

1 **Linking parental scaffolding with self-regulated learning in Chinese**
2 **kindergarten children**

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5
6 **Abstract**

7 The current study aimed to examine the relationships between dimensions of parental
8 scaffolding and children's self-regulated learning (SRL). One hundred and thirty
9 Chinese kindergarten children participated in a range of problem-solving tasks with
10 their parents and independently. Parent-child interactions and child-alone behaviours
11 were video-recorded for an in-depth observational analysis. Parental cognitive support,
12 emotional support, and contingency were coded in parent-child interactions.
13 Children's cognitive, metacognitive, and motivational strategic behaviours and task
14 performance were coded and assessed within the context of child-alone tasks. Results
15 showed that contingency was particularly important for children's SRL. Parental
16 contingency was the only independent predictor of children's SRL among the three
17 aspects of parental scaffolding and mediated the effect of parent education levels on
18 children's SRL.

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20 *Keywords:* Parental scaffolding; Self-regulated learning; Contingency; Chinese
21 kindergarten children

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1 **1. Introduction**

2 Since the 1980s, the term self-regulated learning (hereafter abbreviated as SRL) has
3 become widely used and is broadly defined as “learning that results from students’
4 self-generated thoughts and behaviours that are systematically oriented toward the
5 attainment of their learning goals” (Schunk, 2001, p. 125). Children’s development of
6 SRL has been identified as an important socialisation process beginning in early
7 childhood (Suchodoletz, Trommsdorff, & Heikamp, 2011). As self-regulatory abilities
8 are learnt and highly teachable, parenting plays a key role in kindergarten children’s
9 learning of SRL strategies within problem-solving situations (Whitebread & Basilio,
10 2012). A small number of studies have suggested that parental scaffolding, as one of
11 the primary parental behaviours during parent-child interactions, is related to
12 children’s SRL (e.g. Neitzl & Stright, 2003; Pino-Pasternak, Whitebread & Tolmie,
13 2010).

14
15 Much of the existing research concerning children’s SRL has centred on school-age
16 children and has suggested the importance of children’s effective use of SRL
17 strategies to their learning outcomes in academic tasks (e.g. Pino-Pasternak et al.,
18 2010), whereas less attention has been given to kindergarten children’s strategic
19 behaviours in problem-solving contexts. Moreover, the predominance of Caucasian
20 participants in this research area calls for further studies in different cultural contexts.
21 No studies of which we are aware have linked parenting with children’s use of SRL
22 strategies in China. The current study aimed to expand the literature by shedding light
23 on the role of parental scaffolding in kindergarten children’s SRL in the Chinese
24 context.

25 26 **1.1 Early development of SRL**

27 As SRL has consistently been related to academic performance in school settings,
28 most researchers have focused on school-aged children’s self-regulatory competence
29 in specific academic tasks (e.g. Throndsen, 2011). In fact, children’s learning begins
30 long before they enter school and before anyone intentionally teaches them (Vygotsky,
31 1978). Whitebread (2012) emphasised that young children’s self-regulatory abilities
32 can be significantly promoted within playful contexts characterised by emotional
33 support, appropriate levels of cognitive challenges, and opportunities for children to
34 explore their learning processes and that methodological limitations in prior studies
35 have led to the underestimation of kindergarten children’s SRL performance. An
36 over-reliance on verbal-based methodologies is evident in many of the earliest studies
37 on children’s metacognitive abilities (Winne & Perry, 2000). Cognitive constructivists,
38 following Flavell’s (1979) influential work, tend to argue that young children’s
39 incapacity for self-regulation during learning activities results from limitations of their

1 metacognitive competence (Zimmerman, 2001). Studies set in naturalistic settings,
2 however, have shown that young children's ability to demonstrate their metacognitive
3 competence can be negatively affected by contextual factors during experiments
4 (Perry, 1998). The ecological validity of research tasks is therefore essential in
5 investigating young children's strategy use, which is demonstrated more accurately
6 when the tasks are meaningful and age-appropriate (Whitebread et al., 2009).

7
8 Despite limited research on young children's SRL, evidence has identified the
9 emergence and development of SRL behaviours in children as young as 3 years old.
10 Bronson (2000) provided a comprehensive review of kindergarten children's
11 development of self-regulation and its relations to environmental support. She
12 concluded that, compared to infants and toddlers, kindergarten children are more
13 organised in their control of attention, monitoring behaviours, and adoption of
14 strategies. Further, with regard to motivational aspects of SRL, kindergarten children
15 are increasingly interested in taking challenges and their focus gradually moves from
16 exploring the task to achieving goals. The kindergarten period is a crucial time for
17 children's development of SRL due to children's significant advances in cognitive
18 awareness, effortful control, language, etc., which allow children to choose
19 appropriate strategies to solve problems (Bronson, 2000).

20 21 **1.2 Socialisation of SRL: The importance of parental scaffolding**

22 The construct of scaffolding is introduced to explicate an interactive process by which
23 an experienced adult instructs a child to complete a difficult task that the child finds
24 difficult or cannot complete independently (Wood, Bruner, & Ross, 1976). Relying on
25 the "scaffold" of instructional and socioemotional strategies created by parents, the
26 child can not only successfully tackle the task but also gradually become an
27 independent learner (Robinson, Burns, & Davis, 2009). A few studies have shown a
28 tendency towards multidimensional approaches, exploring the contribution of
29 different scaffolding behaviours to indicators of children's SRL (e.g. Pino-Pasternak
30 et al., 2010). Parental scaffolding behaviours which have been found to be related to
31 children's SRL can be categorised into three main aspects as cognitive support,
32 emotional support, and contingency.

33 34 **1.2.1 Parental cognitive support and children's SRL**

35 Parents provide cognitive support during joint problem-solving tasks by conveying
36 information about task management techniques and strategies (Vygotsky, 1978).
37 Previous research has indicated the predictive role of parents' provision of cognitive
38 support in children's SRL during child-alone and classroom activities. Robinson et al.
39 (2009) provided new insights into the importance of parental cognitive support by

1 investigating the associations between children's performance with mothers'
2 assistance and child-alone performance in a similar task. The findings suggested that
3 for children with mothers who demonstrated more cognitive support in the task,
4 higher proportions of self-regulated attention in the parent-child task were related to
5 higher accuracy in the child-alone task. In contrast, for children with mothers who
6 provided minimal scaffolding instructions, the attention regulation skills observed in
7 the parent-child task were not associated with performance in the child-alone task. As
8 Vygotsky (1978) suggested, children's learning can be viewed as a process of moving
9 from other-regulation to self-regulation.

