

## The impact of teacher support and feedback on students' reading literacy: the mediating and suppression effect of meta-cognitive strategies

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**Abstract:** Teacher support and feedback are important factors that affect students' meta-cognitive strategies and reading literacy, but at present, the relationships among perceived teacher's support and feedback, meta-cognition, and reading literacy are unclear up to the present. The current study using structural equation modeling to investigate the relationships among these variables by using the Chinese students' data which come from the program for international student assessment in 2018. Results show that: 1.The perceived teacher's support has significant positive effect on both the reading meta-cognitive strategies (including understanding and remembering strategy and summarizing strategy) and reading literacy. 2. The perceived teacher's feedback has significant negative effect on reading literacy and has significant positive effect on understanding and remembering strategy, while the effect of feedback on summarizing strategy is non-significant. 3. The reading meta-cognition played both the mediation and suppression effect in the relationship between teacher's support and feedback and reading literacy.

**Keywords:** Reading literacy; teacher support and feedback; reading meta-cognitive strategies; mediating effect; suppression effect

### 1 Introduction

Reading is the oldest and most enduring way of learning and communication for mankind, and it is also an important way for the development and inheritance of a country and national culture. In the fast changing era of knowledge economy, all kinds of information are growing explosively. Information acquisition is no longer an important factor hindering people's learning. Instead, how to select, screen, evaluate and use information has become the key to improving people's reading literacy. How to select, screen, evaluate and use information largely reflects the level of reading literacy. Reading literacy is an important support for people's learning, an important foundation for lifelong development, and an important symbol of the improvement of social civilization and comprehensive national strength (Song Naiqing & Luo Shiyan, 2018). Cultivating and improving students' reading literacy is of great significance to both personal and national development.

Currently, there are in-depth and detailed studies on reading literacy at home and abroad. International assessment projects such as PISA, PIRLS, and NAEP have clearly defined reading literacy and conducted periodic assessments of students' reading literacy. Professor Zhu Xinhua, a scholar from Hong Kong, believes that reading literacy is "decoding texts composed of written words, pictures, tables, and electronic language materials, integrating, inferring, and evaluating information, and proposing new ideas; actively participating in relevant activities, and communicating with teachers, students, and family members, communicate with people in society, and experience the fun of reading; actively reflect and use the information obtained from reading to solve practical problems" (Zhu Xinhua, 2015). Chinese scholar Professor Song Naiqing drew on reading literacy frameworks such as PISA,

PRILS, and NAEP, and based on the requirements of the "Chinese Curriculum Standards for Full-time Compulsory Education (2011 Edition)" and based on empirical research, they operationally defined reading literacy: "Students use knowledge, It is a comprehensive expression of the knowledge, abilities and character required for reading perception, reading comprehension, reading evaluation and reading expression of reading materials" (Luo Shiyan, Song Naiqing & Wang Yanling, 2016). Reading literacy is of great value to individual development and national progress. It requires us to actively explore methods and paths to improve students' reading literacy on the one hand, and to identify the relevant factors that affect students' reading literacy on the other hand. Research shows that students' reading literacy is comprehensively affected by multiple factors such as the country, family, school, teachers and students themselves (Xiao Lin & Song Naiqing, 2017). Teacher factors and students' own factors are two very important factors (Huang Huijing & Xin Tao, 2007; Zhang Wenjing et al., 2012). Therefore, this study intends to explore the influencing factors of students' reading literacy from two aspects: teachers and students, in order to clarify the internal relationship between teachers, students and reading literacy.

As important others that students can come into contact with during school, teachers directly or indirectly affect students' learning through their teaching methods and words and deeds. Teacher support and teacher feedback are two important aspects of teacher factors. Teacher support is students' perception of teachers' attention to students, care for students' lives and emotions, and support for students' learning problems (SFraser et al., 2015). It has an important impact on students' academic development (Schuitema et al., 2015). , 2016; Chen Xu et al., 2018; Qin Xufang, Sun Jingjing, 2020), Vansteenkiste used college students as subjects and found through a completely randomized two-factor design that the autonomy support provided by teachers has a significant impact on students' achievement (Vansteenkiste et al. , 2004). Zhang Jiajia studied the relationship between children's perceived teacher support and mathematics performance, and found that children's perceived teacher support can significantly positively predict their mathematics performance and act on mathematics performance through students' self-efficacy (Zhang Jiajia et al., 2019). In addition, research also found that teacher support can not only affect students' learning outcomes, but also have a significant impact on students' meta-cognitive strategies (González et al., 2015). Through a cross-lagged analysis method, Schuitema et al. found that students' perceived teacher support can significantly affect students' meta-cognitive strategies. The stronger the students' perceived teacher support, the more frequently students use meta-cognitive strategies (Schuitema et al. , 2016).

