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Psychometric properties of the Feedback Literacy Behaviour Scale (FLBS) for Chinese students

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ABSTRACT

Feedback plays a crucial role in enhancing students' learning outcomes, but it can be unproductive if not used effectively. While there has been increasing attention to feedback literacy, few theory-driven instruments currently exist for measuring feedback literacy behaviours, particularly with Chinese samples. The 24-item Feedback Literacy Behaviour Scale (FLBS), initially developed in Western contexts, focuses on what students can do in the feedback processes. It includes five dimensions: Seek Feedback information (SF), Make Sense of information (MS), Use Feedback information (UF), Provide Feedback information (PF), and Manage Affect (MA). This study examined its psychometric properties with a sample of 723 Chinese university and high school students aged 14 to 27. Confirmatory factor analysis (CFA) results supported a five-factor structure of the FLBS. Each factor showed good internal consistency (Coefficient H > 0.80). Multigroup CFA results demonstrated acceptable measurement invariance across gender and education sector. The significant but not high correlations between the FLBS and the Chinese Big Five Personality Inventory-15 (CBF-PI-15) supported the external validity of the FLBS. The findings supported using FLBS for Chinese students and are expected to help understand how student feedback literacy operates in Chinese culture.

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Introduction

Feedback holds great potential for student achievement in higher education (Hattie & Timperley, 2007). However, students often report less satisfaction with assessment and feedback of their courses when feedback is insufficient, poorly designed, difficult to understand and use, and occasionally demotivating (Boud & Molloy, 2013; Carless, 2015; Evans, 2013). Thus, providing feedback alone does not necessarily enhance students' learning achievement if feedback remains mere information ("data") that is not utilized ("dangle") (Boud & Molloy, 2013; Yan & Chiu, 2023; Yan et al., 2021; Zhu et al., 2024). Recently, there has been an important shift in the conceptualization of feedback, shifting from a teacher-centred to a learning-centred perspective. This perspective entails viewing feedback as a process

where students serve as active agents to seek, understand, process, and use feedback to elicit the power of feedback (Carless & Boud, 2018; S. W. Chong, 2020).

Therefore, a growing body of research has embarked on the topic of student feedback literacy conceptually (Carless & Boud, 2018; S. W. Chong, 2020; Molloy et al., 2020) and empirically (Han & Xu, 2020, Hoo et al., 2022; N. E. Winstone et al., 2019). Feedback-literate students are expected to actively seek, process, and utilize feedback to enhance learning, rather than remaining passive recipients under the teacher-centred feedback paradigm (Carless, 2015; Molloy et al., 2020). To develop student feedback literacy, teachers are repositioned as designers of feedback environments and facilitators of feedback processes that are not limited to transmitting knowledge to students (Carless & Winstone, 2020). Students must exercise agency and volition to proactively engage in the feedback process. Otherwise, they feel ill-equipped to make sense of the feedback and become demotivated to invest time and effort in using it effectively (Nash & Winstone, 2017).

To our knowledge, the existing instruments (e.g., G. T. Brown et al., 2016; Dong et al., 2023; Liao, 2021; Lipnevich & Lopera-Oquendo, 2022; Song, 2022; Yildiz et al., 2022; Yu et al., 2022; Zhan, 2022) designed to benchmark student feedback literacy predominantly focus on students' beliefs about feedback or evaluations of their capabilities, while placing less emphasis on what students do in the feedback process. Therefore, there is a need for instruments to capture behavioural indicators of student feedback literacy.

Dawson et al. (2023) employed a theory-driven approach to developing the Feedback Literacy Behaviour Scale (FLBS) using a combined sample recruited from Australia, Ireland, New Zealand, and the United Kingdom. The FLBS underlines student feedback literacy behaviour as enacted, addressing the five dimensions: Seek Feedback information (SF), Make Sense of information (MS), Use Feedback information (UF), Provide Feedback information (PF), and Manage Affect (MA).

Given its good psychometric properties and the growing recognition of the significance of the learning-centred feedback paradigm in China, this study makes the first attempt to validate the FLBS in the Chinese context, contributing to extending the application of the FLBS in a different culture. Using such an instrument facilitates a better understanding of the overt indicators of student feedback literacy and informs the development of targeted interventions to improve students' feedback literacy from high school to higher education.

Student feedback literacy

Despite the acknowledged benefits of feedback on students (Evans, 2013; Hattie & Timperley, 2007; Wisniewski et al., 2020), feedback information does not always effectively improve students' learning outcomes if students do not play an active role in the feedback process (Nieminen & Carless, 2023). When feedback is viewed as a process, attention must be given to how students assume responsibility for understanding, processing, and using feedback to enhance their future work, rather than passively receiving "transmitted information" (Boud & Molloy, 2013; N. Winstone & Carless, 2019). Such actions can facilitate students' self-regulated learning, improve their self-efficacy, and shape more emotional responses (G. T. Brown & Zhao, 2023).

Recently, there has been a blossoming interest in student feedback literacy owing to the shift to the learning-centred feedback perspective, also called the new feedback

paradigm (Carless, 2015). Student feedback literacy is defined as students' understanding, capacities, and dispositions to understand feedback information and use it to enhance performance and learning strategies (Carless & Boud, 2018). Building on a synthesis of broad feedback literature, four crucial components of student feedback literacy are proposed, including appreciating feedback, making judgements, managing affect, and taking action (Carless & Boud, 2018). In spite of its importance, there is a long history of underscoring the dialogic process of providing feedback to an agentic recipient, albeit not necessarily in the name of "student feedback literacy" (Weaver, 1963).

The rapidly growing sub-field of feedback literacy offers significant opportunities for synergies with related research, including feedback-seeking, understanding, using, and providing feedback, and emotional regulation (Carless & Boud, 2018; Molloy et al., 2020). Feedback seeking shows positive associations with assessment outcomes, proactive student engagement, higher academic achievement/GPA, and supportive relational climates (G. T. Brown & Zhao, 2023; Leenknecht & Carless, 2023). Yan and Brown (2017) noted that seeking feedback encourages self-reflection by helping individuals identify strengths and weaknesses in their performance, evaluate the feedback received, and adjust their own judgements based on external inputs.

