigsaw particularly quickly,
2 or if the younger children displayed a lack of interest in the task or showed signs of distress.
3 All the 5-year-old children successfully completed the jigsaw, correctly positioning all 12
4 blocks before the 5 minutes were up. In order to verify the stability of their performances (see
5 Verba, 1998), we asked them to do the jigsaw three more times. All the 5-year-olds
6 successfully performed these three trials and were therefore considered sufficiently expert to
7 take on the teacher's role, while the 3-year-old children, none of whom correctly positioned
8 more than six blocks, were deemed to be learners.

9 *FB tasks.* The three FB tasks were administered to all the children in random order. In
10 the change-of-location story, the lion figurine of the original test (Caillies & Le Sourn-
11 Bissaoui, 2008) was replaced with a dog figurine, but the rest of the task was the same. The
12 experimenter explained that Pierre has a plastic dog that he puts away in a box with a blue top
13 before going out. While he is out, his sister enters the room, takes the dog out and places it in
14 a box with a green top. Pierre comes back into the room and wants to play with his plastic
15 dog. We asked the children two test questions, followed by two control questions. The test
16 questions were: "Where will Pierre look for his plastic dog?" (Q1) and "Why will Pierre look
17 for his dog in (child's answer)?" (Q2). The control questions were: "Where did Pierre put his
18 dog before going out?" and "Where is the dog really?" Each test question was scored 1 point,
19 with a maximum score of 2, providing the control questions were also answered correctly.

20 In the Band-Aid box task, the experimenter showed the children two boxes, one plain,
21 the other with a picture of Band-Aids on it. She asked the children to indicate the box
22 containing Band-Aids, and most of the children pointed to the labeled box. She then offered
23 to open both boxes, and they established that the labeled box was empty, whereas the plain
24 box contained Band-Aids. She closed the two boxes. The experimenter then produced two

1 dolls, named Camille and Hugo, that both needed Band-Aids because they had cut
2 themselves, but did not know what was in the boxes.

3 Next, she asked four test questions. A prediction question (Q1: “Where will Camille
4 look for the Band-Aids first?”) was followed by a control question (“Will she find the Band-
5 Aids?”). The prediction question was scored 1 point, providing the control question was
6 answered correctly. Then came an explanatory test question (Q2: “Why should Hugo look in
7 this box [the box containing Band-Aids]?”), an ignorance test question (Q3: “Does Hugo
8 know where the Band-Aids are?”), and an explanatory test question (Q4: “What does Hugo
9 believe?”). These three questions were followed by a control question about the objects’
10 location: “Where are the Band-Aids?” Each correct answer to a test question was scored 1,
11 providing the children had correctly answered the control questions, with a maximum score of
12 4.

13 In the Candies task, the children were shown the contents of two boxes. One had a
14 picture of sweets on it but contained a pencil, while the other one was plain but contained
15 sweets. We asked the children a prediction test question about the time when they did not yet
16 know what the boxes contained (Q1: “What did you think the box contained before you saw
17 inside it?”). We then asked a prediction test question about a classmate who did not know
18 about the boxes’ contents (Q2: “What would a classmate expect to find in the boxes?”). This
19 was followed by an explanation test question (Q3: “Why would s/he think that there was
20 (previous response to Q2) in the box?”). The final question was a control question (“What is
21 in the box?”). Correct answers to the three test questions were each scored 1, providing the
22 control question was correctly answered, with a maximum score of 3.

23 Twenty-six 5-year-olds were allocated to one or other of the groups according to their
24 FB scores. Those who scored 6-9 points on the three FB tests were included in the FB+ group
25 (12 dyads), and those who scored 0-3 joined the FB- group (14 dyads). None of the 3-year-

1 olds scored more than 2 and were all randomly assigned to one or other of the dyad groups.
2 Six 5-year-olds scored 4 or 5 points and were excluded from the sample.

3 *Verbal tasks.* We administered the three different subtests, always in the same order, to
4 the 5-year-old children. The Information standard subscore ranged from 0 to 15, the
5 Receptive Vocabulary standard subscore from 0 to 15, and the Verbal Reasoning standard
6 subscore from 0 to 15. The maximum CVS ranged from 0 to 45.

