



The role of perspective-taking in mediating the relationship between teacher feedback and reading achievement

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Abstract

Teacher feedback has been acknowledged as an important facilitator for students' learning performance. However, teachers' feedback efforts are not always found to pay off, especially in the context of Confucian-heritage countries. Scholars are seeking answers from student agencies during feedback-taking. The current study aimed to examine the role of students' perspective-taking in passing over the effect of teacher feedback on students' reading test performance. We set the study in Hong Kong, where teacher feedback has often been reported to fail its aims. We used OECD Programme for International Student Assessment (PISA) 2018 data generated by 5665 15-year-old students. The results of multi-level structural equation modeling confirmed our hypothesis that perspective-taking significantly mediated the relation between teacher feedback and students' reading achievement. Our results highlight the benefits of accounting for perspective-taking as a key element of student feedback literacy. Implications for future research and practice are discussed.

Keywords Mediation · Multilevel modeling · Perspective-taking · Reading · Teacher feedback

Introduction

Teacher feedback has been widely documented as an essential pedagogical means of empowering learning (Carless & Boud, 2018; Hyland, 2013). By taking teacher feedback, students can reflect on their existing knowledge, identify weaknesses and strengths, and take relevant

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measures to remedy these weaknesses (Bitchener & Knoch, 2010; Dann, 2016). However, due to the complex nature of feedback (Brooks et al., 2019; Evans, 2013), this transmission varies and does not always lead to better learning outcomes (Carless, 2020). A variety of factors have been found to contribute to this instability. Widely studied factors include contextual factors such as culture (Kennedy, 2016), teachers' instructional method (Van den Bergh et al., 2014), teacher assessment literacy (Stiggins, 1991), and student factors such as motivation to learn (Li, 2016), growth mindset (Yan et al., 2021), prior knowledge (Narciss et al., 2014), and competence to take feedback (Carless & Boud, 2018). Regardless of this advancement, the literature has ignored perspective-taking, an important factor that might impact students' feedback uptake.

Perspective-taking refers to a tendency or capacity to consider a situation from another person's perspective, and the concept involves three dimensions: perceptual, cognitive, and affective or emotional (Davis, 1983; Litchfield & Gentry, 2010). The perceptual aspect is about understanding how others may see and hear from their positions (Gülay Ogelman et al., 2017); the cognitive aspect denotes the ability to infer others' thoughts, beliefs, knowledge, and intentions, and the affective aspect connotes the ability to understand another person's emotional states (Healey & Grossman, 2018).

As a pivotal component of social cognition, perspective-taking enables individuals to understand others' mental states and actions (Frith & Frith, 2012; Healey & Grossman, 2018). Individuals equipped with perspective-taking are more ready to take in information from others. The association between feedback and perspective-taking has been supported in psychological research. For instance, experimental studies have shown that feedback can improve people's capacities in perspective-taking by reducing overreliance on self-perspective and strengthening the disposition to relate to others (Damen et al., 2021; Montoya-Rodríguez et al., 2017). In feedback research, studies have shown that teacher feedback can help students to challenge their erroneous views and elicit attention to broader perspectives (Forsythe & Johnson, 2017; Li & Zhang, 2020), an important message for the bond between feedback and perspective-taking.

In reading research, perspective-taking has been found to benefit reading by various means such as activating prior knowledge (Wetzels et al., 2011) and developing multicultural competency (Thein & Sloan, 2012). When confronted with multiple-text processing, students with a higher disposition of perspective-taking are more ready to infer the intentions and stances of authors from multiple sources, figure out relations among diversified perspectives, or discern their relevance to a specific issue (LaRusso et al., 2016; OECD., 2019).

In short, studies in relevant fields are suggesting the potential role of perspective-taking in bridging the relationship between teacher feedback and reading achievement. However, whether this role holds still awaits empirical investigations. The current study aimed to explore the relations among teacher feedback, perspective-taking, and reading, with an emphasis on the mediating role of perspective-taking. Given the outcry over the failure of feedback in the Confucian-heritage context, the current study was set in Hong Kong using the Programme International Student Assessment 2018 (PISA 2018) data (OECD., 2019).

Teacher feedback and learning

Feedback has been defined as the information concerning a learner's actual state of performance or understanding against a certain standard (Hattie & Timperley, 2007). Feedback comes from multiple sources (e.g., teachers and peer students), and hence is known as teacher feedback (Van den Bergh et al., 2014) and peer feedback (Falchikov, 2001).