Students fail to acknowledge the messages embedded in feedback, leaving key insights unnoticed and perpetuating a "feedback as telling" approach in the classroom (Sadler, 2010). On the other hand, students need feedback that is unambiguous, free of jargon, and conveyed in explicit language to ensure it is easily understood (Price et al., 2010). Failure to do so may lead to misinterpretations and undermine the teacher's intent in providing constructive feedback. Therefore, students are encouraged to recognize "feedback as feedback" and gain training for interpreting and understanding feedback (Blair & McGinty, 2013).

Jonsson (2013) identified five main reasons for students not to use feedback: (1) feedback may not be useful; (2) feedback is hard to understand; (3) feedback is too authoritative; (4) feedback may not be adequately individualized; (5) students may lack strategies to use feedback. Overcoming this barrier appears to necessitate the shared responsibility between the sender (e.g., teacher) and the receiver (e.g., student). Therefore, students need to act as "proactive learners", that is, actively seeking, generating, and making productive use of comments (Boud & Molloy, 2013), thereby fostering a sense of responsibility and ownership for their learning (Handley et al., 2011). Unless students have the skills to interpret the comments they receive; otherwise, few of them can succeed in utilizing feedback (Robinson et al., 2013). Herewith, students also need to invest time and effort in using feedback; it bears a significant association with their academic attainment (P. Adams, 2006; G. T. Brown et al., 2016). From Gao and Brown's (2023) study, Chinese students' active use and understanding of teachers' feedback can positively affect their self-efficacy and task value beliefs, enhancing their mastery and performance goals.

On the other hand, providing feedback information drives students to actively explore task-specific processes and requirements, enhancing their performance (Huisman et al., 2019). Besides, providing comments to peers is conducive to helping learners understand the value of feedback, internalize the criteria of good feedback practices, and improve their sense of responsibility (Carless & Boud, 2018; Yu, 2019). In addition, students tend to exhibit positive and negative emotional responses to

feedback, which has an unavoidable effect on their cognition, motivation, and achievement (Pekrun et al., 2014; Zumbunn et al., 2016). Consequently, how students manage their emotions and use regulative strategies in response to feedback influences their engagement with feedback and feedback resilience, as well as whether they reject or accept feedback (Mahfoodh, 2017).

Personality traits

The widely acknowledged trait model of personality is the Big Five model, which encompasses neuroticism, conscientiousness, agreeableness, openness to experience, and extraversion (Costa & McCrae, 1992). The Big Five Inventory also serves as the predominant tool for personality description and assessment, which has been extensively validated and applied in both Western (e.g., BFI-10, Thalmayer et al., 2011; BFI-2-XS; Soto & John, 2017; Mini-IPIP; Baldasaro et al., 2013) and Chinese contexts (e.g., CPFI, Cheung et al., 1996; NEO-PI-R; Dai et al., 2004; BFI-44; Leung et al., 2012; CBF-PI; M. C. Wang et al., 2010) through various versions.

According to Costa and McCrae (1992), neuroticism represents a tendency to experience emotional instability, characterized primarily by aggression or withdrawal, and is often linked to anxiety, depression, and vulnerability. Conscientiousness reflects individual differences in organizing, planning, and performing tasks. Conscientious people have been shown to exhibit a tendency to achievement-striving, self-discipline, good control of impulsiveness, and responsibility. Agreeableness refers to an individual's tendency to exhibit trust, kindness, cooperativeness, tenderness, and altruism. Openness to experience describes individuals who are imaginative, intellectually curious, and open to embracing diverse and novel ideas. Extraversion refers to individuals who thrive in social settings and enjoy interacting with others. It is characterized by positive emotions, gregariousness, talkativeness, assertiveness, a drive for status, competitiveness, and a sense of adventure (Erevik et al., 2023).

Student feedback literacy and personality traits

The theory of planned behaviour (TPB) provided a theoretical basis to understand the relationship between the Big Five model of personality traits and student feedback literacy. TPB posits that concepts related to behavioural dispositions, such as personality traits, play an important role in predicting and explaining human behaviours via three antecedents of intentions: attitude, subjective norm, and perceived behavioural control (Ajzen, 1991, 2005). Attitude towards the behaviour refers to the extent to which an individual holds a favourable or unfavourable evaluation of the behaviour in question, while the subjective norm means the perceived social pressure to either perform or avoid performing the behaviour (Ajzen, 1991). Perceived behavioural control describes the perceived ease or difficulty of performing a task, and it is assumed to reflect prior experiences and expected challenges or barriers (Ajzen, 1991). The more positive the attitude and subjective norm towards a behaviour, and the higher their perceived behavioural control, the greater should be an individual's intention to engage in that behaviour (Ajzen, 1991).

In this sense, highly neurotic people experience more negative affect, and maladaptive coping, competence-related threats. Therefore, they are motivated to seek feedback, as it helps alleviate their heightened sensitivity to uncertainty (Brunson et al., 2016; Krasman, 2010). Furthermore, they consider interpersonal interactions with others as less pleasurable and rewarding and perceive less behavioural control in responding to negative feedback (Swift & Peterson, 2018). Conscientious people, who are achievement-oriented and demonstrate a tendency for hard work and self-discipline, are likely to exhibit stronger intentions and greater perceived behavioural control when engaging in behaviours (Costa & McCrae, 2008). As a result, those people with high conscientiousness performed significantly better after receiving negative feedback than positive feedback or no feedback (Swift & Peterson, 2018). Similarly, N. E. Winstone et al. (2021) found that students who were more conscientious and mastery-goal-oriented were prone to understand the value of feedback. Conversely, students' neuroticism, due to its behavioural inhibition and sensitivity to criticism facets, was not correlated with their use of feedback.