10
11 Neitzel and Stright (Neitzel & Stright, 2003; Stright, Neitzel, Sears, & Hoke-Sinex,
12 2001) examined the influences of two indicators of maternal cognitive support, the
13 provision of metacognitive information and manner of instruction, on children's SRL
14 in classroom activities. The results of both studies demonstrated that mothers' manner
15 of instruction moderated the relationships between parents' provision of
16 metacognitive information and children's SRL behaviours in the classroom such as
17 metacognitive talk, task persistence, and self-monitoring. Both studies suggest that
18 parents need to not only provide adequate metacognitive information, but also convey
19 the information in an understandable way and at an appropriate pace. However,
20 although both studies highlighted the importance of the manner of instruction, they
21 focused entirely on mothers' behaviours, but did not assess their contingency that is
22 the degree to which mothers were able to adjust their manner of scaffolding in
23 response to children's ongoing evidence of task understanding.

24 25 **1.2.2 Parental emotional support and children's SRL**

26 While parental cognitive support contributes more to children's cognitive and
27 metacognitive behaviours, emotional support has been found to be related more
28 strongly to children's motivational and emotional regulatory process, particularly
29 children's persistence on the task, motivation to continue the task and emotional
30 responses to the task (Pino-Pasternak et al., 2010). Without appropriate and timely
31 emotional support from parents, children may lack motivation to learn cognitive
32 strategies or to practice newly acquired knowledge when solving problems
33 independently (Stright et al., 2001).

34
35 Early studies have paid attention to both positive and negative aspects of parental
36 emotional behaviours and their relations to children's motivational behaviours of SRL.
37 For instance, Salonen, Lepola, and Vauras (2007) examined the role of parents'
38 positive and negative emotional responses in children's task orientation. The findings
39 indicated that parents of task-oriented children adjusted their emotional responses

1 more sensitively to their children’s emotional expressions, compared to parents of
2 non-task oriented children. In addition, parents of task-oriented children emitted more
3 positive emotional signals than parents of non-task oriented children.

5 **1.2.3 Parental contingency and children’s SRL**

6 The concept of contingency is also termed as “the shift rule”. It refers to a parental
7 shift in scaffolding following the rule of providing less specific instructions and
8 higher cognitive demand after a child’s success and more specific instructions and
9 lower cognitive demand after a child’s failure (Wood & Middleton, 1975). For
10 instance, a parent who is able to provide contingent scaffolding will use a more
11 challenging question to promote his or her child’s thinking when the child
12 demonstrates a good understanding and provides a more manageable instruction when
13 the child shows a poor understanding of the task. Children’s SRL in problem-solving
14 tasks have been shown to be associated with parental contingent scaffolding
15 behaviours. Wood and Middleton (1975) firstly showed that the sensitivity of parents’
16 instructions contingent on children’s level of task ability was related to children’s
17 independent performance in a post-instruction task. In contrast, the actual frequency
18 of parent’s instructions had no relation with children’s post-instruction performance.
19 These findings reveal a clear distinction between quantity and quality of parental
20 scaffolding.

22 Inspired by Wood and his colleagues’ work with young children, later studies have
23 further corroborated the significance of varying levels of intervention contingent on
24 children’s reactions, but have paid more attention to school-aged children’s
25 performance in homework-type activities. Pratt and Savoy-Levine (1998) examined
26 the relationships between contingent tutoring and children’s performance on
27 long-division mathematics homework. Both studies found that mothers’ use of “the
28 contingent shift rule” was related with children’s level of learning gains from a
29 tutoring session to an independent post-testing task. Consistently, a fine-grained
30 analysis of parental contingency based on parents’ demand levels and children’s
31 understanding levels showed that medium- and high-level cognitive demands
32 contingently conveyed by parents were positively related to children’s SRL
33 behaviours in homework tasks (Pino-Pasternak et al., 2010).

35 **1.2.4 Parental education**

36 Parental education has been identified as an important resource for scaffolding in
37 problem-solving situations. Specifically, more educated parents are more likely than
38 less educated parents to provide children with useful cognitive instructions (Supplee,
39 Shaw, Hailstones, & Hartman, 2004), positive emotional responses (Stright et al.,

1 2009), and respond more contingently with less directive behaviours (Carr & Pike,
2 2012). Parents with more education have greater exposure to cognitive knowledge,
3 strategies, and practice which enable them to provide more effective support when
4 assisting their children in problem-solving situations (Neitzel & Stright, 2004).
5 However, the role of parental education in the relations between parental scaffolding
6 and children's SRL has not been studied thoroughly. In Neitzel and Stright (2003), it
7 was assumed that mothers' education might impact their scaffolding behaviours,
8 which in turn, might influence children's SRL behaviours. But due to its modest
9 sample size, this study did not test this assumption.

11 **1.2.5 Parental scaffolding and children's SRL in the Chinese context**

12 Although no studies have linked parental scaffolding with Chinese kindergarten
13 children's SRL, some distinctive characteristics of Chinese parenting have been found
14 in limited cross-cultural studies. For example, Wu et al. (2002) found that Chinese
15 mothers laid different emphases on parenting practices, displaying more behaviours
16 than American mothers in terms of encouragement of modesty, protection,
17 directiveness, and shaming/love withdrawal when interacting with preschool-age
18 children. In a study by Ng, Pomerantz, and Lam (2007), laboratory observations
19 indicated that Chinese mothers' negative statements (e.g. "You only got 6 out of 12?")
20 predicted children's improvement in children's school performance, possibly because
21 they conveyed useful strategic resources without display of annoyance and hostility,
22 which did not dampen children's motivation but rather pointed out what children
23 could improve. Whether Chinese parents show unique features when interacting with
24 their children, and whether the relationship between parental scaffolding and
25 children's SRL found in Western cultures holds in Chinese children remains unknown
26 and warrants further studies.

28 **1.3 The present study**

29 The present study aimed to take an initial step to shed light on the relationships between
30 parental scaffolding and Chinese kindergarten children's SRL in problem-solving
31 situations. The study examined the following research questions:

- 33 (a) Are children's SRL strategic behaviours associated with their task performance?
- 34 (b) Do parental scaffolding behaviours relate to children's SRL strategic behaviours
35 and task performance?
- 36 (c) Do parental scaffolding behaviours mediate the relationship between parental
37 education and children's SRL?
- 38 (d) Are the relationships between parental scaffolding and children's SRL found in
39 existing Western research evident in the Chinese context?

1 Given existing evidence (Dermitzaki, Leondari, & Goudas, 2009), the hypothesis was
2 that children's cognitive and metacognitive strategic behaviours would predict
3 children's task performance, while motivational strategic behaviours would not
4 independently predict task performance (H1). But as the first two dimensions were
5 combined together and found to jointly predict children's task performance in
6 Dermitzaki et al. (2009), the magnitude of the effect respectively exerted by cognitive
7 and metacognitive strategic behaviours remains unclear.

8
9 With regard to the role of parental scaffolding in children's SRL, we only made a
10 general hypothesis that parental scaffolding would be related to children's SRL but
11 did not hypothesise specific relationships between the dimensions of scaffolding and
12 SRL strategic behaviours due to the lack of evidence in Chinese research in this area.
13 But given early Western studies that have highlighted the importance of contingency
14 (e.g. Pino-Pasternak et al., 2010), it was expected that contingency would be a unique
15 predictor of Chinese children's SRL strategic behaviours (H2).