As another aspect of teachers' teaching process, teacher feedback also plays an important role in students' learning and development. Teacher feedback refers to the process in which teachers observe differences between students' actual performance and expected standards and inform students of these differences to improve their performance (Van et al., 2013). Harks et al. systematically explored the relationship between teacher feedback and student achievement, and divided teacher feedback into process-oriented and performance-oriented feedback. The results of path analysis showed that when teachers adopt process-oriented feedback, it changes the level of student achievement. The amount is significantly greater than that of performance-based feedback, and process-oriented feedback has a greater indirect effect on the changes in students' mathematics achievement and learning interest (Harksetal., 2014). Based on the PISA2018 test data, Chen Chunjin analyzed the influencing factors of Chinese students' reading literacy and found that teacher feedback has a significant impact on Chinese students' reading literacy, but this impact is a negative impact, that is, the teaching feedback provided by teachers The more, the lower the students' reading literacy level (Chen Chunjin, 2020). Some researchers have also studied the relationship between teacher feedback and students' meta-cognitive strategies, but obtained inconsistent results (Harksetal., 2014; Leeetal., 2015; Molinetal., 2020). Lee et al. discussed the impact of teacher feedback on students' meta-cognition in a human-computer interactive teaching situation. The results showed that teacher feedback on students' learning activities can better predict the probability of students using meta-cognitive strategies. Teaching feedback is an important factor in

improving students' meta-cognition. Important teaching strategies for the use of meta-cognition (Leet al., 2015). Through a randomized experiment, Molin et al. found that only when students used peer discussion and teacher feedback at the same time, it had a positive impact on students' meta-cognitive skills; only using teacher feedback did not have a significant impact on students' use of meta-cognitive strategies. impact (Moline et al., 2020). Students' own factors are the most important factors affecting their performance or literacy level. Among the five major factors that affect students' reading literacy, the country, family, school and teachers are all external stimuli. Their impact on students' achievement levels and the size of their effects will be transformed to a large extent through students' own factors, such as students' Self-efficacy, self-esteem, interest in learning, meta-cognitive strategies, etc. Research has found that in most cases, emotional support from parents or teachers affects students' reading literacy through the mediation of students' own cognitive and emotional factors (Chen Xu et al., 2018; Zhang Jiajia et al., 2019; Harksetal., 2014; Liao Qin, Wang Zhe, 2020), and among the own factors that affect students' learning results, meta-cognitive strategies and other factors have a more important impact on learning results than other factors (Chen Chunjin, 2020; Zhou Zhijin et al., 2017; Pourtaherian et al. ., 2013). In layman's terms, meta-cognitive strategies refer to cognition of cognition, which refers to an individual's cognition of their own cognitive strategies and cognitive resources. Self-monitoring and self-regulation are its two main contents (Flavel, 1979). Controlling the family and school environment, reading meta-cognitive strategies can explain 19.8% of the variation in students' reading literacy, and their relative contribution to the total variation in students' reading literacy also reaches 36.4%, which is much higher than other factors of students, such as Self-education expectations (24.5%) and students' reading interests (7.05%) (Chen Chunjin, 2020).

Based on the above research results, it can be seen that there is a close relationship between teacher support and feedback and students' learning outcomes and meta-cognitive strategies. However, the current research on the relationship between teacher support or feedback and learning outcomes, and between students' meta-cognitive strategies and learning outcomes is still unclear in China. There are relatively many studies outside the country, but there are relatively few studies that consider the relationship between teacher support and feedback, meta-cognitive strategies and learning outcomes at the same time; the relationship between teacher feedback and meta-cognitive strategies is still unclear. In this regard, this study intends to use Chinese students as subjects to explore the interrelationship between teacher support and feedback, students' meta-cognitive strategies and students' reading literacy in the Chinese educational context. Based on the previous literature review, this study makes the following research hypotheses: 1. Teacher support has a significant impact on students' reading literacy; 2. Teacher feedback has a significant impact on students' reading literacy; 3. Students' meta-cognitive strategies It has a significant impact on their reading literacy; 4. meta-cognitive strategies play a mediating role between teacher support and students' reading literacy.