Agreeable individuals show great interest in others' thoughts, ideas, and opinions. Often adopting a participatory style favoured to resolve conflict; thereby, they are highly likely to develop favourable attitudes towards seeking and accepting feedback and are more inclined to take initiative when provided with positive feedback (Bell & Arthur, 2008; Krasman, 2010). Individuals who are open to new information always show a favourable attitude towards the value of feedback, which increases their intentions in providing and utilizing feedback in organizational contexts (Dawson et al., 2023; Lipnevich et al., 2021). Extraversion people are more adept at social interaction with others and are thought to be skilful in mood maintenance after encountering stimuli. This enhances feedback-seeking behaviours and promotes their positive affective responses to using feedback, regardless of the feedback messages (Arun Kumar & Lavanya, 2024; Bell & Arthur, 2008).

On the other hand, S. W. Chong's (2020) three-dimensional model of student feedback literacy suggests that students can become cognitively, emotionally, and behaviourally engaged with feedback, with such engagement shaped by both contextual and individual factors. Some researchers also indicated that the broad personality dimensions of the Big Five personality inventory – extraversion, agreeableness, conscientiousness, emotional stability, and openness – often very well overlap to a significant degree with the burgeoning fields like student feedback literacy, social-emotion skills (e.g., resilience, self-efficacy, self-regulation, social engagement, teamwork, collaboration, empathy, and relationship skills) and coping strategies (e.g., problem-focused and emotional-focused strategies) (MacCann et al., 2012; Walton et al., 2023). For instance, openness and the ability to understand feedback are often considered more closely related to cognitive abilities, whereas neuroticism, self-efficacy, emotion-focused coping, and managing affect are thought to be more linked to affective engagement (S. W. Chong, 2020; Sutton, 2012; Walton et al., 2023).

Conscientiousness involves socially prescribed impulse control that facilitates task- and goal-directed behaviours. It demonstrates a moderate relationship with problem-focused coping, which is believed to be more related to the practical (e.g., behavioural engagement with feedback) of student feedback literacy (S. W. Chong, 2020; MacCann et al., 2012; Walton et al., 2023). Thus, we believe that the Big Five model offers a comprehensive framework to subsume crucial components of the novel notion of student feedback literacy. Additionally, empirical research indicates that the Big Five model of personality

is closely linked to students' receptivity of instructional feedback and their feedback literacy, especially for conscientiousness and agreeableness (Dawson et al., 2023; Lipnevich et al., 2021).

The Feedback Literacy Behaviour Scale

The concept of student feedback literacy has gained much traction conceptually (e.g., Carless & Boud, 2018; S. W. Chong, 2020; Molloy et al., 2020) and empirically (e.g., Han & Xu, 2020, Hoo et al., 2022; N. E. Winstone et al., 2019) in higher education literature. Therefore, there are some instruments to measure this crucial notion or similar concepts, such as the Student Assessment-Based Feedback Literacy (SAFL) scale (Liao, 2021), the Scale of Student Feedback Literacy (SSFL) (Zhan, 2022), the Feedback Literacy Scale (Song-FLS) (Song, 2022), the L2 Student Writing Feedback Literacy Scale (L2-SWFLS) (Yu et al., 2022), the Feedback Literacy Scale (Yildiz et al., 2022), the Peer Feedback Literacy Scale (PFLS) (Dong et al., 2023), the Students' Conceptions of Feedback scale (SCOF) (Gao, 2022), the Student Conceptions of Feedback (G. T. Brown et al., 2016) and the Receptivity to Feedback (Lipnevich & Lopera-Oquendo, 2022). As these instruments have been subjected to a formal validation process, they mainly focus on students' beliefs about feedback or evaluation of their capabilities when engaging in the feedback process (Dawson et al., 2023).

Furthermore, there is a consensus that feedback is an active process, and the central focus of student feedback literacy is what students do in the feedback process, not merely what they think they should or can do. This is reflected in the prevalent frameworks underlining "take actions" and "enacting, eliciting, processing and enacting" (Molloy et al., 2020). Such instruments offer little or no consideration for students' enacted feedback behaviours, namely, what students can do in the feedback process. Hence, the existing instruments have inadequately captured behavioural indicators of student feedback literacy in great depth.

Given the lack of a robust scale specifically targeting feedback literacy behaviours, Dawson et al. (2023) developed the Feedback Literacy Behaviour Scale (FLBS), which is a 24-item measure that gauged students' feedback literacy behaviour by addressing the five dimensions: Seek Feedback information (SF), Make Sense of information (MS), Use Feedback information (UF), Provide Feedback information (PF) and Manage Affect (MA). Unlike prior instruments (e.g. Song, 2022; Yu et al., 2022; Zhan, 2022), the FLBS incorporated the provision of feedback as a necessary component because feedback is an active process and reciprocal act (Carless & Boud, 2018; Molloy et al., 2020), implying that feedback-literate students should have the capacity to provide feedback information to others.

The FLBS was based on the conceptual frameworks of student feedback literacy (Carless & Boud, 2018; Molloy et al., 2020), which laid a solid base for substantive validity. The expert review ensured the content validity. Confirmatory factor analysis (CFA) and Rasch analysis (Bond et al., 2020) were applied to university students from the UK, Australia, Ireland, and New Zealand, confirming the five-factor structure validity. Furthermore, the external validity was examined by correlating subscales of the Big Five Personality Inventory-Short Form (BFI-S) and the FLBS.

The need for further validation of the FLBS with a Chinese sample

The literature over the last few decades has demonstrated that feedback, as a crucial component of formative assessment, plays an important role in promoting students' learning through adjusting ongoing teaching and learning around the world (Black & Wiliam, 1998; Hattie & Timperley, 2007; Irons & Elkington, 2021; Lipnevich & Smith, 2018). Accordingly, the shift towards formative assessment has been increasingly implemented through policy initiatives in Chinese educational contexts (e.g., Guidelines on Curriculum Reform of Basic Education (for Experiment) (Ministry of Education, 2001), the College English Curriculum Requirements (CECR, Ministry of Education, 2007), and the College English Teaching guidelines (Ministry of Education, 2020) in Chinese educational contexts (Q. Chen et al., 2013). Besides, some empirical studies using PISA data also provide evidence that teacher feedback has been extensively adopted to enhance East Asia students' achievement and cultivate their resilience (Yoo & Jang, 2023; Zhan et al., 2024).