16
17 On the basis of the untested assumption in Neitzel and Stright (2003), it was
18 hypothesised that parental education levels would have an indirect influence on
19 children's SRL through the mediation of parental scaffolding behaviours (H3).

20
21 As existing evidence mentioned in section 1.2.5 has indicated that compared to
22 American mothers, Chinese mothers tend to display more negative statements
23 regarding children's academic performance, which however predict heightened
24 performance of children (Ng et al., 2007), it was hypothesised that parental emotional
25 support would not be as important as found in Western research to Chinese children's
26 SRL in problem-solving tasks (H4).

27 28 **2. Method**

29 **2.1 Participants**

30 One hundred and thirty Chinese family dyads consisting of kindergarten children and
31 their parents participated in the study. The participants were recruited from three
32 kindergartens in Beijing. Recruitment advertisements were given to teachers in the
33 kindergartens, who assigned copies to children's parents. The children, 59 girls and 71
34 boys, ranged in age from 59 to 79 months; the mean age was 71.6 months. The
35 parents, 39 fathers and 91 mothers, ranged in age from 23 to 45; the mean age was
36 35.7 years. With regard to parental education, 11% of the parents had less than a high
37 school education, 18% had high school certificates, 16% had college diplomas, 28%
38 had college degrees, 27% had Master's degree or above.

39

2.2 Procedures

Data was collected successively in the three kindergartens. Each parent-child dyad was visited in a playroom of the kindergarten. In each of the kindergartens, the process of data collection was divided into two stages. First, each parent-child dyad completed two parent-child interaction tasks. Second, after approximately three weeks when the measurement of all the parent-child dyads' interaction in the kindergarten was completed, each child was asked to do two-child alone tasks for the assessment of their SRL. The researcher sat in a corner of the playroom and remained a good distance from the participants in order to provide them with a relaxing atmosphere. Parents were asked to play with their children as naturally as they would at home. All the tasks were video-recorded for an in-depth behavioural analysis. This process was repeated in each of the three kindergartens.

Two parent-child problem-solving tasks, a puzzle-matching task and an origami paper-folding task, were used to assess parental scaffolding. The puzzle and origami tasks were used due to cultural and age appropriateness. Empirical evidence (e.g. Robinson et al., 2009; Hane, Cheah, Robin, & Fox, 2008) and a pilot study conducted prior to the main data collection has shown that puzzle and origami tasks are appropriate for investigating parental behaviours in the context of problem solving. In the puzzle task, each parent-child dyad was given a set of twenty puzzle blocks and target pictures as a model, with which to reproduce pictures within ten minutes. Each puzzle block had six faces, which allowed the parent-child dyad to complete up to six pictures. Each parent-child dyad had the freedom to decide how many pictures they would like to produce. In the origami task, each parent-child dyad was given an origami pig model, an instruction showing eight steps, and two pieces of origami paper to reproduce either one or two origami pigs within ten minutes. In both tasks, the parent was instructed to play with the child as naturally as they would at home.

Children's SRL in terms of their strategic behaviours and task performance was assessed using two child-alone tasks, which were similar to the parent-child tasks. In the child-alone puzzle task, the child was asked to complete a thirty-piece jigsaw puzzle in ten minutes. In the child-alone origami task, the child was asked to make an origami house in ten minutes following six steps in the instructions. The primary difference between the parent-child tasks and child-alone tasks was in the difficulty level. Parent-child tasks were beyond kindergarten children's abilities to complete independently, highlighting the necessity for parental scaffolding. In contrast, the child-alone tasks were challenging but not beyond kindergarten children's capacities. Success at the child-alone tasks required children to adopt SRL strategies. It has to be noted that although the parent-child puzzle task involved fewer pieces than the

1 child-alone one, it was more challenging for the child due to the multiple faces on
2 each puzzle block.

3 4 **2.3 Measures**

5 **2.3.1 Demographic questionnaire**

6 A demographic questionnaire was used to collect basic information of the participants.
7 Questions included parental age, gender, and educational levels, and children's age
8 and gender.

9 10 **2.3.2 Parental scaffolding**

11 Parental scaffolding in the two parent-child tasks was assessed in terms of cognitive
12 support, emotional support, and contingency. Cognitive support and emotional
13 support were coded by an adapted version of the Parental Scaffolding Coding Manual
14 by Neizel and Stright (2003). To ensure sufficient sensitivity and accuracy in the
15 analysis of parents' scaffolding behaviours, each 10-minute task was divided into five
16 2-minute segments for coding each item. Compared to coding in shorter time
17 segments which were tried in a pilot study, the use of 2-minute segments provided
18 enough information and allowed for more room for variability in the data. Each aspect
19 of scaffolding was rated on a 5-point scale from 1 (low) to 5 (high). Parental cognitive
20 support includes parents' provision of metacognitive information that facilitated the
21 thinking behind the problem-solving process. Specifically, parents' suggestions of task
22 management strategies (e.g. "Shall we observe this picture carefully?"), explanations
23 about how the task works (e.g. "Our goal is to follow the steps here.") and rationale
24 for the use of a particular strategy (e.g. "It would be easier if we could first find all the
25 pieces for this picture.") were counted as metacognitive information. Two aspects of
26 emotional support were coded. Encouragement includes the parent's positive
27 reactions towards the child, such as words of encouragement, supportive comments,
28 and positive nonverbal behaviours. Rejection refers to the parent's negative reactions
29 such as criticism, disapproval, dismissal of the child's efforts, and negative non-verbal
30 behaviours. Parental manner of instruction and transfer of responsibility in the
31 original Neitzel and Stright's coding framework were removed and replaced with
32 separate measures of contingency.

33
34 To examine parental contingency referring to the extent to which parents were able to
35 provide or withhold instructions contingent on their children's success or failure of
36 understanding, parental instructional demand and children's ongoing evidence of task
37 understanding were firstly assessed. Two coding schemes were modified from the
38 *Coding of parental instructional demand* and the *Coding of children's evidence of*
39 *task understanding* used by Pino-Pasternak (2014) and Pino-Pasternak, et al. (2010).

1 As the play-based problem-solving tasks in the present study and homework-like
2 activities in Pino-Pasternak’s study were different in nature, original coding items
3 were modified in order to make them relevant to the current tasks. Specifically,
4 parental instructional demand was conceptualised as three levels representing low
5 demand (level 1, D1), medium demand (level 2, D2), and high demand (level 3, D3)
6 embedded in parents’ instructions (Pino-Pasternak, 2014). Low demand refers to the
7 situation where the parent asks the child to do the easy part of the task, models the
8 application of strategies and simply asks the child to follow, and poses low-level
9 yes/no questions. Medium demand refers to the situation where the parent provides
10 detailed and manageable instructions to reduce the level of difficulty and breaks the
11 task into manageable sub-goals and relates the sub-goals to the overall goal of the task.
12 High demand refers to the situation where the parent uses questions or comments to
13 activate prior knowledge and encourage planning, performance monitoring, and
14 strategy use. Children’s evidence of task understanding was coded at five levels of
15 understanding representing no clear evidence of understanding (level 0, U0), poor
16 understanding (level 1, U1), partial understanding (level 2, U2), clear understanding
17 (level 3, U3), and independent understanding not prompted by parental support (level
18 4, U4). The coding for parental instructional demand and children’s task
19 understanding was utterance by utterance.