## **2. Research design**

### **2.1 Subjects selection**

PISA2018 conducted a relatively systematic test on students' reading literacy. Four provinces and cities in eastern China (Beijing, Shanghai, Jiangsu, and Zhejiang) participated in this PISA test. Therefore, this study will use the test data of PISA2018 Chinese subjects to analyze the performance and influencing factors of Chinese students' reading literacy. 12,508 students from 361 schools participated in the test. After weighting, these students represent a total of 992,302 15-year-old middle school students (born in 2002) in four provinces and cities in eastern China. (Chen Chunjin, 2020) Since some students have missing data on some items, after excluding students with more than 50% missing responses on each variable (taking the teacher support as an example, this variable has 4 response items, when a student fails to answer more than 2 questions, the subject will be deleted), and the final number of subjects is 11,973. Among these student groups, there are 5,734 girls (47.9%) and 6,239 boys

(52.1%); the grades of the students range from the first year of junior high school to the third year of high school, with the majority of students in the third year of junior high school and the first year of high school, and the number of students in each grade is 26 ( 0.2%), 189 (1.6%), 4077 (34.1%), 7544 (63.0%), 130 (1.1%) and 7 (0.1%). Overall, there are 4292 junior high school students (35.85 %), there are 7681 high school students (64.15%).

## 2.2 Variable Selection

The study mainly selected four variables, namely students' perceived teacher support (TEACHSUP), perceived teacher feedback (PERFEED), reading meta-cognitive strategies and students' reading literacy scores. Perceived teacher support has four 4-level scoring items, with 1 indicating that some kind of teacher support basically occurs in every class, and 4 indicating that it almost or never occurs; perceived teacher feedback has 3 items. Items scored on a 4-level scale, with 1 indicating that a certain type of feedback from the teacher almost or never occurs, and 4 indicating that feedback occurs in almost every class. PISA subdivides students' reading meta-cognitive strategies into three sub-dimensions, namely understanding and remembering (UNDREM), summarising (METASUM) and assessing credibility (METASPAM). This study will use these three strategies as students' meta-cognitive strategies; The three strategies have 6, 5 and 5 items respectively, and all items are scored at 6 levels . 1 means that a certain strategy is completely useless for the reading task, and 6 means that a certain strategy is very useful for the reading task. In addition, this study will use the average of 10 plausibility values provided by PISA as students' reading literacy (M=561.03, SD=85.94); considering that gender and students' family economic, social and cultural status (ESCS), students' reading literacy has an impact (Chen Chunjin, 2020; Sun Xiaojian et al., 2021); in addition, since it involves junior high school and high school students, and different educational stages may also have an impact on students' reading literacy, the study combines gender, ESCS and educational stage (junior high school) and high school) as covariates. The description of each variable is shown in Table 1 (OECD, 2019).

Table 1 Main variables of the study and description of variables<sup>1</sup>

type	variable	variable Description	reliability
predictor variables	teacher support	The degree to which students perceive the teacher's concern for them, the help they provide for the problems they encounter, and the care they show for other aspects of their lives and emotions.	0.86
	teacher feedback	Students perceived feedback from teachers on the strengths, weaknesses, and ways to improve.	0.90
	understanding and remembering	Inquire about strategies for students to understand and remember information related to the article.	0.77
	summarising	Inquire about strategies for writing summaries after reading lengthy and profound articles.	0.80
	assessing credibility	Assess students' ability to discern information reliability.	0.43
result variables	reading literacy	The ability of students to use knowledge and skills in reading, analyzing, reasoning, and communicating effectively to solve and explain problems in various contexts.	--
	gender	0 represents female, 1 represents male	--

<sup>1</sup> Specific examples of each predictor variable can be found on the PISA official website: <https://www.oecd.org/pisa/data/2018database/>

covariates	ESCS	The combination of the highest professional status of one parent, the average education level of the parents, and family wealth, the higher the value, the higher the ESCS.	--
	grade	0 represents middle school, 1 represents high school	--

### 2.3 Data processing

Use SPSS20.0 to clean the data and calculate the reliability of the variables used in this study, The  $\alpha$  coefficient is shown in Table 1; Mplus6.12 was then used for Structural Equation Modeling(SEM) analysis. Due to the assessing credibility in reading meta-cognitive strategies is relatively low (0.43), and incorporating it into SEM may produce relatively large errors, so this sub-dimension was deleted in this study. In addition, considering that students' summarizing an article (summarizing) needs to be based on understanding the article (understanding and remembering), this study believes that students' understanding and remembering(UNDREM) can affect students' summarising(METASUM). Based on this, the hypothetical model of this study is shown in Figure 1.