7 *Tutoring session.* For each dyad, the 5-year-old child-teacher and 3-year-old learner
8 were placed side by side in front of the completed clown jigsaw so that the learner could see
9 the goal to be attained. The experimenter then said that one of them (name of the older child)
10 knew how to put the clown together and could teach the other one (name of the younger
11 child). The adult took the blocks apart and jumbled them up. The session was videotaped and
12 lasted as long as it took to complete the jigsaw. The duration of the sessions ranged from 80 to
13 364 seconds. The learner was then asked to do the jigsaw unaided in an immediate posttest.

14 *2.4. Measures*

15 *2.4.1. Analysis of teaching strategies*

16 The teaching strategies displayed by the child-teachers were divided into the three
17 categories identified in the Introduction: conveying information, engaging in nonverbal
18 demonstration/modelling, and giving verbal explanations coupled with demonstrations. These
19 three categories were intended to correspond to three forms of teaching displayed by child-
20 teachers. The *conveying information* strategy was identified when the learner states were
21 consistently monitored from a distance, and included both verbal and nonverbal modes. The
22 *nonverbal demonstration/modelling* strategy involved showing the learner how to do the
23 jigsaw by actually putting the blocks together. The intermediary category (*verbal explanations*
24 *coupled with demonstrations*) was a combination of the two preceding ones. These strategies,
25 which took the form of actions and verbalizations, were only taken into account if the learner

1 was watching the child-teacher at the time. *Conveying information* strategies were defined as
2 teaching behaviors that allowed the learner's activity to be monitored or followed from a
3 distance by the child-teacher (i.e., the latter did not actually do the jigsaw). This strategy
4 included monitoring the learner by *enrolment*, where the teacher attempted to direct the
5 learner's attention to the task (e.g., "Can we begin?"), *responses* to the learner's questions
6 about performing the task (e.g., "Where do I put this block?" "It's the hand"), *evaluation of*
7 the learner's performance (e.g., "This block isn't in the right place"), *offers of help* to the
8 learner (e.g., "Do you want me to help you?"), *verbal guidance* (e.g., "You have to turn the
9 block round first"), *nonverbal guidance* of the learner's activity (e.g., pointing to the place
10 where a block picked up by the learner should go), and following the learner by *observing his*
11 *or her activity* (e.g., observing the learner's handling of the blocks). *Nonverbal*
12 *demonstration/modelling* strategies exclusively comprised the child-teacher's actions (e.g.,
13 picking up and positioning the blocks to construct the jigsaw). *Verbal explanations coupled*
14 *with demonstrations* also included the child-teacher's actions, but this time combined with
15 verbalizations (e.g., "Look at this block, it belongs here", or "Not this block, I'll show you").
16 As task duration and the number of behaviors varied across the dyads, we calculated the
17 amount of time taken up by each behavior in relation to the total duration of each dyad's
18 tutoring session. As in Ziv et al. (2016), in order to check that the behaviors had been
19 accurately identified in terms of teaching strategies, two judges coded five dyads' behaviors
20 (20% of videotapes): one Master's student who was trained to code behaviors according to the
21 categories, and one of the authors, who had not participated in the data collection. The coding
22 was based on transcripts of the videotapes. In the cases where a doubt persisted, the coders
23 consulted the video, and when two coders disagreed, a discussion generally led to agreement.
24 *2.4.2. Learners' performances*

1 Learners' performances were measured in terms of the number (0-12) of blocks that
2 were correctly positioned during the tutoring session, in which learners were assisted by their
3 child-teacher, and then in a posttest administered after the tutoring session, in which learners
4 were given 5 minutes to do the clown jigsaw unaided, unless they displayed a lack of interest
5 in the task or showed signs of distress before this time had elapsed.

6 **3. Results**

7 *3.1. Group differences and reliability*

8 Preliminary analyses did not reveal any significant difference between the two FB
9 groups on any of the following variables: teacher age ($M_{FB-} = 58.71$ months, $M_{FB+} = 60$
10 months), $t(24) = 1.19$, *ns*, learner age ($M_{FB-} = 38.93$ months, $M_{FB+} = 38.83$ months), $t(24) = -$
11 $.12$, *ns*, jigsaw pretest performances of the learners (all FB-), who were paired with either FB-
12 or FB+ teachers ($M_{FB-} = 1.93$, $M_{FB+} = 2.17$), $t(24) = .33$, *ns*, jigsaw completion times (in
13 seconds) ($M_{FB-} = 200.29$, $M_{FB+} = 185.17$), $t(24) = -0.71$, *ns*, or length (in seconds) of the three
14 jigsaw completion trials ($M_{FB-} = 381.71$, $M_{FB+} = 349.92$), $t(24) = -.93$, *ns*. Furthermore, there
15 was no significant difference between the dyads on either mean videotape duration (172.79 s
16 for the FB- group vs. 215.83 s for the FB+ group), $t(24) = 1.53$, *ns* or teacher CVS ($M_{FB-} =$
17 31.57 , $M_{FB+} = 34.17$), $t(24) = 1.34$, $p = .19$, 95% CI [-2.12, -9.95]. To check that the behaviors
18 had been accurately identified in terms of teaching strategies, we used Cohen's kappa to
19 measure interrater reliability. For teaching strategies, overall agreement was 98.09% (range:
20 94.59-100%), yielding a kappa of .97.