An abundance of studies highlights teacher feedback as a powerful engine empowering learning. By providing feedback, teachers intend to guide students to amend their behavior or thinking to narrow the gap between a student's current level and the desired learning goals (Shute, 2008). Through information-rich feedback, learners can notice their weaknesses and strengths, revise complex mistakes, and reach learning goals (Dann, 2016; Mak & Lee, 2014). Hattie and Timperley (2007) underscored that feedback at the task, process, and metacognitive levels encourages students to evaluate the requirements of the task, procedures for performing the task, and regulation of the strategic processes.

According to Carvalho et al. (2021), effective teacher feedback increases students' behavior engagement with schoolwork, that is, they would devote more time and attention to enhancing new knowledge or skills. This information decreases confusion and increases reflection and re-construction of knowledge (Bitchener & Knoch, 2010). This increase in behavioral and cognitive engagement, in turn, brings about improvement in learning achievement. For instance, Ruegg (2015) found that students at a Japanese university made improvements in their grammatical ability after they received systemic teacher feedback on their essays.

Nonetheless, educational studies disclose that teacher feedback often falls short of the goal of enhancing students' learning in everyday practices (Carless, 2011; Nguyen & Griffin, 2010; Yan et al., 2021). For instance, in a large-scale study involving 59,601 five graders in Vietnam, Nguyen and Griffin (2010) found a trivial effect of teacher feedback on reading achievement ($\beta = .03, p < .05$).

To unveil the complexity of teacher feedback, scholars turn to ecological factors such as country cultures that might have constrained the beneficial effect of teacher feedback. A proposal is that feedback, as embedded in formative assessment, might only work in the West but not in the Confucian-heritage culture, where summative assessment dominates at the cost of formative assessment (Carless, 2011; Kennedy, 2016).

However, evidence is accumulating that points to the deficiency of using culture to interpret this complexity. Drawing on data from 1026 first-grade students in Germany, Gentrup et al. (2020) found none of the three aspects of teacher feedback studied (performance relatedness, valence, and elaborateness) predicted reading achievement. Using PISA 2018 data, Yan et al. (2021) found a non-significant relation between teacher feedback and reading achievement in the West and a negative relation between teacher feedback and reading in Confucian-heritage countries/territories. The negative association between feedback and science achievement was found to be universal in a few other studies based on PISA 2015 data (Lau & Lam, 2017; Li et al., 2021). All these endeavors seemed to show that ecological factors are insufficient to understand the myth of teacher feedback.

There is a growing recognition that feedback is not a unidirectional transmission from teachers to students and it does not necessarily directly result in learning progress or output (Boud & Molloy, 2013). Students are not only merely recipients of feedback messages, but also active agents in interpreting and acting upon feedback comments to regulate learning (Molloy et al., 2020). In the recent decade, a school of scholars has shifted their attention from sociocultural influences to student characteristics that are likely to interfere with teacher feedback, such as student engagement (Wang & Zhang, 2020), students' perception of feedback cognitive load (Wang et al., 2019), self-concept (Ma et al., 2022), and students' competence to take up teacher feedback, or student feedback literacy as widely known in the literature (Brooks et al., 2019; Carless & Boud, 2018; Narciss et al., 2014). Among them, of note is the concept of student feedback literacy advocated by Carless and his colleagues (Carless, 2020; Carless & Boud, 2018).

Carless and Boud (2018) argued for three features underlying student feedback literacy: appreciating feedback, managing feedback, and managing affect. To appreciate feedback, the students should be ready to recognize feedback information coming from different sources in different forms (Carless & Boud, 2018). A consensus has been reached that learning occurs only when students convert feedback information into practice (Molloy et al., 2020). For students with low levels of feedback literacy, it is challenging to seek and interpret feedback, grab learning opportunities, and further use it productively (Carless & Boud, 2018). Despite the acknowledgment of learners' role in feedback-taking, previous studies have ignored an important cognitive factor, i.e., perspective-taking, in facilitating the process of feedback-taking.

Perspective-taking and reading

Perspective-taking lays a solid foundation for humans' cognitive development, social-emotion skills, and learning performance (Brewer & Phillippe, 2022; Donahue, 2014). Exposure to a diversity of perspectives is beneficial for greater tolerance of different views and mental stances (Mutz, 2006). When people attempt to understand others, they seem to shake off their default mental routines and employ a new schema, which in turn assists reorganization and digestion of the obtained information (Whitehead, 2002). Practices in perspective-taking can also foster empathy and encourage people to consider how others are feeling (Bowman-Smith et al., 2021; Brewer & Phillippe, 2022).