Despite its critical importance for learning improvement, feedback remains unused information, as students may become passive recipients when they lack the feedback literacy to reap the benefits of feedback (Carless, 2015; Nieminen & Carless, 2023). Furthermore, within countries (e.g., China, Japan, and Korea) that share a Confucian heritage culture (CHC), many of the vestiges of this system – such as the utilitarian nature of education, the emphasis on collectivism, power distance, teacher-centred transmission style, competition, and memorization – may influence the development of Chinese students' feedback literacy (G. T. Brown et al., 2015; S. W. Chong, 2020; D. Y. K. Chong & McArthur, 2023; Ho, 2020; Zhan, 2021). For instance, learners in Confucian-influenced societies tend to utilize feedback for examination success but are less willing to provide critical comments for peers to avoid embarrassment and loss of face (Wicking, 2020; Zhan, 2021). Inversely, learners in individualist cultures are more self-focused, actively seek feedback without concern for face-saving, and even feel frustrated when receiving excessive positive feedback (Harrison et al., 2016; Luque & Sommer, 2000).

In addition, learners in a collectivist culture (e.g., Chinese) prefer to be provided with indirect and implicit feedback messages, as they have a tendency to understand feedback through nonverbal cues or the physical context (Gudykunst, 1983; Luque & Sommer, 2000). In contrast, learners in a low-context culture (e.g., Americans) tend to use direct and explicit feedback messages since this culture emphasizes specific criteria-based information independent of the feedback setting (Luque & Sommer, 2000; Singelis & Brown, 1995).

Hence, cultural influences should be considered when applying Western-origin instruments in a Chinese context (Cheung et al., 1996; Y. Wang et al., 2023). It is essential to validate the FLBS, originally developed in Western culture (Dawson et al., 2023), within the Chinese context to profile students' feedback literacy practices and provide guidelines for implementing educational interventions that facilitate the effects of feedback literacy. The validation process, in addition to examining the factor structure and external validity, also ensures establishing measurement invariance of the FLBS across gender and education sector (e.g., high school VS. university). Otherwise, the interpretation and use of the FLBS scores may be misleading (T. A. Brown, 2015; Hoyle & Smith, 1994).

Past studies showed that feedback behaviour varies across gender. Some suggested that females tend to seek, uptake, and use feedback more than males (Noroozi et al., 2023;

Sinclair & Cleland, 2007). Others claimed that the average feedback effect was positive for males but negative for females. Females appear disheartened by feedback regarding ability distribution (Goulas & Megalokonomou, 2021).

In terms of education sector, the different contexts between high school and higher education in China affect students' feedback behaviours. Feedback seeking and self-monitoring are aspects of self-regulated learning, which involves an active, deliberate, and considerate process of reaching out for feedback (Leenknecht & Carless, 2023; Yan & Brown, 2017). When embarking on university studies, students' autonomous learning and self-regulated learning assume a pivotal role, allowing them to have opportunities and motivation to actively seek and use feedback to regulate their cognition, metacognition, and academic achievement (Shen et al., 2023). However, there is a unidirectional top-down culture and hierarchical power distance in high school, which greatly inhibits students from seeking feedback since they are afraid of receiving negative comments because of their poor performance (G. T. Brown et al., 2015; Yao & Zhu, 2024).

With the growing recognition of the learning-centred feedback paradigm in higher education (Ministry of Education, 2020; Wei et al., 2021), university students are encouraged to assume responsibility in the feedback process. They actively use feedback for learning improvement and are willing to provide feedback to support their unmotivated and low-achieving classmates, as well as to praise and encourage their counterparts' strengths (Han & Xu, 2020; Jonsson, 2013; Wei et al., 2021; Zhan, 2021). Nonetheless, the teacher-centric feedback approach remains dominant in high school, inadvertently reducing students' responsibility for seeking, processing, and utilizing feedback; consequently, high school students are often positioned as passive recipients of feedback information (Carless, 2015; J. Huang, 2020; Yan & Brown, 2021). Consequently, they often lack guidance on using feedback effectively, relying on directly copying corrective answers rather than making evaluative judgements for the comments (Burke, 2009; Lee, 2008). To be admitted to prestigious universities, high school students consistently study hard and outperform their peers (G. T. Brown et al., 2015). This highly competitive environment discourages their practices of providing feedback to peers, as they perceive it to be more time-consuming and demanding than authoritative teacher feedback (Man et al., 2018).

Regarding disparities in emotional regulation between the two groups, some studies indicated that university students show higher emotional resilience when facing critical comments, enabling them to understand their value and decide what needs to be incorporated into further learning (Yu & Liu, 2021). Still, high school students, in such an examination-oriented environment, often exhibit a low level of emotional resilience (S. Chen, 2019; C. C. Huang et al., 2019). Negative feedback in such settings can easily overwhelm their sense of self-efficacy, posing a threat to their ego and academic performance (Yao & Zhu, 2024).

It is noted that both high school and university students may demonstrate a strong conscientiousness in understanding teachers' comments, shaped by Confucian heritage culture, which places a high value on academic performance, personal efforts, discipline, and teacher authority (Ho, 2020). For instance, university students are often mastery-goal-oriented and frequently encounter indirect or automated feedback (e.g., hints, informative prompts, and queries), which possibly nurtures their intrinsic motivation to grasp feedback for resolving uncertainties and promoting self-improvement (Luo et al., 2023). Similarly, high school students are externally driven to make sense of feedback for

outperforming their peers and passing the National College Entrance Examination, since they are more performance-approach-oriented when they are situated in an environment characterized by uniform tasks and assessments, limited autonomy, and an emphasis on recognition and evaluation (J. Wang & Rao, 2019).