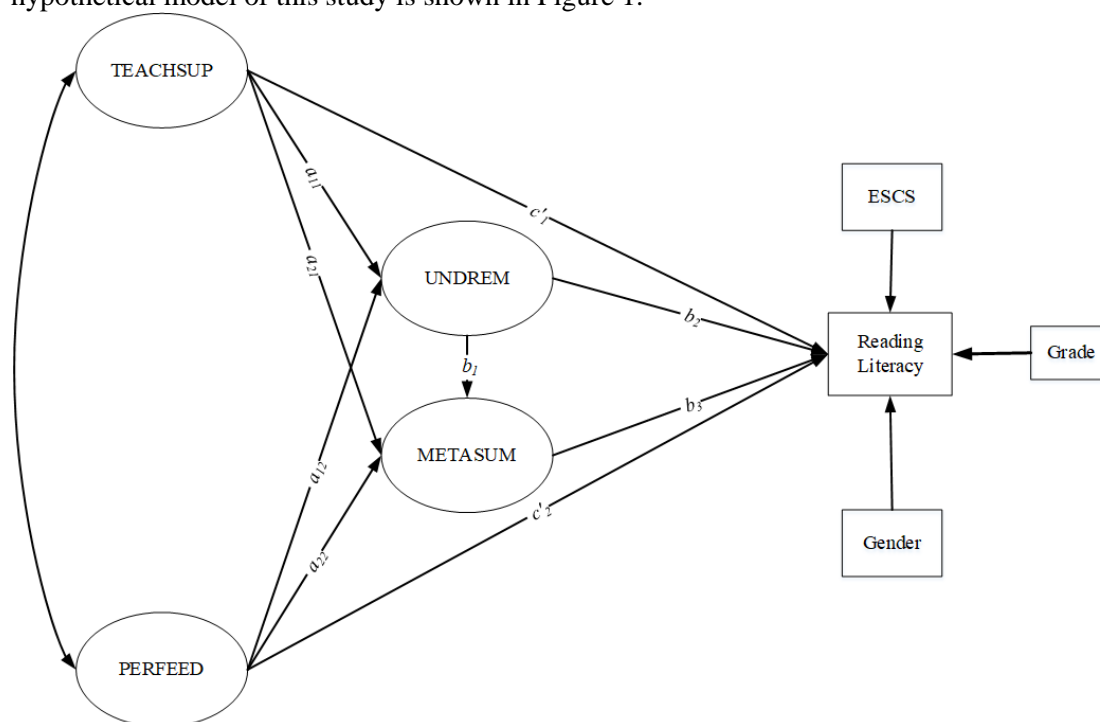


Figure 1 The hypothetical model of this study

## 3 Research results

### 3.1 Common method bias

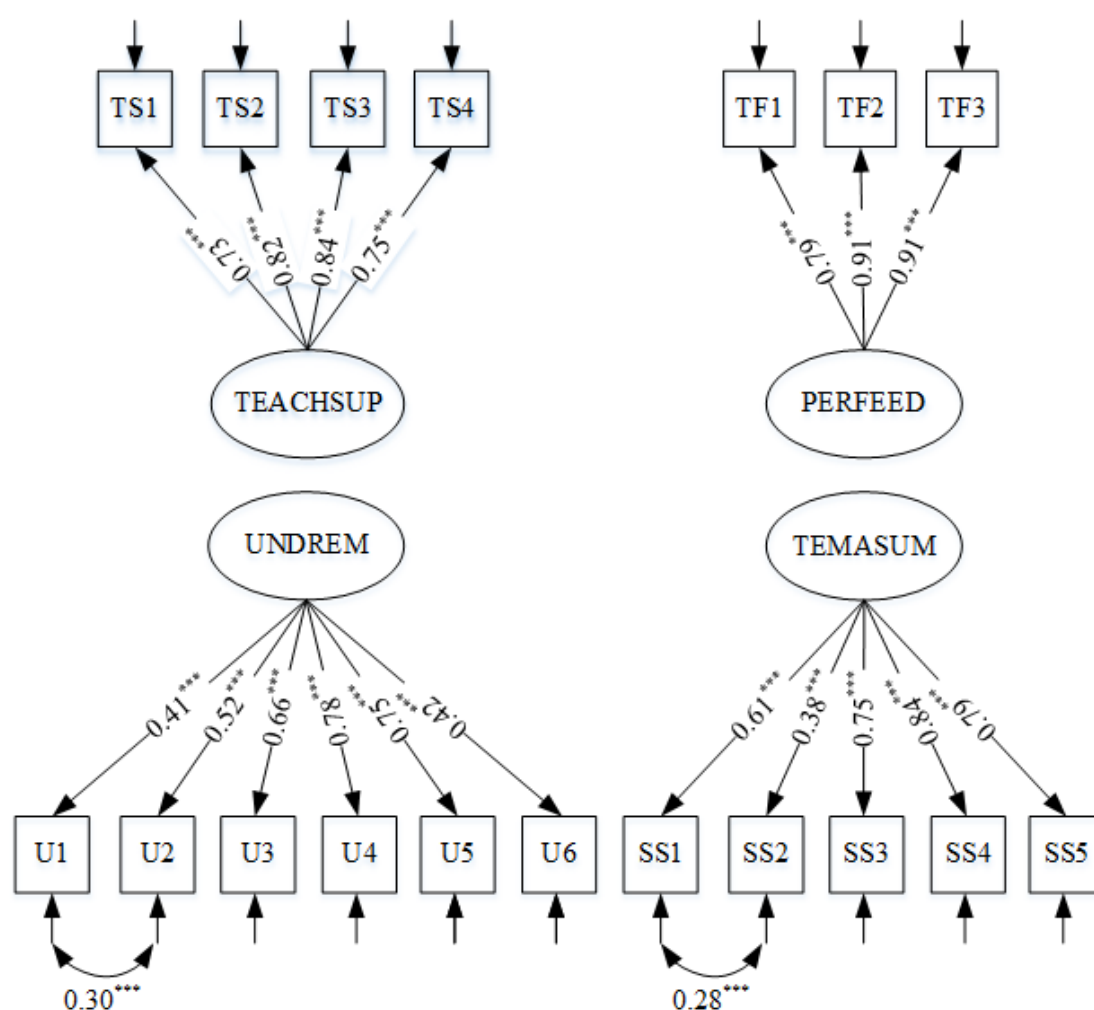
The Harman single-factor test based on exploratory factor analysis was used to test the possible common method bias problem. The results showed that there were 6 unrotated factors in the case of principal component analysis, and the largest factor could explain 26.15% of the total variation in the test, less than the critical value of 40% (Cao Yanmiao et al., 2017), indicating that there is no serious common method bias in this study.