Adopting the perspective of an author/character is a commonly employed strategy in reading (Donahue, 2014). As a process of meaning construction, reading involves the interactions among the reader (Cai et al., 2022b), the texts, and the socio-cultural context (Bernardo et al., 2021; Frankel et al., 2016). When reading, it is common for a reader to confront many characters in texts whose thoughts differ (Donahue, 2014). When information gaps occur, readers should infer the characters' minds to predict their possible actions. Moreover, through the empathetic process of perspective-taking, readers can better immerse themselves in a fictional world, imagine the characters' minds, and feel their emotions (Erle & Topolinski, 2015). Besides, reading is usually replete with multiple viewpoints in a single source or multiple-source texts. The views held by people with diverse backgrounds and values may contradict or complement each other. At this moment, perspective-taking enables readers to derive profound comprehension of text contents (Bråten et al., 2020).

Epley et al. (2004) postulate that perspective-taking undergoes two cognitive stages: egocentric anchoring and adjustment. Initially, people automatically set their perspective as an anchor or a standard for inferring another's view. When they identify a problem, they make adjustments or repairs based on the common ground information and self-other discrepancies until a plausible explanation captures the target (Lin et al., 2010). However, perspective-taking is not genetic (Litchfield & Gentry, 2010) but developmental in nature (Lin et al., 2010). To achieve accurate perspective-taking, individuals should strive to make appropriate adjustments to correct egocentric defaults (Finefter-Rosenbluh, 2017).

Teacher feedback, perspective-taking, and reading achievement

Psychological research supports that feedback is conducive to perspective-taking. Research has shown that immediate feedback improved participants' accuracy rate of subsequent inference about others' thoughts and feelings (Marangoni et al., 1995). Research has also

shown that training people with psychological and intellectual disabilities in understanding another's mind with performance-specific and corrective feedback could contribute to their mastery of deictic relations underpinning perspective-taking performance (Montoya-Rodríguez et al., 2017; O'Neill & Weil, 2014).

In the case of reading, struggling readers are unable to reasonably discern what a character knows. Instead, they often mistakenly ascribe their privileged information to characters who have no access, an indicator of perspective-taking deficits (Weingartner & Klin, 2005). Damen et al. (2021) examined whether feedback eliminated such egocentric bias and found that narrative feedback could reduce egocentric bias and increase adjustment.

Weingartner and Klin (2005) disclosed that readers might miss critical messages when a character was not in the readers' focus. Feedback can challenge students' patterns of thinking and confront them to adopt new perspectives (Forsythe & Johnson, 2017). In this sense, teacher feedback has the potential to redirect students' attention to allocentric perspectives (Eyal et al., 2018) and perspective-taking occurs when there is salient evidence indicating another perspective is relevant to learning goals (Galinsky et al., 2005).

This adjustment is not automatic but under effortful and conscious control, a process entailing the investment of time and attention (Eyal et al., 2018). Although individuals effortfully adjust to others' perspectives, such adjustment is sometimes miscalibrated and insufficient (Epley & Caruso, 2008). This failure derives from the difficulty of discerning the validity of the information in place (Epley & Caruso, 2008; Finefter-Rosenbluh, 2017), and inaccessibility to other perspectives (Litchfield & Gentry, 2010).

Teacher feedback is characteristic of verification and elaboration on how to deal with uncertainty (Shute, 2008). By reviewing feedback messages, students can exclude erroneous hypotheses and gain insights into new strategies (Hattie & Timperley, 2007). For instance, Li and Zhang (2020) found that incidental feedback scaffolded students' thoughtful evaluation of social phenomena and extended their multiperspective thinking to real-world issues. The studies echoed Lindgren's (2012) argument that learning occurs when an individual turns to follow the opinion of someone with more relevant knowledge of the domain.

Drawing on the review above, we argue that perspective-taking plays a mediating role in the relationship between teacher feedback and reading achievement. Conceptually, a perspective taker is proactive in looking for feedback and striving to understand useful cues included. By taking the viewpoints of their teachers, students can incorporate a range of new perspectives into their beliefs, which further helps make sound judgments during learning. The present study aimed to explore the potential relationships among teacher feedback, perspective-taking, and reading achievement, with an emphasis on the mediation of perspective-taking between teacher feedback and reading achievement.

The present study

The current study addressed three research questions:

1. To what extent does teacher feedback predict perspective-taking?
2. To what extent does perspective thinking predict reading achievement?
3. To what extent does perspective-taking mediate the relation between teacher feedback and reading achievement?