21 *3.2. Effects of FB success on teaching strategies*

22 To explore how teaching strategies differed between the FB- and FB+ dyad groups, we
23 conducted three analyses of covariance (ANCOVAs) on the proportion of time taken up by
24 each type of teaching strategy used by the child-teachers (i.e., conveying information,

1 nonverbal demonstration/modelling, and verbal explanations coupled with demonstrations) as
2 a function of FB group, with CVS as the covariate. Results (see Fig. 1) revealed significantly
3 greater use of conveying information, $M_{FB-} = 33.89$, $M_{FB+} = 62.96$, $F(1, 23) = 6.80$, $p < .02$,
4 and verbal strategy coupled with demonstrations and $M_{FB-} = 1.17$, $M_{FB+} = 13.59$, $F(1, 23) =$
5 11.99 , $p < .001$, with FB task success.

6 Insert Figure 1 about here

7 *3.3. Effects of child-teachers' FB success on learners' performances*

8 To further document previous findings (Strauss et al., 2002) and examine the effect of
9 child-teachers' FB on learners' performances, we conducted an ANOVA on the mean numbers
10 of blocks correctly positioned by the learners during the tutoring session and at the posttest,
11 and an ANCOVA with CVS as the covariate. As illustrated in Table 1, results revealed
12 significant main effects of both FB group, $F(1, 24) = 8.31$, $p = .01$, and session (i.e., tutoring
13 session or posttest), $F(1, 24) = 7.60$, $p < .01$, but no significant interaction, $F(1, 24) = 0.91$,
14 *ns*. However, when CVS was introduced as a covariate, only the FB group effect remained
15 significant, $F(1, 23) = 5.97$, $p < .02$. These results supported previous findings.

16 Insert Table 1 about here

17 *3.4. Relationship between teaching strategies and learners' performances as a function of FB* 18 *group*

19 To test the prediction that teaching strategies would be more efficient in the FB+ dyad group
20 than in the FB- dyad group, we calculated Pearson's correlation coefficients between each
21 type of teaching strategy and learners' performances as a function of FB dyad group. Results
22 (set out in Table 2) showed that when teachers scored highly on the FB tasks, their use of
23 conveying information strategies was positively and significantly correlated with learners'
24 tutoring session performances, while their use of verbal explanations coupled with
25 demonstrations strategies was negatively and significantly correlated with learners' tutoring

1 session performances. These results remained significant when language (CVS) was kept
2 constant (Table 3). When teachers scored poorly on the FB tasks, their use of conveying
3 information strategies was positively and significantly correlated with learners' performances,
4 not only during the tutoring session like the FB+ teachers, but also at the posttest. These
5 results remained significant when language (CVS) was kept constant. Moreover, results
6 revealed that for FB- teachers, verbal explanations coupled with demonstrations strategies
7 were not significantly linked to learners' performances, but when CVS was kept constant, this
8 link was positively and significantly correlated with learners' tutoring session performances.
9 These results suggest that whatever the child-teachers' FB level, their teaching strategies were
10 efficient enough for learners to perform well.

11

12 Insert Table 2 about here

13 Insert Table 3 about here

14

15 **4. Discussion**

16 We conducted a novel investigation into the impact of FB/ignorance understanding, as
17 measured by the usual tasks, on child-teachers in a tutoring situation, and specifically on their
18 use of efficient teaching strategies. Before tackling this issue, we documented two points to
19 clarify previous sparse but mixed literature findings and address methodological limitations of
20 previous studies.