20
21 Four categories of parental contingency (“contingent”, “non-contingent up”,
22 “non-contingent down”, and “non-contingent off”) were operationalised as
23 combinations of parental instructional demand and children’s task understanding.
24 “Contingent” refers to parental demand that changes in agreement with the child’s
25 evidence of understanding; “non-contingent up” refers to parental demand that
26 exceeds the child’s level of understanding; “non-contingent down” refers to parental
27 demand that underestimates the child’s level of understanding; “non-contingent off”
28 refers to when the parent takes over the task with no cognitive demand directed to the
29 child. Categories of contingency were determined by the combination of coding of
30 parental demand and children’s understanding following the combination rules in
31 Pino-Pasternak et al. (2010). Take the category “contingent” as an example. When the
32 parent’s demand was maintained at a high level or went up following children’s clear
33 understanding and independent understanding (e.g. D3-U3-D3 and D2-U4-D3), when
34 the parent’s demand was maintained at a medium level or went down following
35 children’s partial understanding (e.g. D2-U2-D2 and D3-U2-D2), or when the
36 parent’s demand was maintained at a medium level to provide more hints or went
37 down from a high level following children’s poor understanding (e.g. D2-U1-D2 and
38 D3-U1-D2), the parent’s behaviour was coded as “contingent”.

39

1 The number of contingent behaviours and non-contingent behaviours was counted in
2 every 2-minute segment in the parent-child tasks. According to the counts of
3 contingency behaviours, the extent to which parents provided contingent instructional
4 support in the parent-interaction tasks was rated on a 5-point rating scale from 1 (not
5 contingent at all) to 5 (consistently contingent). Because not all parent-child dyads
6 spent 10 minutes for each task, counts of contingent behaviours were not used directly
7 as an indicator of parental contingency. Parents who spent less than 10 minutes with
8 their children on the task would be given a score for contingency lower than their
9 actual performance if counts instead of ratings were used. Less than 5% of
10 parent-child dyads spent less than 10 minutes on each task, and among these parents,
11 only two parent-child dyads spent less than 8 minutes on the origami task. One
12 parent-child dyad who spent less than 5 minutes on each task was excluded from
13 analyses.

14 **2.3.3 Children’s SRL strategic behaviours and task performance**

15 Children’s SRL strategic behaviours were coded using a coding framework adapted
16 from the *Strategic Behaviour Observation Scale* (SBOS) in Dermitzaki et al. (2009)
17 in the two child-alone tasks. Each 10-minute child-alone task was divided into five
18 2-minute time segments for coding. Children’s cognitive, metacognitive, and
19 motivational strategic behaviours were assessed in the child-alone tasks. Each aspect
20 covers several coding items. As for cognitive strategic behaviours, children’s effective
21 use of the model was coded in both the puzzle and origami tasks; effective use of
22 instruction was coded in the origami task. Metacognitive strategic behaviours
23 included behaviours indicative of planning (e.g. The child talks to himself that “I have
24 to put pieces of the lion together”), self-monitoring (e.g. The child pauses and talks to
25 herself that “I have got two legs for the piggy and will make the other two”), and
26 awareness of errors (e.g. The child observes what she made carefully and adjusts two
27 pieces she wrongly puts together.) in the problem-solving procedure. Motivational
28 strategic behaviours were coded in terms of children’s concentration on the task (e.g.
29 The child concentrates on the task and is not affected by external stimuli.),
30 maintaining motivation (e.g. The child talks to herself during the task that “I like this
31 game. It’s lots of fun!”), and initiative (e.g. The child initiates each step himself and
32 does not ask the researcher for help.). The degree to which the child was able to adopt
33 SRL strategies was assessed using 4-point ratings from 1 (low) to 4 (high). Take
34 children’s effective use of model as an example. Whether the child effectively
35 referred to the target pictures provided in the puzzle task and the origami house model
36 in the origami task was rated from 1 (does not utilise the model at all) to 4 (utilises the
37 model sufficiently and effectively).

1 The coding system was slightly modified in accordance with the characteristics of the
2 tasks used in the present study. For instance, two coding items concerning children's
3 abilities to choose between main and trivial information and analysing and combining
4 activities were not examined in the study, because these behaviours were not relevant
5 in these tasks.

6
7 Children's task performance in the two child-alone tasks was respectively measured
8 by two 5-point ratings from 1 (low) to 5 (high). Children's performance was rated
9 given how many pieces they correctly completed in the puzzle task, and how many
10 steps they correctly completed in the origami task. For instance, the child who
11 completed less than 1/3 (less than 10 pieces in the puzzle task and less than 2 steps in
12 the origami task) was given 1; the child who completed the whole task (30 pieces in
13 the puzzle task and 6 steps in the origami task) correctly was given 5.

14 15 **2.3.4 Reliability**

16 To assess the interrater reliability of these coding schemes, a second coder with a
17 Psychology degree, blinded to the study hypotheses, was carefully trained and
18 independently coded 20% of the videos that were selected at random. Both the first
19 and second coder were native speakers of Mandarin and were proficient in English.
20 The observational measures of parental scaffolding and children's SRL were double
21 coded. Because all the videos were divided into five 2-minute segments for coding,
22 the degree of agreement was assessed at the level of individual segments and
23 computed using Cohen's kappa. The average Kappa coefficients across time segments
24 for parent and child codes ranged from .78 to .92, which showed good levels of
25 agreement.

26 27 **3. Results**

28 **3.1 Preliminary analyses**

29 Due to the constraints on the number of predictors for achieving the desired statistical
30 power, data reduction through the construction of aggregate measures was necessary
31 for the main analyses. Table 1 shows descriptive statistics for the aggregate scores of
32 the observational measures. To create the aggregates of parent and child observational
33 measures, two analyses were conducted. The first step was to calculate Cronbach's
34 alpha to examine the stability of parental scaffolding behaviours and children's SRL
35 strategic behaviours across the puzzle task and the origami task. Given good internal
36 consistency shown by Cronbach's alpha (ranged from .71 to .88), the ratings for
37 parent and child measures were averaged to create aggregates on the puzzle and
38 origami tasks.

39

1 Thereafter, the second step was to calculate aggregate scores for sub-dimensions that
 2 had more than one coding item in the coding schemes. In the coding scheme for
 3 parental scaffolding, ratings of encouragement and rejection (reversed scoring) were
 4 averaged to create an aggregate for emotional support, which showed good internal
 5 consistency (Cronbach's alpha= .7). In the coding scheme of children's SRL
 6 behaviours, ratings of sub-dimensions of each aspect of SRL strategic behaviours
 7 were averaged to create three aggregates for cognitive strategic behaviours,
 8 metacognitive strategic behaviours, and motivational strategic behaviours. Cronbach's
 9 alpha coefficients for the three composite measures were .76, .86 and .82, which
 10 showed high internal consistency. Children's performance scores for the puzzle and
 11 origami tasks were averaged for subsequent data analyses, supported by significant
 12 correlations between the puzzle task score and origami task score, $r = .30, p < .001$.