Method

Data

OECD PISA 2018 data from Hong Kong were used for the current study (<https://www.oecd.org/pisa/data/2018database/>). In particular, we used student response data on perspective-taking, perceived feedback, and reading. After removing cases with complete missing values on any of the key variables, we retained a sample of 5665 students (51% = girls, mean age = 15.74, SD = .29).

Measures

Perceived feedback Perceived feedback was measured with a four-point scale (1 = strongly disagree, 4 = strongly agree) on three statements about what took place in reading class. The overall mean was 2.38 (SD = .76), and the internal consistency of the three items was $\alpha = .90$. Details of the scale are shown in Table 1.

Perspective-taking Perspective-taking was measured with a five-point scale (1 = very much like me, 5 = not at all like me) on five statements related to students' daily communication. The overall mean was 3.38 (SD = .77), and the internal consistency was $\alpha = .88$. Note responses to all items were reversed as they were reversely asked.

Reading achievement PISA 2018 provided achievement scores in three domains: reading, mathematics, and science. As the feedback data were collected from reading class, we only utilized reading as the dependent variable. In PISA 2018, reading was referred to as the ability to comprehend, reflect, and engage with written texts with goals (OECD., 2019). We used the first plausible value to represent reading achievement out of the 10 plausible values provided in PISA 2018. This is because previous studies have shown that results built on different plausible values are identical (Spiezia, 2011). The mean of the plausible value for the dataset was 528.84 (SD = 96.88).

Covariates Socio-economic status (SES) and sex have been frequently reported to affect learning achievement (Chiu & McBride-Chang, 2006) and were included in this study to control for potential confounding effects from them. Girls were coded as 1, and boys were coded as 2. SES in PISA 2018 was represented by ESCS (an index of economic, social, and cultural status) that contained information on students' family background (e.g., their parents' education and occupation, home possessions, and cultural resources) (OECD., 2019). The mean of ESCS for our data was $- .52$ (SD = 1.02).

Data analysis

Primary data analysis involved three steps. First, we conducted a series of confirmatory factor analyses (CFAs) to ensure the measurement validity of two multiple-indicator variables (i.e., perceived feedback and perspective-taking). Second, a single-level structural equation model (SEM) was constructed to explore the relations among perceived feedback, perspective-taking, and reading, with covariates, included. Third, the single-level SEM was

Table 1 Descriptive statistics and reliability estimates

	Code	Content	<i>M</i>	<i>SD</i>	Alpha
Teacher feedback	ST104Q02	The teacher gives me feedback on my strengths in this subject.	2.24	.84	.90
	ST104Q03	The teacher tells me in which areas I can still improve.	2.46	.82	
	ST104Q04	The teacher tells me how I can improve my performance.	2.45	.83	
Perspective-taking	ST215Q01	I try to look at everybody's side of a disagreement before I make a decision.	3.61	.88	.88
	ST215Q02	I believe that there are two sides to every question and try to look at them both.	3.74	.90	
	ST215Q03	I sometimes try to understand my friends better by imagining how things look from their perspective.	3.75	.90	
	ST215Q04	Before criticizing somebody, I try to imagine how I would feel if I were in their place.	3.44	.97	
	ST215Q05	When I'm upset at someone, I try to take the perspective of that person for a while.	3.37	.99	

converted to a multilevel structural equation modeling (ML-SEM) with the school as the cluster variable. As our focus was on the relations at the student level, no relations were constructed at the school level.

All primary analyses were conducted with *Mplus* 8.5 (Muthén & Muthén, 1998-2020) with full information maximum likelihood as the estimator. Multiple criteria were referred to assess the model-data fit: a value of .05 or smaller in root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR) together with a value of .95 or larger in Tucker–Lewis index (TLI) and comparative fit index (CFI) suggest a good model-data fit (Mueller & Hancock, 2010).

Results

Correlation analysis

Table 2 shows the results of bivariate correlations among the variables. As shown, reading was not significantly related to perceived feedback but positively related to perspective-taking ($r = .22, p < .01$). Perceived feedback was positively associated with perspective-taking ($r = .12, p < .01$). Regarding the covariates, SES was positively associated with all key variables, whereas gender was negatively associated with reading and perspective-taking but negatively related to perceived feedback.

Results of model fit

Table 3 shows the results of the model fit. The CFA model (model 1) for perceived feedback was saturated and produced a perfect fit. The CFA model for perspective-taking (model 2) fit the data excellently after freeing two pairs of covariances: one between ST215Q01 WITH ST215Q02 (both about “looking at two sides”) and the other between ST215Q04 WITH ST215Q05 (both about “thinking in other’s place”): CFI = .998, TLI = .993, RMSEA (90% CI) = .042 (.030, .056), and SRMR = .007.