21 First, in order to probe how teaching strategies differed according to FB task success,
22 we compared FB- and FB+ dyad groups on the use of three types of strategies. In line with
23 Davis-Unger and Carlson (2008)'s, Strauss et al. (2002)'s and Ziv et al. (2016)'s findings, our
24 results showed that FB+ child-teachers made more use of conveying information and verbal
25 explanations coupled with demonstrations strategies than FB- child-teachers. As in Wood et

1 al. (1995)'s study, however, the two FB groups did not differ significantly on
2 demonstration/modelling strategy use. Our results showed that child-teachers with FB or
3 ignorance understanding spend more time applying teaching strategies than FB- child-
4 teachers did, and each strategy was adapted to specific teaching sequences (Davis-Unger &
5 Carlson, 2008). For instance, conveying information allowed the FB+ child-teachers in our
6 study to guide the learners from a distance and facilitate their handling of the blocks to
7 construct the jigsaw. Giving verbal explanations coupled with demonstrations provided an
8 alternative to the other types of strategies when, for instance, conveying information proved
9 to be inadequate. Once the learners had begun to grasp how to construct the jigsaw, the child-
10 teachers could go back to using the conveying information strategies, as they were now better
11 adapted to the learners' needs. Moreover, while we cannot exclude the possibility that
12 demonstration/modelling was adapted to learners' needs, the fact that the two groups did not
13 differ significantly on this strategy, probably because of the low number of dyads in each
14 group, leads us to suggest that further studies would yield similar findings.

15 Second, to further document sparse findings (Davis-Unger & Carlson, 2008; Strauss et
16 al., 2002), we examined the effect of child-teachers' FB success on learners' performances
17 during the tutoring session and at the posttest. We found that the learners' performances
18 during the tutoring session and at posttest were better when their child-teachers had FB or
19 ignorance understanding, even when we controlled for CVS. This means that the impact of
20 child-teachers' FB or ignorance understanding can be both immediate and deferred, thus
21 doubly benefiting learners. The effect of child-teachers' FB task success on learners'
22 performances appeared to be substantial and instantaneous. Despite the small size of our
23 sample, we can cautiously suggest that these results generally confirm the impact of child-
24 teachers' FB or ignorance understanding both on their strategy use and on learners'
25 performances.

1 However, our main goal was to test alternative hypotheses in terms of teaching
2 strategies and learners' performances. First, we hypothesized that teaching strategies are more
3 efficient in terms of learners' performances when child-teachers have achieved FB
4 understanding. However, we also assumed that before they reach this point, children's
5 teaching strategies are already efficient in terms of learners' performances, as a result of their
6 prior experience of teaching strategies and their early implicit FB understanding.
7 Furthermore, our study was designed to establish which teaching strategies (conveying
8 information, verbal explanations coupled with demonstrations, or demonstration/modelling)
9 are most efficient, depending on the child-teachers' FB or ignorance understanding. Results
10 showed that FB+ child-teachers' use of conveying information was positively linked to
11 learners' performances during the tutoring session, while their use of verbal explanations
12 coupled with demonstrations strategies was negatively linked to learners' performances
13 during the tutoring session when CVS was kept constant. This result suggests that the use of
14 conveying information strategies by child-teachers with FB or ignorance understanding
15 allows learners both to benefit from the teachers' information or guidance, and to gain direct
16 experience of performing the task. The fact that the child-teachers' use of verbal explanations
17 coupled with demonstrations strategies was negatively linked to learners' performances
18 during the tutoring session is not surprising, given that when they used these strategies, they
19 placed the blocks instead of the learner, thereby reducing the learners' performance during the
20 tutoring session. Although this may be an interesting alternative strategy for child-teachers,
21 particularly when learners have obvious difficulty placing the blocks, overuse of this strategy
22 may be counterproductive. Bearing in mind our small sample size, we cautiously suggest that
23 conveying information strategies allow learners to quickly gain in efficiency, even during the
24 tutoring session. These results also complement a previous study (Bensalah, 2011) showing
25 that child-teachers with FB understanding are more interested in learners' needs, by