Methods

Participants

There is a growing interest in exploring student feedback literacy in both high school and higher education (H. Chen et al., 2024; Han & Xu, 2020; Zhan, 2022; E. D. Zhang et al., 2023). Thus, it is necessary to develop an instrument for measuring students' feedback literacy behaviours in Chinese students to facilitate its development. Given that this study focuses on validating the FLBS in Chinese students, a convenience sampling approach was used to recruit students entering high school and those admitted to university, thereby extending the scale's applicability from high school to higher education. Moreover, those students have more recent and fruitful experience developing feedback literacy behaviours than those who have not cleared the Zhongkao¹ hurdle.

The study reported in this paper was conducted at a science and technology university in Harbin City and a private secondary school in Shenzhen City in Mainland China. Both are non-key institutions. High school students were enrolled in liberal education and science programmes from grades 10 to 12. University students primarily majored in civil engineering and road and bridge engineering from year 1 to year 4, with a small portion studying social science and architecture.

A total of 807 valid responses were received. Participants with missing data over 5% and outliers for any measure were removed (See Statistical analysis section for details), resulting in data from 723 participants remaining for the final analysis. In the final sample, 417 (57.67%) were males and 306 (42.32%) were females. There were 472 (65.28%) university students and 251 (34.72%) high school students. Of university students, 97 were freshmen, 112 were sophomores, 111 were juniors, and 152 were seniors. 157, 73, and 21 students were from grades 10, 11, and 12, respectively. The participants ranged in age from 14 to 27 years old ($M = 19.25$, $SD = 2.69$ years).

Procedures

Prior to the commencement of the study, ethical approval was obtained from the author's affiliated university. The lecturer was contacted beforehand to be briefly introduced to the research, and they helped distribute paper-and-pencil questionnaires to the students. Participants were informed that their participation was voluntary and that they could withdraw from the study anytime. Their submission of the questionnaire was considered as their informed consent.

Students were given 30 minutes to finish the questionnaire, which was administered in the students' primary language of Mandarin. The FLBS was translated into Chinese according to Brislin's (1980) translation and back-translation process. Two bilingual experts with expertise in feedback research translated the questions into Chinese. Two Chinese translation professionals translated Chinese items back into English.

Discrepancies and consistency were discussed and resolved with the researchers and the translators, leading to a final agreement on the translation.

Measures

Feedback Literacy Behaviour Scale (FLBS) (Dawson et al., 2023). The FLBS is a 24-item self-report measure, which consists of five subscales: Seek Feedback information (SF, 5 items; # I seek out examples of good work to improve my work), Make Sense of information (MS, 4 items; # I carefully consider comments about my work before deciding if I will use them or not), Use Feedback information (UF, 5 items; # When receiving comments I plan how I will use them to improve my future work, not just the immediate task), Provide Feedback information (PF, 5 items; # I offer to provide feedback to my peers), and Manage Affect (MA, 5 items, # I am open to reasonable criticism about my work) (see Appendix A). Response options range from 1 (never) to 6 (Always). The Coefficient H of the FLBS subscales in this study ranged from 0.84 to 0.87 (see Table 6).

The Chinese Big Five Personality Inventory-15 (CBF-PI-15). We used a shortened version of the Chinese Big Five Personality Inventory Scale with 15 items (CBF-PI-15) (X. Zhang et al., 2019) to measure different facets of students' personalities. It includes five dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. Students rated each item from 1 (Totally Disagree) to 6 (Fully Agree). In our study, its Coefficient H ranged from 0.80 to 0.92 (see Table 6).

Statistical analysis

Data screening on missing data and extreme values was conducted, and participants' responses ($N = 16$) were discarded if the item-level of missing data was over 5% (Tabachnick & Fidell, 2007). The Chi-Square test of independence indicated that there was a nonsignificant association between deleted ($N = 16$) and retained groups ($N = 791$) and gender ($\chi^2(2) = 2.37, p = 0.31$), suggesting that our deletion is random without favouring females or males.

Responses of item-level missing data were imputed by multivariate imputation by chained equations (Van Buuren & Groothuis-Oudshoorn, 2011). In this study, 68 outliers were removed from the analysis as those participants' Mahalanobis' d^2 values exceeded the chi-square cut-off scores ($\chi^2(39) = 72.05, p = 0.001$), leading to the final sample size of 723 participants. Normality was suggested following an argument of Kline (2015): the values of all fall between skewness (± 3) and kurtosis (± 8) were acceptable.

Messick's (1995) validity framework was adopted to guide the validation. The structural aspect of FLBS' validity was investigated by confirmatory factor analysis (CFA), while the evidence of generalizability can be drawn from multigroup confirmatory factor analysis (MGCFAs). Both CFA and MGCFAs were carried out with R software (R Core Team, 2020). The remaining correlation and reliability analyses were performed by IBM SPSS.26.

CFA model fit was evaluated according to the following multiple fit indices that cover different aspects of model-data fit instead of one fit index exclusively: Comparative Fit Index (CFI), Tucker-Lewis index (TLI), and Gamma hat ≥ 0.90 ; $\chi^2/df < 3.80$; the standardized root-mean square residual (SRMR) ≤ 0.08 , and the root mean square error of approximation (RMSEA) ≤ 0.08 (G. T. Brown et al., 2017; L. Hu & Bentler, 1999).

Measurement invariance across gender and education sector was performed following a stepwise procedure: configural invariance, metric invariance, scalar invariance, and strict invariance (Vandenberg & Lance, 2000). A lack of structural invariance implies there is population heterogeneity concerning the construct of our interest (J. Wang & Wang, 2019; Wu et al., 2019). Thus, when measurement invariance is ensured, we continue to examine structural invariance, which includes the evaluation of factor variance, factor covariances, and factor means across gender and education sector. Considering our relatively large sample size ($N = 723$), invariance models with $\Delta CFI < 0.010$ and $\Delta RMSEA < 0.015$ are favoured for invariance model comparison because they are insensitive to the sample size and complexity of the models (F. F. Chen, 2007).

Evidence for the external aspect of FLBS's validity was provided by correlations and structural equation modelling (SEM) results with the CBF-PI-15. Following Cohen's (1988) guidelines, a correlation coefficient (r) less than 0.29 is considered weak, while values between 0.30 and 0.49 indicate moderate correlations. A correlation of 0.50 or higher is interpreted as strong or robust. In addition, we tested the FLBS' internal consistency/reliability by checking its Coefficient H (McNeish, 2018).