The full measurement model (model 3) which combined the two latent factors and the structural equation model (model 4) which included reading and the covariates both produced an excellent fit to the data.

The final ML-SEM model (model 5) that controlled for covariances between schools continued to fit the data excellently: CFI = .983, TLI = .974, RMSEA = .041, and SRMR (within) = .023. The estimates of this final model were used to interpret our findings.

Table 2 Correlations

Variables	Teacher feedback	Perspective-taking	SES	Sex
Reading	.022	.224*	.200*	– .162*
Teacher feedback		.118*	.068*	.067*
Perspective-taking			.118*	– .075*

* $p < .01$

Table 3 Results of model fit

Models	X^2/df	p	CFI	TFI	RMSEA (90% CI)	SRMR
Model 1. CFA for teacher feedback	.000/0	.000	1.000	1.000	.000 (.000, .000)	.000
Model 2. CFA for perspective-taking	33.278/3	.000	.998	.993	.042 (.030, .056)	.007
Model 3. Full measurement model	100.672/17	.000	.997	.995	.029 (.034, .035)	.009
Model 4. SEM	440.403/35	.000	.985	.977	.045 (.042, .049)	.023
Model 5. ML-SEM	371.794/35	.000	.983	.974	.041	.023 (Within)

Estimates of the ML-SEM

The results of the ML-SEM are shown in Fig. 1. Perspective-taking had a direct positive effect on reading ($\beta = .22, p < .001$). Students' perception of teacher feedback had a direct effect on perspective-taking ($\beta = .14, p < .001$). Through perspective-taking, teacher feedback had an indirect effect on reading achievement ($\beta = .03, p < .001$).

Regarding covariate effects, reading was positively predicted by SES ($\beta = .16, p < .001$) and negatively predicted by student gender in favor of girls ($\beta = -.23, p < .001$).

Discussion

The current study investigated the relationships between teacher feedback, perspective-taking, and reading achievement. Results of ML-SEM showed that, after controlling for gender and SES effect at the student level and variances at and beyond the school level, teacher feedback was positively related to reading by way of perspective-taking, suggesting the full mediation effect of perspective-taking on the relation between teacher feedback and reading achievement.

1. To what extent does teacher feedback predict perspective-taking?

Our results showed that teacher feedback was positively associated with perspective-taking. The results ascertained the positive association between feedback and cognitive reactions in relevant fields. Damen et al. (2021) have demonstrated that feedback facilitates perspective-taking by helping individuals to eliminate wrong egocentrism and make sufficient adjustments to attain a reasonable account. It has also been evidenced that feedback can be efficacious in enhancing the accuracy of performing perspective-taking tasks (Marangoni et al., 1995; Montoya-Rodríguez et al., 2017). Given the paucity of research attention to the influence of feedback on perspective-taking in the education sector, this study lends initial evidence to the potential of linking feedback and perspective-taking in reading research.

There are at least three reasons explaining this positive association. First, feedback with explanations, examples, and clues make readers cognizant of whether their self-perspective is biased and what alternative perspectives are available. With salient evidence presenting self-other differentiation, readers are less likely to impose their own beliefs on the authors and hence more likely to digest the text from multiple perspectives (Sassenrath et al., 2014). Second, teacher feedback diagnoses readers' current state of knowledge and provides concrete guidance for strategically rectifying egocentric judgments over text