### 3.2 SEM estimated results

The SEM analysis results found that the fitting results of the hypothetical model were poor. Based on the revision indicators provided by Mplus and without violating the model assumptions, the study increased the correlation between error terms on two question indicators of the two reading meta-cognitive strategies. (See Figure 2 for details). At this time, the model can fit the test data well. The fitting indicators are  $\chi^2=9134.12^{***}$ ,  $df=195$ ,

CFI=0.92, TLI=0.90, RMSEA =0.06 and SRMR=0.06. Subsequent presentation of results will be based on the revised model. Considering that if the measurement model and structural model are placed in one picture, the picture will be relatively large and unattractive, so we try to decompose the complete SEM picture into a measurement model diagram and a structural model diagram. The estimation results of the measurement model and the structural model will be analyzed separately below.

Figure 2 shows the loads of the item indicators on each variable (measurement model). The item loads on the teacher support (TEACHSU) ranged from 0.73-0.84, the estimated loads on the teacher feedback (PERFEED) ranged from 0.79-0.91, and the loads on students' meta-cognitive strategies for understanding and remembering (UNDREM) ranged from 0.41-0.78. The loads of students' summarising (METASUM) ranged from 0.38-0.84. The estimated loads for teacher support and feedback are relatively large, both above 0.70; Although the load on reading meta-cognitive strategies is relatively small, all estimated loads are significant at the 0.001 level