Results

In this dataset, 16 participants with missing data higher than 5% and 68 outliers were removed, resulting in 723 participants. The skewness values of the final dataset varied from -0.09 to 0.34 , and the range of kurtosis values was from -1.05 to -0.73 , indicating that all responses were fairly normally distributed.

CFA

CFA results with the five-factor model indicated a good fit (see Table 1): $\chi^2(252) = 1024.508$, CFI = 0.921, TLI = 0.910, gamma hat = 0.917, RMSEA = 0.067 (90%CI [0.063, 0.071]), SRMR = 0.048. The five-factor model also had a significantly better fit than the one-factor model [χ^2 diff (10) = 864.32, $p < 0.001$]. Additionally, the standardized factor loadings for the 24 items were all statistically significant, ranging from 0.62 to 0.80 (see Table 2).

Table 1. Fit indices of CFA models of the FLBS.

Models	χ^2	N	df	χ^2/df	CFI	TFI	Gamma hat	RMSEA (90% CI)	SRMR
One-factor model	1888.823***	723	252	7.49	0.835	0.820	0.841	0.095 (0.091, 0.099)	0.055
Five-factor Model	1024.508***	723	242	4.23	0.921	0.910	0.917	0.067 (0.063, 0.071)	0.048
Men	780.343***	417	242	3.22	0.907	0.894	0.903	0.073 (0.067, 0.079)	0.055
Women	671.094***	306	242	2.77	0.901	0.887	0.896	0.076 (0.069, 0.083)	0.053
University	712.155***	472	242	2.94	0.933	0.924	0.924	0.064 (0.059, 0.070)	0.042
High school	621.365***	251	242	2.57	0.881	0.864	0.888	0.079 (0.071, 0.089)	0.066

CFI = comparative fit index; TLI = Tucker – Lewis index; RMSEA = root mean squared error of approximation; SRMR = standardized root mean squared residual. *** $p < 0.001$.

Table 2. Standardized factor loadings of the final CFA model of the FLBS.

Item	Standardized factor loadings (λ)				
	SF	MS	UF	PF	MA
1. I reflect on the quality of my own work and use my reflection as a source of information to improve my work.	0.78				
2. I seek out examples of good work to improve my work.	0.78				
3. When other people provide me with input about my work I listen or read thoughtfully.	0.72				
4. When I am working on a task, I consider comments I have received on similar tasks.	0.74				
5. I ask for comments about specific aspects of my work.	0.73				
6. I carefully consider comments about my work before deciding if I will use them or not		0.79			
7. When receiving conflicting information about my work from different sources, I make a judgement about what I will use.		0.74			
8. When deciding what to do with comments, I consider the credibility of their sources.		0.75			
9. I consider how comments relate to criteria or standards.		0.72			
10. I check whether my work is better after I have acted on comments.			0.73		
11. I use comments on my work to refine my understanding of what good quality work looks like.			0.73		
12. When receiving comments I plan how I will use them to improve my future work, not just the immediate task.			0.72		
13. I keep comments on previous work to use again in the future.			0.65		
14. When I receive comments from others, I use them to improve what I'm working on at the time.			0.73		
15. When commenting on the work of others, I provide constructive criticism.				0.77	
16. I comment on other people's work when I am invited to.				0.78	
17. When commenting on other people's work I refer to standards or criteria.				0.80	
18. I offer to provide feedback to my peers				0.71	
19. I try to be very clear when providing feedback comments to others.				0.62	
20. I am open to reasonable criticism about my work.					0.69
21. I deal well with any negative emotional responses I have to feedback information.					0.70
22. When a feedback message is valuable but upsetting or annoying, I still find a way to make use of it.					0.76
23. Critical comments motivate me to improve my work.					0.76
24. I make use of critical comments even if they are difficult to receive.					0.78

SF = Seek Feedback information; MS = Make Sense of information; UF = Use Feedback information; PF = Provide Feedback information; MA = Manage Affect. All Factor loadings > 0.50 and p -values < 0.001.

Establishing a model fit for each sub-sample is required before conducting measurement invariance analysis (Byrne et al., 1989). Thus, separate CFAs were run for each gender group and education sector (university students VS. high school students) for the five-factor model. Overall, all CFA models fitted the data well (see Table 1) and further confirmed the factorial structure of the FLBS, which laid the ground for subsequent measurement invariance analysis. The standardized factor correlations among the five factors (SF, MS, UF, PF, and MA) were statistically significant (0.72 to 0.89, $p < 0.001$).

Measurement invariance and structural invariance across gender

Table 3 summarizes the results of the measurement invariance across gender. Configural invariance (M1) showed an adequate fit (CFI = 0.905, TLI = 0.891, RMSEA = 0.074 (90%CI [0.070, 0.079]), which involved an initial analysis with no constraints estimated simultaneously across gender as our baseline model. Metric invariance (M2) was then tested where factor loadings were constrained to be equal across males and females. This model was supported because the differences between metric and configural invariance were Δ CFI = 0.000 and Δ RMSEA = - 0.001.

Table 3. Measurement invariance results across gender.

	χ^2	df	χ^2/df	CFI	TFI	Gamma hat	RMSEA (90% CI)	SRMR	Δ CFI	Δ RMSEA
M1	1451.436***	484	3.00	0.905	0.891	0.901	0.074 (0.070, 0.079)	0.054	—	—
M2	1467.258***	503	2.91	0.905	0.896	0.900	0.073 (0.069, 0.077)	0.056	0.000	- 0.001
M3	1496.950***	522	2.87	0.904	0.899	0.899	0.072 (0.068, 0.076)	0.056	- 0.001	- 0.001
M4	1528.693***	546	2.80	0.903	0.902	0.897	0.071 (0.066, 0.075)	0.056	- 0.001	- 0.001
M5	1578.658***	561	2.81	0.900	0.901	0.895	0.071 (0.067, 0.075)	0.061	- 0.003	0.000
M6	1591.069***	566	2.81	0.899	0.902	0.894	0.071 (0.067, 0.075)	0.062	- 0.001	0.000

M1 = configural invariance; M2 = metric invariance; M3 = scalar invariance; M4 = strict invariance; M5 = factor variances and covariances; M6 = factor variances, covariances, and factor means. CFI = comparative fit index; TLI = Tucker – Lewis index; RMSEA = root mean squared error of approximation; SRMR = standardized root mean squared residual. *** $p < 0.001$.