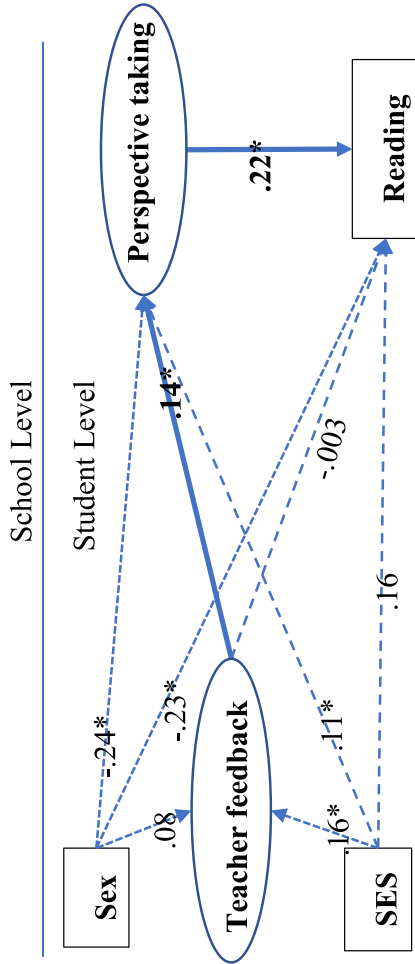


Fig.1 Multilevel modeling results with standardized estimates. * $p < .001$

information (Hattie & Timperley, 2007). Third, learners receiving specific solution suggestions do not need to devote considerable cognitive resources to detect the reliability of other perspectives on their own, which in turn saves time and effort for more productive learning (Wardlow & Heyman, 2016). Given these benefits, readers exposed to more teacher feedback are more likely to apply perspective-taking.

2. To what extent does students' perspective thinking predict reading achievement?

We found that perspective-taking was positively related to reading achievement. LaRusso et al. (2016) found a positive relationship between perspective-taking and reading among elementary and secondary school students of various cultural backgrounds. By focusing on a specific cultural group of students in Hong Kong, our study verified this positive relation.

The reading tasks in PISA 2018 involved a wide array of multiple-source texts (e.g., blog posts and web pages) and potential scenarios (OECD, 2019). These task features required readers to handle similar or conflicting viewpoints across texts and make inferences about the relevancy of the content. High dispositional perspective takers strive to understand what different authors write or characters know and figure out the multiple defensible stances carried in the test questions (LaRusso et al., 2016). Taking account of factors beyond their self-beliefs, perspective-taking students can expand insights on the multiaspects of a question and disentangle the reasons why disagreement occurs. By further integrating a diversity of views, perspective-taking readers narrow the gaps when comprehending text content, correct bias, and consider alternatives (Thein & Sloan, 2012). All these strategies help the readers to have an objective reconstruction of the text (Lindgren, 2012).

In addition, incorporating other perspectives into their philosophy might have helped the students to thoughtfully process PISA reading tasks, especially, by taking a critical stance on a myriad of tensions, contradictions, and emotions. In line with Hodges et al. (2018), perspective-taking students might be more attentive to the emotions and feelings of characters in the PISA texts. During this course, readers built up intense relationships with characters by inferring what different characters are thinking and feeling (Donahue, 2014). As Bowman-Smith et al. (2021) pinpointed, perspective-takers are more disposed to experience emotional congruence with characters and may be mindful of how events occur from others' viewpoints. In this way, the attempts to walk in others' shoes should have helped PISA test takers to make more sense of the texts.

3. To what extent does students' perspective-taking mediate the relation between students' perceptions of teacher feedback and their reading achievement?

The study showed that teacher feedback was not directly related to reading achievement. However, teacher feedback was related to reading achievement by way of perspective-taking, thereby supporting the full mediation of perspective-taking between teacher feedback and reading achievement.

The absence of a direct relation between feedback and reading is congruent with a few previous studies about teacher feedback with K-12 students in the West, e.g., Gentrup et al. (2020) and Yan et al. (2021), and undergraduate students in the East, e.g., Wang and Zhang (2020). The absence of this direct relation pointed to the fact that feedback information could not be absorbed automatically. The fundamental reason

could lie in students' low levels of feedback literacy in general, which in turn led to their failure in using teacher feedback productively. Specifically, Hong Kong students in general might lack awareness of responsibility for seeking out teacher feedback and using it (Molloy et al., 2020). Without proactivity and receptiveness, students would not initiate to find out what feedback is, appreciate the value of feedback, and relate it to their learning (Molloy et al., 2020; Winstone et al., 2017). Other barriers, though not explicitly scrutinized in the current exploration, such as students' limited knowledge about feedback terminology and strategies (Carless & Boud, 2018), weak self-evaluation (Boud et al., 2013), and negative affective reactions to critical feedback (Robinson et al., 2013), might have caused difficulties in capitalizing on feedback as well.

This absent association could also relate to the cognitive nature of teacher feedback. As teacher feedback is most about pointing out students' weaknesses and strengths, digesting feedback inevitably bears a cognitive load on students. For some students (especially those low achievers), teacher feedback (especially, corrective feedback) is too dense for them and may discourage them from carefully evaluating the feedback and deciding which aspect of the feedback to prioritize (Yan et al., 2021). Apart from that, low achievers with a sense of helplessness and frustration would typically refrain from discussions with teachers about the feedback (Winstone et al., 2017). This special feature of feedback giver and taker may have disguised the possible beneficial effect of teacher feedback for middle and higher achievers (Cai et al., 2022a).