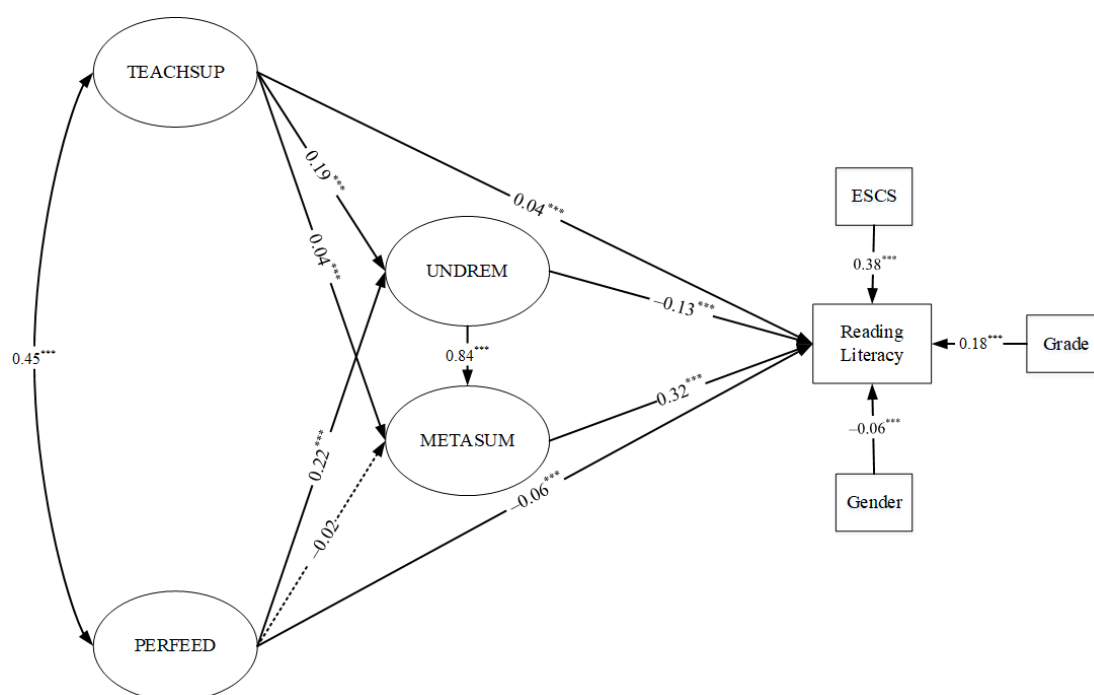


Note: The values in the figure are all standardized coefficient values : \*\*\* P<0.001

Figure 2 Loads of four latent variables on various question indicators

Figure 3 presents the estimated path coefficients between each test variable (structural model). It can be seen from the figure that, after controlling for students' ESCS, gender, and students' educational stage, students' perceived teacher support and feedback have a significant direct impact on students' reading literacy (neither  $c_1\hat{c}$  nor  $c_2\hat{c}$  is equal to 0), in which teacher support has a positive impact, while teacher feedback has a negative impact; at

the same time, teacher support also has a significant positive impact on students' two reading meta-cognitive strategies (a11 and a21), while teacher support also has a significant positive impact on students' two reading meta-cognitive strategies ( $a_{11}$  and  $a_{21}$ ), while teacher feedback has a significant positive impact on understanding and remembering meta-cognitive strategies ( $a_{12}$ ), but has an insignificant impact on summarising ( $a_{22}$ ); both understanding and remembering and summarising have a significant impact on students' reading literacy, in which summarising have a positive impact on reading literacy ( $b_2$ ), while understanding and remembering have a negative impact ( $b_3$ ); moreover, understanding and remembering can significantly and positively predict summarising ( $b_1$ ). Teacher support and feedback, understanding and remembering, summarising, ESCS, gender and students' educational stage can explain 23.2% of the variation in students' reading literacy ( $R^2=0.232$ ).



Note: The values in the figure are all standardized coefficient values : \*\*\*  $P < 0.001$ . The dashed line indicates that the coefficient is not significant.

Figure 3: Estimated path coefficients between variables in the structural model

### 3.3 Testing the mediating role of meta-cognitive strategies

Based on the test procedure of mediating effects (Wen Zhonglin & Ye Baojuan, 2014), without considering understanding and remembering and summarising and controlling students' ESCS, gender and educational stage, there is a good model fit between teacher support, teacher feedback, and student reading literacy ( $\chi^2=1455.85^{***}$ ,  $df=39$ ,  $CFI=0.97$ ,  $TLI=0.96$ ,  $RMSEA=0.06$  and  $SRMR=0.05$ ), the path coefficients between teacher support and teacher feedback and reading literacy are both reached the significance level of 0.001, and their standardized coefficients ( $c_1$  and  $c_2$ ) were 0.08 and  $-0.04$  respectively. The bias-corrected non-parametric percentile Bootstrap method was used to repeatedly sample 2000 times to conduct the mediation effect test. Each path coefficient and the estimation results of the mediation effect are shown in Figure 2 and Table 2 respectively. It can be seen that the two reading meta-cognitive strategies not only have a mediating effect, but also have partial suppression effect between teacher support, teacher feedback and students' reading literacy. Under the condition of consistent mediating effect, the direction of the direct effect ( $c'$ ) and indirect effect ( $ab$ ) of the independent variable on the outcome variable is consistent. The independent variable can positively (negatively) affect the mediating variable, and then

positively (negatively) affect the outcome variable. taking "Teacher Support→summarising→Reading Literacy" as an example, when students perceive more teacher support, students use more summarising strategies, thereby improving their reading literacy. Under the condition of inconsistent mediation effects, the directions of the direct effect ( $c'$ ) and indirect effect ( $ab$ ) of the independent variable on the outcome variable are inconsistent, but at this time the absolute value of the direct effect on the outcome variable ( $|c'|$ ) is still smaller than The absolute value ( $|c|$ ) of the direct impact of the independent variable on the outcome variable without intervening variables, that is,  $|c\phi| < |c|$  (Wen Zhonglin & Ye Baojuan, 2014). Taking "Teacher Support→Understanding and Remembering→Reading Literacy" as an example, when students perceive more teacher support, students think that the strategies they are currently using (such as understanding and remembering) are strategies allowed and recognized by teachers, so students may use understanding and remembering frequently, but this strategy may not be able to process the reading materials in depth. As a result, although students can still improve their reading literacy, it also puts students in a state of getting half the result with twice the effort. The suppression effect is roughly the same as the consistency mediation effect. The only difference is that under the suppression effect  $|c'|$  is larger than  $|c|$ , that is,  $|c\phi| > |c|$ . Taking "Teacher Feedback→Understanding and remembering→Summarising→Reading Literacy" as an example, when understanding and remembering and summarising are not considered, teacher feedback has a negative impact on students' reading literacy ( $c=-0.04$ ), that is, the more teacher feedback students perceive, the reading literacy level will decrease; and after considering understanding and remembering and summarising, the negative impact of teacher feedback students perceive on their reading literacy becomes stronger, indicating that the negative direct impact of teacher feedback on students' reading literacy is not as small as it seems on the surface. The actual situation is that its negative direct impact is greater. It is just that the negative impact that is not shown is covered by other variables such as understanding and remembering and summarising.