1 suggesting that the use of these distant teaching strategies (Davis-Unger & Carlson, 2008;
2 Strauss et al., 2002) indicates that child-teachers who have acquired FB and ignorance
3 understanding are able to continually detect them in learners. It would be interesting for future
4 studies to dissociate the FB and ignorance measures, in order to confirm this interpretation.
5 Nevertheless, our results showed that when the child-teachers had low FB scores, their
6 conveying information strategies were also positively correlated with learners' performances,
7 both during the tutoring session and at posttest, and that verbal explanations coupled with
8 demonstrations strategies were positively linked to learners' performances, but only during
9 the tutoring session, even when CVS was kept constant. This suggests that even when the
10 child-teachers failed on the FB tasks, the learners benefited from both types of strategies
11 during the tutoring session, and continued to benefit from conveying information strategies at
12 posttest. These results are consistent with the hypothesis whereby children acquire experience
13 of both conveying information (Ashley & Tomasello, 1998; Liskowski et al., 2006; O'Neill,
14 1996; Verba, 1994; Warneken & Tomasello, 2013) and reading other people's minds before
15 the age of 4-5 years (Baillargeon et al., 2018; Buttelmann et al., 2009; He et al., 2011;
16 Knudsen & Liskowski, 2012; Onishi & Baillargeon, 2005; Rubio-Fernandez & Geurts, 2013;
17 Scott & Baillargeon, 2014; Song et al., 2008). Nevertheless, the fact that verbal explanations
18 coupled with demonstrations strategies were positively linked to learners' performances in the
19 tutoring session when child-teachers had low FB scores, but negatively linked when child-
20 teachers had high FB scores, suggests that beyond a certain threshold, this type of strategy is
21 counterproductive. Further studies may support this view. These results therefore indicated
22 that whatever the child-teachers' FB scores, all the learners seemed to make maximum use of
23 the conveying information strategies to perform the task in hand, whether or not they were
24 accompanied by verbal explanations coupled with demonstrations strategies. This suggests
25 that this type of strategy is efficient at a particularly early age, presumably as a result of

1 children's observation and/or experience of conveying information strategies displayed by
2 parents, siblings, and relatives in everyday life. Above all, however, the fact that more
3 teaching strategies were positively linked to learners' performances, and that one type
4 influenced performances both during and after the tutoring session, even when the child-
5 teachers had a low FB score, lessens the importance of child-teachers' FB or ignorance
6 understanding. Here again, however, these explanations will have to be further documented,
7 owing to the small size of our sample.

8 To conclude, in addition to supporting and extending previous findings (Bensalah,
9 2011; Davis-Unger & Carlson, 2008; Strauss et al., 2002; Wood et al., 1995), the main
10 contribution of our study is to highlight specific links between teaching strategies and
11 learners' performances in a tutoring situation, depending on whether the child-teachers have
12 acquired FB and ignorance understanding. Consistent with a growing number of findings in
13 young children (e.g., Warneken & Tomasello, 2013) and infants (e.g., Baillargeon et al.,
14 2018), our study revealed an early, pre-FB/ignorance understanding ability to teach
15 efficiently, through the use of conveying information strategies and, to a less extent, verbal
16 explanations coupled with demonstrations. We also assessed the actual impact of acquiring
17 this ToM ability, highlighting a rapid but also limited gain in efficiency among learners as a
18 result of child-teachers using distant teaching strategies. These findings now need to be
19 confirmed by further studies with larger samples. Moreover, several other control measures
20 will have to be added in future studies, such as executive function assessments. In the
21 education field, our findings indicate that adult teachers should encourage pupils to engage in
22 tutoring situations, as these could be a good way of enabling learners to continue learning, at
23 least in this type of task, whatever the child-teachers' level of FB understanding. They
24 probably also tell us something about how child-teachers understand adult teachers in an

1 educational setting, and how adults can adapt their teaching practices to preschoolers, as
2 advocated by Strauss et al. (2012).

3 **References**

4 Allen, J. W. P. (2015). How to help: Can more active behavioral measures help transcend the
5 infant false-belief debate? *New Ideas in Psychology*, 39, 63-72.

6 <http://dx.doi.org/10.1016/j.newideapsych.2015.07.008>

7 Ashley, J., & Tomasello, M. (1998). Cooperative problem-solving and teaching in
8 preschoolers. *Social Development*, 7(2), 143-163. [http://dx.doi.org/10.1111/1467-
9 9507.00059](http://dx.doi.org/10.1111/1467-9507.00059)

10 Astington, J. (2003). Sometimes necessary, never sufficient: False belief understanding and
11 social competence. In B. Repacholi & V. Slaughter (Eds.), *Individual differences in
12 theory of mind* (pp. 13-38). New York: Psychology Press.

13 Baillargeon, R., Buttelmann, D., & Southgate, V. (2018). Invited commentary: Interpreting
14 failed replications of early false-belief findings: Methodological and theoretical
15 considerations. *Cognitive Development*, 46, 112-124.