Notably, our finding contradicts a few other studies. Yan et al. (2021) found a negative relationship between teacher feedback and reading achievement in the Confucian-heritage context which included Hong Kong ($\beta = -.09, p < .001$). There were at least three reasons that led to the relatively large negative effect size. First, the data used in their study came from 12 countries/territories, each containing more than a hundred schools. However, the study only used single-level structural equation modeling to derive estimates for the relationship. The failure to address confounding effects from the school level might have distorted their estimates.

The second reason should also relate to the study context. Although Yan et al.'s (2021) study was valuable in unveiling the teacher feedback effect by distinguishing the West from the East, the study was unable to distinguish the effects between education systems within the same culture group. Even in countries/territories with a similar culture such as Hong Kong and mainland China, the education systems differ significantly and their policies on instruction and feedback also differ (Ryan & Louie, 2007). Take Hong Kong as an example. To ease the notorious damaging effect of summative assessments on student learning, Hong Kong has been waging a movement of assessment for learning (AfL) since the 1990s. During this course, teachers in Hong Kong are stipulated to guide students to recognize their strengths and weakness (Mak & Lee, 2014). Our finding of the nonsignificant direct relation between feedback and reading could be a reflection of this movement effect.

The third reason for the negative association found by Yan et al. (2021) should be the ignorance of student agency in their model construction. As Carless and Boud (2018) argue, teacher feedback takes effect only when students can understand it and use it actively. In line with this thinking, we argue that there are multiple paths by which teacher feedback can exert its influence on learning achievement, for example, through student agency. This is also the motive for the design of the current study to include perspective-taking, an important feature of student agency.

Our study showed that, although teacher feedback was not directly related to reading achievement in Hong Kong, it was indirectly related to reading achievement by way of perspective-taking. That is to say, perspective-taking fully mediated the relationship between teacher feedback and reading achievement. These findings corroborated the idea of student agency proposed by feedback researchers such as Carless and Boud (2018). In line with their thinking, the actual effect of teacher feedback is the outcome of the interaction between the feedback givers and feedback takers. On the one hand, the quality of feedback (e.g., the sufficient range of the corrective information, the appropriate depth of feedback, and the clarity of expression) affects the results of feedback taking (Cai et al., 2022a). On the other hand, student agency such as their motivation to learn (Li, 2016; Xiao et al., 2022), their self-beliefs, and their readiness for cognitive resources such as working memory, metacognitive strategies, critical thinking, and perspective-taking all can play their essential roles in converting teacher feedback into the factual occurrence of learning (Carless & Boud, 2018).

In our case, Hong Kong students who perceived more teacher feedback reported a higher disposition in perspective-taking, and again, these students obtained higher scores in reading achievement. These findings suggested that teacher feedback notifies students of alternative (and perhaps better) ways of thinking about their learning; by referring to such multiple-perspective information, students adjust their learning behaviorally, cognitively, and emotionally. Such adjustment in learning engagement enables them to realize optimized learning which eventually leads to enhanced performance on their PISA reading test.

Conclusion, limitations, and implications

Ecological factors such as cultures, educational systems, and teacher behaviors have often been regarded as the important factors determining whether teacher feedback can facilitate learning achievement. However, mixed findings from this strand of studies pointed to the deficiency of only blaming the contextual factors. In line with the recent trend of looking at feedback-takers, the current study examined whether teacher feedback could exert its influence on Hong Kong adolescents' reading achievement. After controlling for contextual bias from the school level and micro-level bias such as gender and SES, we found that teacher feedback on reading achievement was fully mediated by students' perspective-taking.

Our results have a few theoretical and pedagogical implications. Theoretically, the current study is the first to include perspective-taking to study the effect of teacher feedback on academic achievement. Most recently, scholars in feedback research have realized the importance of accounting for student agency in uncovering the beneficial effect of teacher feedback on academic achievement and proposed the concept of student feedback literacy (Carless & Boud, 2018). A key feature of the concept is that students should have the disposition and competence to understand the information carried out in teacher feedback. Studies are accumulating that serve to fill in the list of student factors that contribute to student agency in feedback taking, e.g., motivation (Li, 2016), growth mindset (Yan et al., 2021), and so forth. Our study filled in this gap with initial evidence elucidating the role of perspective-taking for this sake. Compared with existing studies that mostly focused on motivational factors, our study also pointed to the need to account for cognitive factors that might be considered as elements of student feedback literacy. Future studies can explore whether cognitive factors such as metacognitive strategies, critical thinking, and system

thinking, or other cognition-based factors such as self-efficacy, self-concept, motivation regulations, or emotion regulations, can be included in the list.