13

14 Table 1

15 *Descriptive Statistics for Aggregate Scores of Observational Measures*

	<i>M</i>	<i>SD</i>	Range
Parental scaffolding behaviours			
Cognitive support	2.44	.82	1.1-4.5
Emotional support	3.20	.31	2.3-4.05
Contingency	3.59	1.03	1.1-5
Children's SRL strategic behaviours			
Cognitive strategic behaviours	2.36	.51	1-4
Metacognitive strategic behaviours	2.98	.75	1-4
Motivational strategic behaviours	3.56	.49	1.4-4
Children's task performance	3.02	1.19	1-5

16

17 The Shapiro-Wilk test (the S-K test) was used to test whether the measures were
 18 normally distributed, revealing that the distributions of parents' emotional support and
 19 children's motivational strategic behaviours were not normal. To deal with the
 20 problem of skewed data, non-parametric statistical methods and the bootstrap method
 21 in parametric tests were used in the study. Specifically, Mann-Whitney U tests and
 22 Spearman's correlations were used to examine mean differences in and bivariate
 23 correlations between measures. To further reveal the complexity of relationships
 24 between different variables, the bootstrap method was used with parametric tests,
 25 including ANOVA, partial correlations, and regression tests. The bootstrap approach
 26 was also used for examining the mediating effects of parental scaffolding on the
 27 relationships between parental education and children's SRL. Bootstrapping is a
 28 robust method and does not rely on normality assumptions. As an alternative to
 29 parametric estimates when assumptions of normal distribution shape are violated,
 30 bootstrapping allows robust estimates of the properties of the sampling distribution by

1 treating the sample data as a population from which smaller samples are taken (Field,
2 2013). Given the lack of normality in two variables in the study, the bias corrected
3 and accelerated confidence intervals (reported as BCa CI for later analyses) were
4 taken into consideration more than the significance value per se. Unlike the
5 significance values that might be affected by data distributions, the bootstrapped
6 confidence intervals are unaffected and therefore can be trusted (Field, 2013). If the
7 confidence interval crosses zero, the population value could be zero, which suggests
8 no effect in the population. For data analysis in the study, SPSS 22.0 that incorporates
9 an add-on bootstrapping module was used.

10
11 Preliminary analyses were also conducted to determine whether gender and age of
12 parents and children had effects on parent and child measures. The results of
13 Mann-Whitney U tests suggested that mothers and fathers did not differ in any of the
14 parent measures and children did not differ by parent gender in any of the child
15 measures. The results of partial correlations between parent age, parent measures, and
16 child measures showed that parental age was not related to any of the parent and child
17 measures when the effect of parental education was controlled.

18
19 Significant differences between boys and girls were found in their SRL strategic
20 behaviours but not in task performance. Compared to boys, girls showed more
21 cognitive strategic behaviours ($U=1540.50$, $p<.01$), metacognitive strategic
22 behaviours ($U=1637.50$, $p<.05$), and motivational strategic behaviours ($U=1501.50$,
23 $p<.01$), but did not outperform boys in terms of task performance ($U=1710.50$, $p>.05$).
24 The results of Spearman's correlations showed that children's age was significantly
25 related to metacognitive strategic behaviours ($\rho=.19$, $p < .05$), motivational strategic
26 behaviours ($\rho=.22$, $p < .05$), and task performance ($\rho=.24$, $p < .01$). Significant effects
27 identified in above analyses were controlled for in later analyses.

28 29 **3.2 Are children's SRL strategic behaviours associated with their task** 30 **performance?**

31 To test whether children's cognitive, metacognitive, and motivational strategic
32 behaviours would each be significant and independent predictors of children's task
33 performance, partial correlations with the bootstrap method were conducted
34 controlling for child gender and age. Children's task performance was significantly
35 related to cognitive strategic behaviours, $r=.59$, $p<.001$, to metacognitive strategic
36 behaviours, $r=.83$, $p<.001$, and to motivational strategic behaviours, $r=.48$, $p<.001$.

37
38 Table 2 reports the results for hierarchical multiple regression analysis using the
39 bootstrap method, which was conducted to better understand the relative roles of

1 children's different SRL strategic behaviours in predicting task performance. In the
 2 regression equation, child gender and age were entered in Step 1. Previous studies
 3 have revealed that although motivational strategic behaviours are important, cognitive
 4 and metacognitive strategic behaviours have stronger effects on problem-solving
 5 achievement (e.g. Dermitzaki et al., 2009). Therefore, children's cognitive and
 6 metacognitive strategic behaviours were entered at Step 2 and children's motivational
 7 strategic behavior was entered at Step 3 of the regression equation.

8

9 The overall regression model was significant, $R^2=.72$, $F(5, 124) = 62.36$, $p < .001$. At
 10 Step 1, child age and gender accounted for 7% of the variance, $F(2, 127) = 4.5$, $p < .05$.
 11 However, at Step 2, the contribution of child age diminished when children's
 12 cognitive and metacognitive strategic behaviours were entered in the regression
 13 equation and a significant change in the value of R^2 was noted, $\Delta R^2=.64$, $F(4, 125)$
 14 $= 75.85$, $p < .001$. At Step 3, children's motivational strategic behaviours only
 15 accounted for an additional 1% of the variance in children's task performance,
 16 indicating an insignificant change. Interestingly, among the three aspects of children's
 17 SRL strategic behaviours, only children's metacognitive strategic behaviours
 18 significantly predicted task performance, $t(124) = 11.24$, $p < .001$.

19

20 Table 2

21 *Summary of a Hierarchical Regression Analysis Predicting Children's Task*
 22 *performance from Children's SRL Strategic Behaviours, with 95% Bias Corrected*
 23 *and Accelerated Confidence Intervals for B Reported in Parentheses. Confidence*
 24 *Intervals and Standard Errors based on 1000 Bootstrap Samples*

Variable	B	SE B	β
Step1 Gender	0.33 (-0.05, 0.73)	0.20	.14
Age	0.05 (0.01, 0.09)	0.02	.21*
Step2 Gender	0.01 (-0.21, 0.25)	0.12	.00
Age	0.02 (-0.01, 0.04)	0.01	.06
Cognitive strategic behaviours	-0.17 (-0.51, 0.13)	0.16	-.08
Metacognitive strategic behaviours	1.39 (1.19, 1.60)	0.10	.88***
Step3 Gender	0.02 (-0.20, 0.26)	0.12	.01
Age	0.02 (-0.01, 0.39)	0.01	.07

Cognitive strategic behaviours	-0.15 (-0.47, 0.14)	0.16	-.06
Metacognitive strategic behaviours	1.51 (1.31, 1.71)	0.11	.95***
Motivational strategic behaviours	-0.29 (-0.59, -0.01)	0.15	-.12

Note. $R^2=.07^*$ for Step 1; $\Delta R^2=.64^{***}$ for Step 2; $\Delta R^2=.01$ for Step 3.