16 <https://doi.org/10.1016/j.cogdev.2018.06.001>

17 Bartsch, K., & Wellman, H., M. (1989). Young children's attribution of action to beliefs and
18 desires. *Child Development*, 60, 946-964. <https://doi.org/10.2307/1131035>

19 Bensalah, L. (2011). The emergence of the teaching/learning process in preschoolers: Theory
20 of mind and age effect. *Early Child Development and Care*, 181, 505-516.

21 <https://doi.org/10.1080/03004430903507191>

22 Bensalah, L. & Berzin, C. (2009). Les bénéfices du tutorat entre enfants [The benefits of
23 tutoring between children]. *L'Orientation Scolaire et Professionnelle*, 38(3), 325-351.

24 <https://doi.org/10.4000/osp.1959>

- 1 Bensalah, L., Olivier, M., & Stefaniak, N. (2012). Acquisition of the concept of teaching and
2 its relationship with theory of mind in French 3- to 6-year olds. *Teaching and Teacher*
3 *Education*, 28, 303-311. <https://doi.org/10.1016/j.tate.2011.10.008>
- 4 Bensalah, L., & Stefaniak, N. (2014). Theory of mind, tutoring, and children teaching. In O.
5 N. Saracho (Ed.), *Contemporary perspectives on research in theory of mind in early*
6 *childhood education* (pp. 321–340). Charlotte, NC: Information Age Publishing.
- 7 Bidell, T. (1988). Vygotsky, Piaget and the dialectic of development. *Human Development*,
8 31, 329-345. <https://doi.org/10.1159/000276332>
- 9 Bruner, J. S. (1966). *Toward a theory of instruction*. Cambridge, MA: Harvard University
10 Press.
- 11 Buttelmann, D., Carpenter, M., & Tomasello, M. (2009). Eighteen-month-old infants show
12 false belief understanding in an active helping paradigm. *Cognition*, 112, 337–342.
13 <http://dx.doi.org/10.1016/j.cognition.2009.05.006>
- 14 Caillies, S., & Le Sourn-Bissaoui, S. (2008). Children’s understanding of idioms and theory
15 of mind development. *Developmental Science*, 11, 703-711.
16 <https://doi.org/10.1111/j.1467-7687.2008.00720.x>
- 17 Cohen, P., A., Kulik, J., A., & Kulik, C.-L., C. (1982). Educational outcomes of tutoring: A
18 meta-analysis of findings. *American Educational Research Journal*, 19(2), 237-248.
19 <https://doi.org/10.2307/1162567>
- 20 Csibra, G., & Gergely, G. (2009). Natural pedagogy. *Trends in Cognitive Sciences*, 13(4),
21 148-153. <https://doi.org/10.1016/j.tics.2009.01.005>
- 22 Davis-Unger, A., & Carlson, S. M. (2008). Development of teaching skills and relations to
23 theory of mind in preschoolers. *Journal of Cognition and Development*, 9, 26-45.
24 <https://doi.org/10.1080/15248370701836584>

- 1 Hartup, W. W. (1983). Peer relations. In E. M. Hetherington & P. H. Mussen (Eds.),
2 *Handbook of child psychology: Socialization, personality and social development* (pp.
3 103–196). New York: Wiley.
- 4 He, Z., Bolz, M., & Baillargeon, R. (2011). False-belief understanding in 2.5-year-olds:
5 Evidence from violation-of-expectation change-of-location and unexpected-contents
6 tasks. *Developmental Science*, *14*(2), 292–305. [http://dx.doi.org/10.1111/j.1467-](http://dx.doi.org/10.1111/j.1467-7687.2010.00980.x)
7 [7687.2010.00980.x](http://dx.doi.org/10.1111/j.1467-7687.2010.00980.x)
- 8 Knudsen, B., & Liszkowski, U. (2012). 18-month-olds predict specific action mistakes
9 through attribution of false belief, not ignorance, and intervene accordingly. *Infancy*,
10 *17*(6), 672–691. <http://dx.doi.org/10.1111/j.1532-7078.2011.00105.x>
- 11 Koster, M., & Kartner, J. (2019). Why do infants help? A simple action reveals a complex
12 phenomenon. *Developmental Review*, *51*, 175-187.
13 <https://doi.org/10.1016/j.dr.2018.11.004>
- 14 Kruger, A. C., & Tomasello, M. (1996). Cultural learning and learning culture. In D. Olson &
15 N. Torrance (Eds.), *The handbook of human development and education* (pp. 369-387).
16 Oxford: Blackwell.
- 17 LeBlanc, G., & Bearison, D. J. (2004). Teaching and learning as a bi-directional activity:
18 Investigating dyadic interactions between child teachers and child learners. *Cognitive*
19 *Development*, *19*, 499-515. <https://doi.org/10.1016/j.cogdev.2004.09.004>
- 20 Liszkowski, U., Carpenter, M., Striano, T., & Tomasello, M. (2006). 12- and 18-month-olds
21 point to provide information for others. *Journal of Cognition and Development*, *7*(2),
22 173–187. https://doi.org/10.1207/s15327647jcd0702_2
- 23 Miller, S., A. (2000). Children’s understanding of preexisting differences in knowledge and
24 belief. *Developmental Review*, *20*, 227–282. <http://dx.doi.org/10.1006/drev.1999.0501>