Our results also have pedagogical implications for reading instruction and learning. To foster student feedback literacy, teachers could center on monitoring whether students take follow-up actions on feedback, instead of solely focusing on what feedback to deliver and how to deliver it (Winstone, Nash, Parker, & Rowntree, 2017). To shape students' proactive mindset of feedback taking, reading teachers could encourage students to attend to the progress of reading improvement rather than escape from teacher feedback due to immediate failure (Winstone, Nash, Rowntree, & Parker, 2017).

Besides, teachers could pay attention to developing learners' cognitive flexibility and stimulate them to shift between various perspectives (Bowman-Smith et al., 2021). In this way, students can gradually form the habit of applying perspective-taking, thus engaging with deliberate thinking to navigate complex problems in schoolwork as well as in social interactions. Alternatively, teachers could encourage students to discuss the perspectives of characters in a story, discern discrepant points, and imagine the mental states of multiple characters. If students rely excessively on their familiar experiences, teachers could offer timely feedback and inform them of other important views.

Finally, teachers can develop opportunities for students to interact with them or their peer students on feedback digesting and taking. For instance, teachers can ask students to share their evaluation of the feedback or their difficulties or enjoyment in processing and implementing the feedback. These perspective-taking activities may foster students' competence in feedback-taking and eventually lead to the actualization of teacher feedback on learning achievement (Carless & Boud, 2018).

As one of the anonymous reviewers rightly reminded, these theoretical and pedagogical implications should also apply to teaching and learning in other academic domains such as science, mathematics, psychology, and history, among others. This is because feedback has been widely regarded as a helpful teaching and learning practice across domains (OECD, 2019) and perspective-taking has been granted as a kind of generic skill in human intelligence development (Cabrera et al., 2022).

Admittedly, this study had limitations. First, due to the cross-sectional nature, the current study was unable to determine the causal relationships among teacher feedback, perspective-taking, and reading achievement. Future studies need to consider collecting longitudinal data to examine the causality between these variables, especially between teacher feedback and perspective-taking.

Second, perspective-taking measured in PISA was domain-general rather than specific for reading. This general measure of perspective-taking may have rendered the small effects of the relation between perspective-taking and teacher feedback and on reading. Future studies can develop reading-specific measures of perspective-taking. The deficiency in measurement also held to teacher feedback. In PISA 2018, teacher feedback was reported by students about their teachers' comments and advice in reading lessons. This incurred issues of construct-under representativeness (Messick, 1989) by ignoring feedback provided after class (Lau & Lam, 2017; Yan et al., 2021).

Third, our results were derived from students' perceptions of teacher feedback, perspective-taking, and the statistical analysis of these two variables and students' reading performance. To obtain more vivid evidence on how students use teacher feedback to boost perspective-taking and reading achievement, other data collection methods such as interviews, thinking-aloud protocols, or reflective journals are encouraged.

Notwithstanding these limitations, our findings are still valuable. Considering that feedback has often been found to defeat its aim in feedback inquiries, our study opens up a new

avenue for feedback researchers to dig out the efficiency of teacher feedback for empowering student learning.

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Data availability The data that support the findings of this study are openly available in OECD PISA 2018 dataset at <https://www.oecd.org/pisa/data/2018database/>.

Declarations

Ethics approval Not applicable.

Consent to participate Not applicable.

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Conflict of interest The authors declare no competing interests.

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Current themes of research

language assessment; educational psychology; large-scale international educational assessment; psychometrics; educational statistics; educational data mining

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- Cai, Y., King, R., & McInerney, D. M. (2022). The concurrent trajectories of utility value, metacognitive strategy use, and English achievement: A multivariate growth modeling analysis. *The Journal of experimental Education*, 1–22. <https://doi.org/10.1080/00220973.2022.2053496>
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Current themes of research

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- Cai, Y., Yang, Y., Ge, Q., & Weng, H. (2022). The interplay between teacher empathy, students' sense of school belonging, and learning achievement. *European Journal of Psychology of Education*, 1–17. <https://doi.org/10.1007/s10212-022-00637-6>

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Current themes of research

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- Cai, Y., & Yang, Y. (2022). The fluid relation between reading strategies and mathematics learning: A perspective of the Island Ridge Curve. *Learning and Individual Differences*, 98, 102180. <https://doi.org/10.1016/j.lindif.2022.102180>
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