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

3.3 Do parental scaffolding behaviours relate to children's SRL strategic behaviours and task performance?

To test whether parental cognitive support, emotional support, and contingency would each be significant and independent predictors of children's SRL strategic behaviours and task performance, partial correlations and hierarchical multiple regression analyses controlling for parents' and children's demographic measures were conducted. Parental cognitive support was significantly associated with children's cognitive strategic behaviours, $r=.32$, $p<.001$, and metacognitive strategic behaviours, $r=.27$, $p<.01$, but not with motivational strategic behaviours and task performance. Parental emotional support was significantly associated with children's cognitive strategic behaviours, $r=.23$, $p<.01$, metacognitive strategic behaviours, $r=.18$, $p<.05$, and motivational strategic behaviours, $r=.18$, $p<.05$, but not with task performance. Parental contingency was significantly associated with children's cognitive strategic behaviours, $r=.54$, $p<.001$, children's metacognitive strategic behaviours, $r=.68$, $p<.001$, children's motivational strategic behaviours, $r=.50$, $p<.001$, and task performance, $r=.58$, $p<.001$. The bootstrap confidence intervals for the relationships did not contain zero, indicating that the relationships were genuine.

Four hierarchical multiple regression analyses were then conducted in turn to examine the role of parental scaffolding behaviours as predictors of children's SRL strategic behaviours and task performance. In each of the regression equations for children's cognitive, metacognitive, and motivational strategic behaviours, a 4-step analysis was conducted. Demographic variables were entered in Step 1 to control their effects. Then parental scaffolding behaviours were entered into the regression equation in the sequence suggested by Neitzel and Stright (2003). As cognitive support provides the foundation of parental scaffolding in problem-solving processes, it was entered in Step 2, followed by parental contingency in Step 3. Step 4 assessed the contribution of parental emotional support to children's use of SRL strategic behaviours.

Table 3 summarises the regression results. The four overall models respectively,

1 predicted children's cognitive strategic behaviours, $F(7, 122) = 11.44, p < .001$,
2 metacognitive strategic behaviours, $F(7, 122) = 21.76, p < .001$, motivational strategic
3 behaviours, $F(7, 122) = 7.98, p < .001$, and task performance, $F(7, 122) = 14.95$,
4 $p < .001$. However, among the three aspects of parental scaffolding behaviours, only
5 parental contingency was an independent predictor of children's SRL strategic
6 behaviours and task performance. In each of the four regression models, there was a
7 substantial change in the magnitude of the regression coefficients of parental
8 cognitive support when parental contingency was introduced into the equation. When
9 parental contingency was introduced in each regression equation in Step 3, it
10 accounted for an additional 17% of the variance in cognitive strategic behaviours, 32%
11 of the variance in metacognitive strategic behaviours, 20% of the variance in
12 motivational strategic behaviours, and 29% of the variance in task performance.

Table 3

Hierarchical Regression Analyses Predicting Children's SRL Strategic Behaviours and Task performance from Parental Scaffolding Behaviours. Standard Errors based on 1000 Bootstrap Samples

Variable	Cognitive strategic behaviours			Metacognitive strategic behaviours			Motivational strategic behaviours			Task performance			
	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	
Step1	Parent gender	-0.02	0.10	-.01	-0.07	0.14	-.04	-0.12	0.08	-.10	0.09	0.21	.03
	Parent education	0.09	0.03	.24**	0.16	0.05	.31***	0.03	0.03	.08	0.26	0.08	.31***
	Child gender	0.23	0.09	.22**	0.24	0.01	.16*	0.17	0.08	.18*	0.30	0.20	.12
	Child age	0.01	0.01	.10	0.02	0.13	.11	0.01	0.01	.13	0.03	0.02	.14
Step2	Parent gender	-0.01	0.10	-.01	-0.06	0.13	-.03	-0.11	0.08	-.10	0.09	0.22	.04
	Parent education	0.02	0.04	.06	0.08	0.06	.15	-0.02	0.04	-.04	0.21	0.09	.25
	Child gender	0.23	0.01	.22**	0.24	0.12	.16*	0.18	0.08	.18*	0.30	0.20	.12
	Child age	0.01	0.08	.11	0.02	0.01	.12	0.01	0.01	.14	0.04	0.02	.14
	Cognitive support	0.22	0.07	.35***	0.27	0.10	.30**	0.14	0.07	.22*	0.18	0.17	.13
Step3	Parent gender	0.00	0.09	.00	-0.03	0.10	-.02	-0.10	0.07	-.09	0.03	0.19	.01
	Parent education	-0.01	0.03	-.02	0.03	0.04	.05	-0.04	0.04	-.12	0.13	0.07	.15
	Child gender	0.11	0.01	.11	0.01	0.10	.01	0.06	0.08	.06	-0.07	0.17	-.03
	Child age	0.01	0.08	.08	0.01	0.01	.08	0.01	0.01	.11	0.03	0.02	.11
	Cognitive support	0.08	0.06	.13	-0.01	0.08	-.01	-0.01	0.07	-.02	-0.25	0.13	-.17
	Contingency	0.25	0.04	.51***	0.51	0.06	.70***	0.26	0.05	.55***	0.78	0.08	.67***
Step4	Parent gender	0.00	0.09	.00	-0.03	0.10	-.02	-0.10	0.07	-.09	0.03	0.19	.01
	Parent education	-0.01	0.03	-.02	0.03	0.04	.06	-0.04	0.04	-.12	0.13	0.18	.15
	Child gender	0.11	0.08	.08	0.01	0.10	.01	0.06	0.08	.06	-0.07	0.17	-.03
	Child age	0.01	0.01	.11	0.01	0.01	.06	0.01	0.01	.10	0.02	0.02	.10
	Cognitive support	0.09	0.07	.14	0.04	0.09	.04	-0.00	0.08	-.00	-0.22	0.15	-.15
	Contingency	0.26	0.04	.52***	0.54	0.06	.74***	0.27	0.06	.56***	0.80	0.10	.69***

Emotional support	-0.03	0.10	-0.03	-0.20	0.12	-.13	-0.04	0.10	-.04	-0.13	0.20	-.05
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Note. 95% bias corrected and accelerated confidence intervals for B were calculated in the regression analyses and confirmed that all the significant effects in the table were genuine.

For the model of cognitive strategic behaviours as the dependent variable, $R^2=.14^{***}$ for Step 1; $\Delta R^2=.09^{***}$ for Step 2; $\Delta R^2=.17^{***}$ for Step 3, $\Delta R^2=.00$ for Step 4.

For the model of metacognitive strategic behaviours as the dependent variable, $R^2=.16^{***}$ for Step 1; $\Delta R^2=.06^{**}$ for Step 2; $\Delta R^2=.32^{***}$ for Step 3, $\Delta R^2=.01$ for Step 4.