- 1 O'Neill, D. K. (1996). Two-year-old children's sensitivity to a parent's knowledge state when
2 making requests. *Child Development*, 67, 659-677. <https://doi.org/10.2307/1131839>
- 3 Onishi, K., H., & Baillargeon, R. (2005). Do 15-month-old infants understand false beliefs?
4 *Science*, 308, 255-258. <https://doi.org/10.1126/science.1107621>
- 5 Perner, J., Leekam, S. R., & Wimmer, H. (1987). Three-year-olds' difficulty with false belief:
6 The case for a conceptual deficit. *British Journal of Developmental Psychology*, 5,
7 125-137. <https://doi.org/10.1111/j.2044-835X.1987.tb01048.x>
- 8 Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind?
9 *Behavioral and Brain Sciences*, 4(4), 515-629.
10 <https://doi.org/10.1017/S0140525X00076512>
- 11 Rubio-Fernandez, P., & Geurts, B. (2013). How to pass the false-belief task before your
12 fourth birthday. *Psychological Science*, 24(1), 27-33.
13 <http://dx.doi.org/10.1177/0956797612447819>
- 14 Scott, R., M., & Baillargeon, R. (2014). How fresh a look? A reply to Heyes. *Developmental*
15 *Science*, 17(5), 660-664. <http://dx.doi.org/10.1111/desc.12173>
- 16 Song, H.-J., Onishi, K., H., Baillargeon, R., & Fisher, C. (2008). Can an agent's false belief
17 be corrected by an appropriate communication? Psychological reasoning in 18-month-
18 old infants. *Cognition*, 109, 295-315. <http://dx.doi.org/10.1016/j.cognition.2008.08.008>
- 19 Strauss, S., Calero, C. I., & Sigman, M. (2014). Teaching, naturally. *Trends in Neuroscience*
20 *and Education*, 3, 38-43. <https://doi.org/10.1016/j.tine.2014.05.001>
- 21 Strauss, S., & Ziv, M. (2012). Teaching is a natural cognitive ability for humans. *Mind, Brain,*
22 *and Education*, 6, 186-196. <https://doi.org/10.1111/j.1751-228X.2012.01156.x>
- 23 Strauss, S., Ziv, M., & Stein, A. (2002). Teaching as a natural cognition and its relations to
24 preschoolers' developing theory of mind. *Cognitive Development*, 17, 1473-1487.
25 [https://doi.org/10.1016/S0885-2014\(02\)00128-4](https://doi.org/10.1016/S0885-2014(02)00128-4)

- 1 Tudge, J., & Scrimsher, S. (2003). Lev S. Vygotsky on education: A cultural-historical,
2 interpersonal, and individual approach to development. In B. J. Zimmerman & D. H.
3 Schunk (Eds.), *Educational psychology: A century of contributions* (pp. 207–228).
4 Mahwah, NJ: Lawrence Erlbaum Associates.
- 5 Verba, M. (1994). Beginnings of collaboration in peer interaction. *Human Development*, *37*,
6 125-139. <https://doi.org/10.1159/000278249>
- 7 Verba, M. (1998). Tutoring interactions between young children: How symmetry can modify
8 asymmetrical interactions. *International Journal of Behavioral Development*, *22*,
9 195-216. <https://doi.org/10.1080/016502598384577>
- 10 Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*.
11 Cambridge, MA: Harvard University Press.
- 12 Warneken, F., & Tomasello, M. (2013). The emergence of contingent reciprocity in young
13 children. *Journal of Experimental Child Psychology*, *116*, 338–350.
14 <http://dx.doi.org/10.1016/j.jecp.2013.06.002>
- 15 Wechsler, D. (2004). *Wechsler Preschool and Primary Scale of Intelligence: WPPSI III Paris*:
16 ECPA.
- 17 Wellman, H. M., Fang, F., & Peterson, C. C. (2011). Sequential progressions in a theory-of-
18 mind scale: Longitudinal perspectives. *Child Development*, *82*, 780–792.
19 <https://doi.org/10.1111/j.1467-8624.2011.01583.x>
- 20 Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representations and constraining
21 function of wrong beliefs in young children's understanding of deception. *Cognition*,
22 *13*, 103-128. [https://doi.org/10.1016/0010-0277\(83\)90004-5](https://doi.org/10.1016/0010-0277(83)90004-5)
- 23 Wood, D., Wood, H., Ainsworth, S., & O'Malley, C. (1995). On becoming a tutor: Toward an
24 ontogenetic model. *Cognition and Instruction*, *13*, 565-581.
25 https://doi.org/10.1207/s1532690xci1304_7