Table 2 Estimated results of mediating effects

mediation effect pathway	estimated value	95% confidence interval	effect value	effect type
Teacher Support→Understanding and Remembering→Reading Literacy	-0.03	[-0.04, -0.02]	0.62	inconsistent intermediary
Teacher Support→Summarising→Reading Literacy	0.01	[0.01, 0.02]	0.16	inconsistent intermediary
Teacher Support→Understanding and Remembering→Summarising→Reading Literacy	0.05	[0.04, 0.06]	0.64	consistency intermediary
Teacher Feedback→Understanding and remembering→Reading Literacy	-0.03	[-0.04, -0.02]	0.72	consistency intermediary
Teacher Feedback→Summarising→Reading Literacy	-0.01	[-0.01, 0.001]	--	--
Teacher Feedback→Understanding and remembering→Summarising→Reading Literacy	0.06	[0.05, 0.07]	0.99	cover

Note: The calculation method for the effect value under the mediation effect of consistency is  $ab/c$ , where  $a$  and  $b$  represent the path coefficients of the independent variable on the mediation variable and the mediation variable on the outcome variable, respectively.  $c$  represents the direct effect of the independent variable on the outcome variable in the absence



of mediation variables; The calculation method for the effect values of inconsistency mediation and masking effects is  $|ab/c'|$ , The explanation of  $a$  and  $b$  is the same as the mediating effect,  $c'$  indicates the direct effect of the independent variable on the outcome variable in the presence of mediating variables.

#### **4 Discussion**

This study explored the relationship between students' perceived teacher support and feedback, students' reading meta-cognitive strategies and reading literacy based on the latent variable modeling method.

##### **4.1 Perceived teacher support, reading literacy and meta-cognitive strategies**

The results of this study found that, controlling for students' gender and ESCS, students' perceived teacher support has a significant positive impact on their reading literacy performance, regardless of whether students' reading meta-cognitive strategies are included or not. The first study Assuming that the hypothesis is verified, the results are the same as previous studies (Chen Chunjin, 2020; Liao Qin & Wang Zhe, 2020). Teacher support is one of the most important supports for students to obtain and maintain social relationships in school, and it plays an indelible role in students' academic and social development (Chen Yan et al., 2019). Self-determination theory believes that only when students meet lower-level emotional needs, can they pursue higher-level spiritual and cultural needs. Students have three basic emotional needs: relatedness, ability and autonomy, when students are unable to meet these emotionl needs, it is difficult for them to pursue higher-level knowledge needs; teachers' active support for students can help students meet these three basic needs, thereby increasing students' sense of security in the school environment and enabling students to seek knowledge and explore with peace of mind, thereby promoting the development of students in all aspects (Decietal., 2000).

In addition, the results of this study also show that perceived teacher support can also significantly and positively predict students' reading meta-cognitive strategies. The stronger the teacher's support perceived by students, the greater the impact of reading meta-cognitive strategies on students. This result is also consistent with previous studies (Schuitema et al., 2016; González et al., 2015; Kazemiet al., 2016). It can be seen that teachers should give students more encouragement during the teaching process to meet students' basic needs such as relationships, abilities, autonomy, so that students can devote more energy to seeking knowledge and exploration, and promote students' studies ,emotion and social development healthy.