For the model of motivational strategic behaviours as the dependent variable, $R^2=.08^*$ for Step 1; $\Delta R^2=.04^*$ for Step 2; $\Delta R^2=.20^{***}$ for Step 3, $\Delta R^2=.00$ for Step 4.

For the model of task performance as the dependent variable, $R^2=.16$ for Step 1; $\Delta R^2=.01$ for Step 2; $\Delta R^2=.29^{***}$ for Step 3, $\Delta R^2=.00$ for Step 4.

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

1 Following the above regression analyses, meditational analyses were conducted to
2 further examine the relationships between parental scaffolding, children's SRL
3 strategic behaviours, and task performance. The results showed that children's
4 metacognitive strategic behaviours mediated the relationships between parental
5 contingency and children's task performance, $b=0.62^{***}$, BCa CI (0.47, 0.76),
6 $ab_{cs}=.54$, BCa CI (0.43, 0.64). After the effect of children's metacognitive strategic
7 behaviours was taken into account, the direct effect of parental contingency on
8 children's task performance became insignificant.

9 **3.4 Does parental education influence parental scaffolding and children's SRL?**

10 Partial correlation analyses suggested that after the effects of parental scaffolding
11 behaviours and parental age were taken into account, parental education was not
12 significantly related to child outcomes except for children's task performance, $r=.18$,
13 $p<.05$. This indicated that parental education might have an indirect effect on some
14 child measures. To better understand the role of parent education, mediation analyses
15 were conducted using an add-on PROCESS (version 2.15) tool developed by A.F.
16 Hayes in SPSS.

17
18
19 Parental contingency mediated the relations of parental education to the three aspects
20 of children's SRL strategic behaviours and task performance. In contrast, parental
21 cognitive support and emotional support did not have a significant effect in the
22 mediation models. Table 4 summarises the role of contingency in each mediation
23 analysis. After the effect of parental contingency was taken into account, the effect of
24 parental education on all the aspects of children's SRL strategic behaviours and task
25 performance became insignificant. Even for children's task performance that was
26 significantly related to parental education when parental scaffolding behaviours were
27 controlled, the direct effect of parental education on children's task performance
28 became insignificant when the effect of parental contingency was entered in the
29 model.

1 Table 4

2 *The Mediating Role of Parental Contingency in the Relationships between Parent*
 3 *Education and Child Measures, with 95% Bias Corrected and Accelerated Confidence*
 4 *Intervals (BCa CI) Reported. Confidence Intervals based on 1000 Bootstrap Samples*

Mediation model	<i>b</i>	BCa CI	<i>ab_{cs}</i>	BCa CI
1. Parent education → parental contingency → children's cognitive strategic behaviours	0.08**	(0.05, 0.13)	.15	(0.06, 0.25)
2. Parent education → parental contingency → children's metacognitive strategic behaviours	0.14***	(0.07, 0.24)	.21	(0.08, 0.33)
3. Parent education → parental contingency → children's motivational strategic behaviours	0.07**	(0.03, 0.13)	.17	(0.07, 0.30)
4. Parent education → parental contingency → children's task performance	0.23***	(0.14, 0.36)	.27	(0.15, 0.40)

5 **p* < .05. ** *p* < .01. *** *p* < .001.

6

7 **4. Discussion**

8 Four main findings emerged from the current study. First, children's metacognitive
 9 strategic behaviours predicted their task performance. Second, parental contingency
 10 predicted children's SRL strategic behaviours. Third, parental contingency mediated
 11 the relations between parent education and children's SRL strategic behaviours and
 12 task performance. Fourth, based on the above findings, the present study indicated
 13 that in line with Western research, the relationship between parental scaffolding and
 14 children's SRL also exists in the Chinese context. Minor differences between the
 15 current results and Western findings were also found. Inconsistently with Western
 16 findings, parental emotional support was not an independent predictor of children's
 17 SRL in the present study.

18

19 **4.1 Children's SRL strategic behaviours and task performance**

20 The predictive value of metacognitive strategies for children's task performance
 21 found in the present study partially confirmed H1 and is in line with early work with
 22 school-age children (Veenman, Wilhelm, & Beishuizen, 2004), which indicated that
 23 metacognitive skillfulness was the main predictor for children's learning outcomes.
 24 Particularly when learners are faced with a challenging task, metacognitive strategies
 25 help them handle task complexity step by step.

26

27 The results showed that children's cognitive strategic behaviours were not predictive
 28 of their task performance. Very few studies have examined the role of different SRL
 29 strategies in task performance. As mentioned earlier, although Dermitzaki et al. (2009)
 30 investigated cognitive, metacognitive, and motivational strategies respectively, the
 31 first two dimensions were combined together and found to jointly predict children's

1 task performance, which led to the magnitude of the effect exerted by cognitive
2 strategic behaviours alone remaining unknown. In the present study, both the puzzle
3 and origami tasks required children to effectively utilise the model and instructions.
4 However, the possession of this basic cognitive skill was needed but not sufficient for
5 achieving high levels of performance. For instance, some children referred to the
6 model or instruction sufficiently but failed to plan their time and monitor their
7 progress effectively. They gained useful information from the model and instructions
8 by using cognitive strategies, but were unable to use the information productively due
9 to deficiencies in metacognitive skills. This finding is consistent with the view that
10 metacognitive strategic behaviours may occupy a central position in problem solving
11 (Mayer, 1998). Similarly, previous findings have suggested that students who are
12 more adaptive at monitoring the effectiveness of cognitive strategies are more likely
13 to demonstrate good performance (Wolters, 2003). In short, acquisition of basic
14 cognitive strategies may not be sufficient to predict successful task performance.
15 Future research explaining the relationships between children's use of particular
16 category of strategies and problem-solving performance in various kinds of tasks is
17 warranted.

18
19 In relation to H1, the indirect contribution of children's motivational strategic
20 behaviours to task performance found in the present study replicated the finding of
21 Dermitzaki et al. (2009), while some other studies have indicated a direct influence of
22 motivational behaviours on academic performance (e.g. Onatsu-Arvilommi, Nurmi, &
23 Aunola, 2002). The inconsistency across the studies might result from substantial
24 differences in methodology. In the present study, one possible reason for this
25 particular finding is that most children showed high levels of motivational strategic
26 behaviours. The low variability in this measure led to its insignificant influence on
27 variability in children's task performance. One explanation for children's high levels
28 of motivational behaviours may relate to Chinese culture. Influenced by Confucian
29 teachings, Chinese children generally place a great emphasis on effort and its
30 importance to satisfying performance (Chen, Lee, & Stevenson, 1996). This may
31 enable them to motivate themselves in learning contexts. However, this assumption
32 has only been examined among elementary school students in Chen et al. (1996).
33 Additional comparative studies to explore kindergarten children's motivational
34 strategic behaviours and its relation to task performance are needed.