- 1 Ziv, M., & Frye, D. (2004). Children's understanding of teaching: The role of knowledge and
2 belief. *Cognitive Development*, *19*, 457–477.
3 <https://doi.org/10.1016/j.cogdev.2004.09.002>
- 4 Ziv, M., Solomon, A., Strauss, S., & Frye, D. (2016). Relations between the development of
5 teaching and theory of mind in early childhood. *Journal of Cognition and Development*,
6 *17*(2), 264-284. <https://doi.org/10.1080/15248372.2015.1048862>

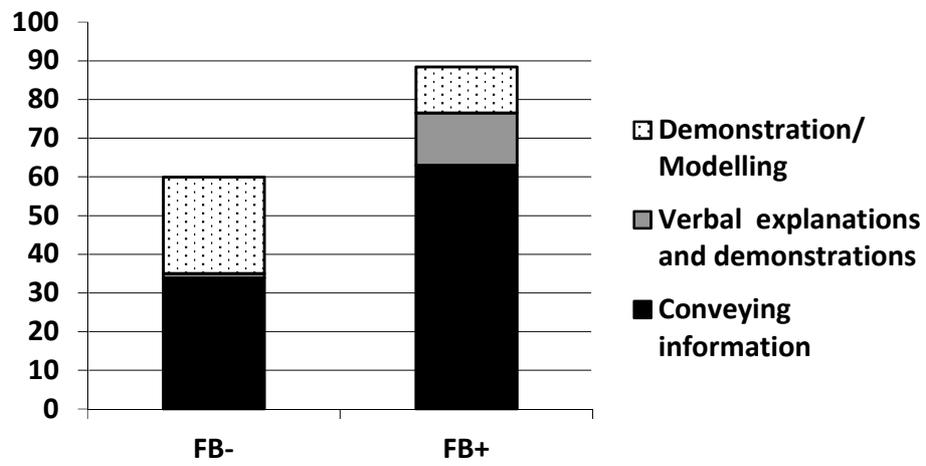


Figure 1 Time taken up by each type of teaching strategy in each type of dyad as a mean proportion of total time.

Table 1 Mean numbers (standard deviation) of blocks* correctly placed by the learners according to type of dyad and session

	FB-	FB+
Learners' performance during tutoring session	3.36 (3.54)	6.92 (3.20)
Learners' performance at posttest	5.07 (3.20)	7.75 (1.36)

* The jigsaw comprised 12 blocks.

Table 2 Pearson's correlation coefficients between each type of teaching strategy (mean proportion of total time) and the two measures of learner performance, according to the type of dyad group

	FB- group		FB+ group	
	Learners' performance during tutoring session	Learners' performance at posttest	Learners' performance during tutoring session	Learners' performance at posttest
Conveying Information	.79***	.73**	.75**	.34
Verbal Explanations and Demonstrations	.49	.35	-.64*	.06
Demonstration/Modelling	-.43	-.36	-.45	-.58

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3 Partial Pearson's correlation coefficients between each type of teaching strategy (mean proportion of total time) and the two measures of learner performance, according to the type of dyad group, keeping language (CVS) constant

	FB- group		FB+ group	
	Learners' performance during tutoring session	Learners' performance at posttest	Learners' performance during tutoring session	Learners' performance at posttest
Conveying Information	.75**	.67*	.76**	.29
Verbal Explanations and Demonstrations	.69**	.55	-.72*	-.02
Demonstration/Modelling	-.35	-.27	-.45	-.54

* $p < .05$. ** $p < .01$. *** $p < .001$.