##### **4.2 Perceived teacher feedback ,reading literacy and meta-cognitive strategies**

Feedback is an important link and means in the process of teacher teaching and student learning. A course without teaching feedback is incomplete. Teacher feedback has an important impact on students' reading literacy. The results of this study confirmed the importance of feedback. However, the research results found that teacher feedback has a negative impact on students' reading literacy. In other words, the more feedback students' perceived from the teachers the lower the students' reading literacy level. This result is the same as many existing research results (Yan Bo et al., 2017; Lu Ke, Wang Yue, 2020), but it is different from Harks et al. research results (Harksetal., 2014) . The possible reason why teacher feedback in this study has a negative impact on reading literacy is that the feedback provided by teachers may not be effective teaching feedback. Some studies have pointed out that effective teaching feedback has accuracy, pertinence, motivation, diversity, guidance, interactivity and other characteristics (Peng Haoxiang, 2009). Only when teacher feedback contains these characteristics, feedback can promote teachers' teaching and students' learning, otherwise it will hinder the development of normal teaching activities. Teacher feedback in PISA2018 mainly focuses on unilateral feedback on students' learning performance, which is closer to result-based feedback. Although it has a certain degree of motivation, it does not have the characteristics of accuracy, pertinence, diversity and interactivity. Therefore, this kind of teacher feedback may not be effective feedback. Harks et

al. also found that just using result-oriented feedback, it has little effect on improving students' achievement levels; on the contrary, process-oriented feedback can significantly improve students' achievement levels.

Based on the results of this study, it can be seen that teacher feedback perceived by students has different effects on different reading meta-cognitive strategies. It can significantly and positively predict students' understanding and remembering strategies, but it has no significant impact on summarizing. Lee found that when teachers provide students with formative feedback, they can greatly improve students' meta-cognitive management strategies, thereby improving students' perception and investment of learning learning (Leet al., 2015). Harks found that whether it is process-oriented or result-oriented feedback, the impact on meta-cognition (self-evaluation) is not significant; similarly, Molin found that when students only receive teacher feedback, the impact on meta-cognition (self-evaluation) is not significant. The impact of students' meta-cognition (self-managed learning or autonomous learning) is not significant. Only when teacher feedback is combined with peer discussion can teacher feedback have a significant positive impact on students' meta-cognition (Moline et al., 2020). Based on the above research, it can be seen that different types of teacher feedback will have an impact on different students' meta-cognitive strategies. Effective feedback and formative feedback can improve students' meta-cognitive level. From the definition of perceived teacher feedback in the PISA2018 questionnaire, teacher feedback in the study is more consistent with result-oriented feedback. This kind of feedback has no significant impact on summarising strategies, but it can strengthen students' understanding of the usefulness of understanding and remembering, thereby making students use this strategy more.

#### **4.3 Mediating effect and suppression effect of meta-cognitive strategies**

The results of the reliability analysis of the three sub-dimensions of meta-cognition strategies show that the test reliability of the variable of assessment of the credibility of reading information is relatively low. If it is simply included in SEM for analysis, on the one hand, it may result in significant errors, on the other hand, it may contaminate the true relationship between variables, so this dimension is deleted in this study. Looking at previous research (Chen Chunjin, 2020; Liao Qin, Wang Zhe, 2020), the vast majority of studies directly incorporate this variable into the test model for analysis, but obviously this approach is not advisable.

The results of this study indicate that students' meta-cognitive strategies play a mediating effect or suppression effect between teacher support, teacher feedback and reading literacy. On the one hand, summarising serve as mediating variables between teacher support and reading literacy. Part of the impact of teacher support on reading literacy will indirectly affect reading literacy by affecting students' summarising. In this way, the total effect of teacher support on reading literacy will be enhanced; in addition, teacher support will also improve students' summarising by positively affecting students' understanding and remembering strategies, and ultimately improve students' reading literacy. This result is the same as that of Schuitema, whom also found that students' meta-cognitive strategies play a mediating effect between teacher support and their average grade point (Schuitema et al., 2016). On the other hand, understanding and remembering have a suppression effect between teacher support and reading literacy, understanding and remembering and summarising have a suppression effect between teacher feedback and reading literacy. Taking the suppression effect of understanding and remembering as an example, teacher support can strengthen students' understanding of the usefulness of understanding and remembering and make students use this strategy more, but this strategy will have a negative impact on students' reading literacy, leading to a certain degree of decline in the total effect of teacher support on reading literacy. Thus, it can be seen that the impact of students' use of reading meta-cognitive strategies on reading literacy is not always positive. At the same time, its role between related predictor variables and reading literacy is not necessarily positive. Researchers need to analyze specific situation in order to obtain more accurate and scientific results and conclusions.

## 5. Conclusion

This study draws the following conclusions: 1. Perceived teacher support has a significant positive impact on reading meta-cognitive strategies and reading literacy; 2. Perceived teacher feedback has a significant negative impact on reading literacy, while it has a significant positive impact on understanding and remembering strategies; 3. Summarising strategies play a partial mediating role between teacher support and reading literacy, while understanding and remembering strategies play a suppression effect among teacher support, summarising strategies and reading literacy; 4. understanding and remembering strategies play a partial mediating role between teacher feedback and reading literacy, while summarising strategies play a suppression effect among teacher feedback, understanding and remembering strategies, and reading literacy.

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