35 36 **4.2 Parental scaffolding and children's SRL**

37 In support of H2, parental contingency significantly predicted children's SRL
38 strategic behaviours. Also, the results showed that parental contingency contributed to
39 children's metacognitive strategic behaviours, which in turn predicted task

1 performance. Through examining contingency indicated by both the levels of parents'
2 demand and children's understanding, the present study expanded work by Neitzel
3 and Stright (2003) that only looked at parents' manner of providing instructions but
4 did not consider children's ongoing evidence of understanding. The predictive value
5 of parental contingency on children's SRL is in line with existing Western evidence.
6 Parents' abilities to provide instructions contingent on children's levels of
7 understanding enable children to effectively learn and used SRL strategies in
8 problem-solving situations (Pino-Pasternak et al., 2010), which in turn lead to
9 successful performance.

10
11 It is worth noting that children's SRL strategic behaviours were examined in the
12 child-alone tasks approximately three weeks after the parent-child session. Parental
13 contingency, therefore, seems to have an influence on children's SRL outcomes in the
14 longer term. This finding is supported in work with school-age children. For instance,
15 Pratt and Savoy-Levine (1998) suggested that children tutored in a contingent manner
16 achieved better performance than those tutored by non-contingent parents in a
17 one-month post-test. Mattanah et al. (2005) revealed a similar result that parents'
18 contingent scaffolding was a unique predictor of children's task performance in the
19 immediate term and school competence in the long term. It is possible that when
20 provided support contingent on their abilities, children have the opportunity to
21 practice acquired knowledge and develop novel skills, thereby allowing them to
22 effectively internalise and generalise newly instructed strategies to independent
23 problem-solving contexts over time. However, this finding needs to be tested in
24 longitudinal studies.

25
26 In contrast, the results showed that parental cognitive support did not predict
27 children's SRL strategic behaviours. A very small body of research has provided
28 supporting evidence. For instance, parents' contingent behaviours were significantly
29 related to kindergarten children's success on problem-solving tasks, while the amount
30 of time spent in didactic teaching and the average level of parental intervention did
31 not correlate with children's performance (Pratt, Kerig, Cowan, & Cowan, 1988).
32 These findings underscored that the extent to which parental scaffolding leads to
33 children's success on problem-solving tasks substantially depends on the level of
34 contingency with which cognitive support is provided rather than the quantity of
35 cognitive support.

36
37 In support of H4, parental emotional support did not have a predictive value for
38 children's SRL strategic behaviours. In contrast to this result, early Western studies
39 have established a connection between parental emotional support and different

1 aspects of children's self-regulatory behaviours. For example, parents' emotional
2 support contributes to children's metacognitive talk and monitoring in the classroom
3 (Stright et al., 2001) and children's task persistence (Salonen et al., 2007). In the
4 present study, a low variability in the parental emotional support measure may have
5 resulted in the absence of its influence on children's SRL outcomes. Most parents
6 displayed encouragement behaviours infrequently but rarely showed rejection
7 behaviours during interactions with their children. The low level of encouragement
8 and rejection therefore produced a moderate aggregate score of emotional support for
9 most parents. It is also possible that the infrequency of encouragement does not
10 discourage children from employing SRL strategies and achieving a satisfying level
11 of performance, as long as the overall problem-solving atmosphere is warm and
12 caring.

13
14 The infrequent displays of encouragement may mirror specific features of Chinese
15 parents' scaffolding. As Chinese parents place great value on achievement and
16 incorporate children's accomplishments into their sense of worth (Ng, Pomerantz, &
17 Deng, 2014), they tend to de-emphasise rather than emphasise children's success and
18 emphasise rather than de-emphasise children's failure to help children improve their
19 performance (Ng et al., 2007). It should be noted that in spite of Chinese parents'
20 relatively infrequent expressions of encouragement, Chinese parents value highly the
21 importance of love and affection in childrearing (Chao, 1995; Chao & Tseng, 2002).
22 Confucianism advocates that benevolence, as a greatly regarded virtue emphasising
23 showing affection to those closely related to us, should be shown in parenting
24 practices (Hwang, 2001). Due to the overall caring atmosphere created by parents,
25 children's SRL and learning in general are not necessarily affected by limited parental
26 affective displays and encouragement during problem-solving processes. However,
27 the insignificant association between Chinese parents' emotional support and
28 children's SRL outcomes found in the present study needs to be interpreted with
29 caution due to the lack of evidence in the literature, and requires further studies to
30 explore the influences of cultural values on parents' emotional support in
31 problem-solving contexts.

32 33 **4.3 Parental education and children's SRL**

34 In support of H3, the results indicated that parental education exerted indirect
35 influences on children's SRL strategic behaviours and task performance through the
36 mediation of parental contingency. It has to be noted that although the results
37 suggested that parental contingency fully mediated the relationships between parental
38 education and children's SRL, we did not claim full mediation in the study, as it is not
39 recommended unless all possible mediators would have been measured, which seems

1 impossible (Hoyle & Kenny, 1999; Rucker, Preacher, Tormala, & Petty, 2011). In
2 addition to contingency, other mediators between parental education and children's
3 SRL, such as parental attitudes towards children's learning, may exist and need to be
4 explored in future research.

5
6 Parents with more education tended to provide higher levels of contingent support,
7 which in turn predicted higher levels of children's strategic behaviours and task
8 performance. Education provides parents important resources to facilitate children's
9 learning (Duckworth & Sabates, 2005). This finding is consistent with previous
10 research which has suggested that higher levels of parental education predicted
11 greater use of contingent instructions in problem-solving situations (Carr & Pike,
12 2012). Also, it expands the work by Neitzel and Stright (2003), confirming the
13 assumption that parental scaffolding behaviours are more predictive of children's SRL
14 than parental education. From a practical point of view, this finding may provide
15 valuable insight into parenting interventions for less-educated parents. Educators may
16 help parents improve children's educational outcomes by providing advice on
17 contingent instructions.

18 19 **5. Conclusions**

20 The present study has limitations that should be taken into account when interpreting
21 the findings. First, the correlational design of the study does not permit causal
22 conclusions. Experimental studies are needed to explore the causal relationships
23 between parental scaffolding and children's SRL. Second, the types of tasks used in
24 the study are limited. It would be useful for future research to use other types of tasks
25 to capture the richness of parent-child dynamics and children's self-regulatory
26 processes. Third, in spite of our focus on Chinese kindergarten children, the sample
27 does not represent the diversity in China. The parents, recruited from Beijing, had
28 higher education levels than the national average. The role of parental scaffolding in
29 children's SRL may be different in other socio-economic environments.

30
31 Overall, the present study provides the first evidence that in line with findings from
32 Western cultures, parental support provided in a contingent manner is important for
33 Chinese kindergarten children's SRL strategic behaviours and task performance.
34 Furthermore, the study reveals an optimistic finding that it is parental scaffolding
35 rather than education itself that has a direct effect on children's SRL outcomes. As the
36 constructs of "scaffolding" and "contingency" remain unfamiliar to most Chinese
37 parents, the results have valuable practical insights on how parents and educational
38 practitioners can facilitate their children's SRL skills.

1

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