Scalar invariance (M3), whose factor loadings and item intercepts were specified to be equal across gender groups, was also attained given Δ CFI = - 0.001 and Δ RMSEA = - 0.001. To evaluate the strict invariance model (M4), we imposed equality constraints on factor loadings, item intercepts, and item uniqueness. Results showed that the changes in CFI and RMSEA between strict and scalar invariance models were lower than the threshold (CFI = - 0.001 and Δ RMSEA = - 0.001). This result demonstrated that measurement invariance across gender met the stringent criterion for strict invariance and surpassed the necessary psychometric standards in invariance testing.

Further tests for structural invariance regarding latent variances and covariances (M5, Δ CFI = - 0.003 and Δ RMSEA = 0.000) and factor means (M6, Δ CFI = - 0.001 and Δ RMSEA = 0.000) were also viable, indicating that two subgroups indeed belong to the same population regarding the focused constructs (e.g., SF, MS, UF, PF, and MA) (Wu et al., 2019).

Measurement invariance over the education sector

As presented in Table 4, the configural invariance model (E-M1) showed a satisfactory fit (CFI = 0.917, TLI = 0.905, RMSEA = 0.070 (90% CI [0.065, 0.074]), suggesting factors were sufficiently defined and measured for both university and high school students. The metric invariance model (E-M2) was fully supported (Δ CFI = -

Table 4. Measurement invariance results across education sector.

	χ^2	df	χ^2/df	CFI	TFI	Gamma hat	RMSEA (90% CI)	SRMR	Δ CFI	Δ RMSEA
E-M1	1333.520***	484	2.76	0.917	0.905	0.910	0.070 (0.065, 0.074)	0.051	—	—
E-M2	1364.617***	503	2.71	0.9157	0.908	0.909	0.069 (0.064, 0.073)	0.057	- 0.001	- 0.001
E-M3	1560.324***	522	2.99	0.8984	0.893	0.894	0.074 (0.070, 0.078)	0.063	- 0.0173	- 0.005
E-M4	1477.821***	520	2.84	0.9063	0.901	0.902	0.071 (0.067, 0.076)	0.061	- 0.0094	0.002

E-M1 = configural invariance; E-M2 = metric invariance; E-M3 = scalar invariance; E-M4 = Partial scalar invariance releasing intercepts of item 18 and item 20. CFI = comparative fit index; TLI = Tucker – Lewis index; RMSEA = root mean squared error of approximation; SRMR = standardized root mean squared residual. *** $p < 0.001$.

0.001, $\Delta\text{RMSEA} = -0.001$). The results, however, indicated a lack of scalar invariance (E-M3; $\Delta\text{CFI} = -0.0173$, $\Delta\text{RMSEA} = -0.005$). This suggests that students in at least one group tend to respond consistently higher or lower to the items on the scales being examined, even if the factor loadings are held across groups (J. Wang & Wang, 2019).

Steenkamp and Baumgartner (1998, p. 88) claimed that “if a measurement instrument is at least partially invariant, then valid cross-national comparisons can be conducted even when the ideal of full invariance is not realised”. Therefore, we continued to perform a partial scalar invariance test (Vandenberg & Lance, 2000). This involves freeing the constraint on the intercepts of each item, in turn, to determine which items were non-invariant. The process demonstrated that the intercepts (τ) of item 18 (# I offer to provide feedback to my peer) and item 20 (#I am open to reasonable criticism about my work) were not invariant. The standardized intercept of item 18 in the university group ($\tau = 3.55$) was higher than the high school group ($\tau = 2.51$). Conversely, the standardized intercept of item 20 in the university group ($\tau = 3.83$) was lower than in the high school group ($\tau = 4.06$).

After releasing these two constraints, the partial scalar invariance model (E-M4) showed a significant improvement in fit when compared with the full scalar invariance model (E-M3): $\chi^2_{\text{diff}}(2) = 82.50$, $p < 0.001$. This indicates a partial scalar invariance model as the less restrictive model was favoured. Besides, the differences in CFI and RMSEA between the partial scalar invariance model (E-M4) and metric invariance (E-M2) were $\Delta\text{CFI} = -0.0094$ and $\Delta\text{RMSEA} = 0.002$. Therefore, partial scalar invariance was supported as the final model, implying that the university and high school students showed the same starting values in the FLBS except for item 18 and item 20. Specifically, university students started with a higher initial expected score in item 18 than high school students but showed a lower baseline in item 20. Because we used a step-down approach to test measurement invariance, structural invariance across education sector was not examined further when there was a lack of scalar invariance.

Scalar invariance constitutes sufficient evidence for measurement invariance for meaningful mean comparison across groups (Wu et al., 2019). Therefore, we further tested latent mean differences based on the partial scalar invariance model (E-M4) by fixing the latent factor means of high school subsamples to zero as the reference group. Indicated by Table 5, the university student subsample showed significantly higher factor means in SF (standardized latent mean difference = 0.18, $\text{SE} = 0.08$, $p < 0.05$, Cohen's $d = 0.19$), UF (standardized latent mean difference = 0.38, $\text{SE} = 0.07$, $p < 0.001$; Cohen's $d = 0.39$), PF (standardized latent mean difference = 0.32, $\text{SE} = 0.08$, $p < 0.001$; Cohen's $d = 0.38$), and MA (standardized latent mean difference = 0.30, $\text{SE} = 0.07$, $p < 0.01$; Cohen's $d = 0.16$). Nevertheless, MS did not show a significant latent mean difference in the university and high school subsamples (standardized latent mean difference = 0.00, $p > 0.05$, $\text{SE} = 0.08$, Cohen's $d = 0.00$).

Internal consistency and external aspect of validity

In Table 6, the FLBS showed good internal consistency, given that all Coefficient H were higher than 0.80: 0.87 for SF and PF, 0.84 for MS and UF, and 0.86 for MA. As indicated by

Table 5. Latent mean comparisons of the FLBS across education sector.

Factors	Partial scalar invariance model			
	University students			
	<i>Est</i>	SE	SD	Cohen's <i>d</i>
Seek feedback information	0.18*	0.08	0.94	0.19
Make sense of information	0.00	0.08	0.94	0.00
Use feedback information	0.38***	0.07	0.85	0.39
Provide feedback information	0.32***	0.08	0.87	0.38
Manage affect	0.30**	0.07	0.81	0.16

Est= Standardized latent mean differences. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

The latent means of high school students are fixed to zero as the reference group.

Table 6. Descriptive statistics and Pearson correlations.

	I	II	III	IV	V	VI	VII	VIII	IX	X
I. Seek feedback information	(0.87)									
II. Make sense of information	0.74***	(0.84)								
III. Use feedback information	0.76***	0.74***	(0.84)							
IV. Provide feedback information	0.64***	0.60***	0.69***	(0.87)						
V. Manage affect	0.67***	0.67**	0.70***	0.65***	(0.86)					
VI. Neuroticism	-0.03	0.002	0.007	-0.05	-	(0.92)				
VII. Conscientiousness	0.39***	0.38***	0.45***	0.31***	0.36***	0.14***	(0.80)			
VIII. Agreeableness	0.31***	0.30***	0.35***	0.25***	0.30***	0.07	0.51***	(0.87)		
IX. Openness to experience	0.37***	0.33***	0.39***	0.41***	0.35***	0.13***	0.46***	0.44***	(0.89)	
X. Extraversion	0.09*	0.01	0.12***	0.15***	0.07	-0.38***	-0.05	0.08*	-0.02	(0.86)
Mean	4.26	4.41	4.28	4.18	4.41	3.51	4.12	4.29	4.02	3.38
SD	0.96	0.92	0.86	0.98	0.90	1.39	1.03	1.08	1.14	1.07

Values shown in parentheses on diagonal are Coefficient H of the scales. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Pearson correlation results, there were strongly positive relationships among the FLBS factors ($r = 0.60$ to 0.76).

Conscientiousness and openness to experience demonstrated moderate positive correlations with all factors of the FLBS ($r = 0.31$ to 0.45 , $p < 0.001$). A similar moderate pattern was observed between agreeableness and four dimensions out of the FLBS ($r = 0.30$ to 0.35 , $p < 0.001$), except for the weak correlation for PF ($r = 0.25$; $p < 0.001$). Weak correlations were yielded between extraversion and SF, UF, and PF ($r = 0.09$ to 0.15 , $p < 0.001$), while it exhibited insignificant correlations with MS and MA ($r = 0.01$ to 0.07). As for neuroticism, it showed no significant positive and negative correlations with five dimensions of the FLBS ($r = -0.002$ to 0.007).

Table 7 and Figure 1 revealed that conscientiousness and openness to experience were the strongest positive predictors of UF ($\beta = 0.45$, $p < 0.001$) and PF ($\beta = 0.40$, $p < 0.001$), respectively. Conscientiousness contributed slightly higher to SF ($\beta = 0.36$, $p < 0.001$), MS ($\beta = 0.33$, $p < 0.001$) and MA ($\beta = 0.30$, $p < 0.001$) than openness to experience predicted SF ($\beta = 0.24$, $p < 0.001$), MS ($\beta = 0.18$, $p < 0.01$), and MA ($\beta = 0.22$, $p < 0.001$).

Table 7. Standardized path coefficients between feedback literacy behaviour and the Big Five personality.

Predictors	Dependent Variables				
	Seek feedback information	Make sense of information	Use feedback information	Provide feedback information	Manage affect
Neuroticism	<i>-0.07</i>	<i>-0.09</i>	<i>-0.02</i>	<i>-0.10*</i>	<i>-0.06</i>
Conscientiousness	0.36***	0.33***	0.45***	0.20**	0.30***
Agreeableness	0.06	0.06	0.03	<i>-0.04</i>	0.04
Openness to experience	0.24***	0.18**	0.21***	0.40***	0.22***
Extraversion	0.08	<i>-0.04</i>	0.12*	0.07	0.03

The bold values indicate the effects with weights above 0.30; italicized numbers indicate negative effects.

Extraversion only showed a positive prediction towards UF ($\beta = 0.12, p < 0.05$) out of five factors of the FLBS, but there was no significant path from extraversion to SF, MS, PF, and MA. Conversely, neuroticism showed a small and negative effect on PF ($\beta = -0.10, p < 0.05$) but did not yield a significant effect on SF, MS, UF, and MA. However, we did not find any significant path from agreeableness to each factor of the FLBS. The full SEM model presented an acceptable fit: $\chi^2(657) = 1927.227$, CFI = 0.922, TLI = 0.912; RMSEA = 0.052 [90%CI (0.049, 0.054)], SRMR = 0.068. The SEM model explained a 35.41% variance of UF, followed by SF (27.41%), PF (24.94%), MS (24.64%), and MA (23.29%) (see [Figure 1](#)).

The results revealed that the associations between the FLBS factors and the personality dimensions of the CBF-PI-15 were generally weak to moderate and predominantly positive. Furthermore, the predictions of the CBF-PI-15 personality dimensions on each FLBS factor varied, with both positive and negative effects observed across different factors. These findings suggest that the associations are not excessively high while these two constructs are related, providing evidence for convergent validity and discriminant validity of the FLBS. Consequently, constructing five distinct factors with unique focuses based on the broad concept of student feedback literacy is well-justified.

Discussion

This study aims to re-validate the 24-item FLBS developed by Dawson et al. (2023) with a Chinese sample of high school and university students. Our CFA results supported the five-factor model for the Chinese version of the FLBS. All standardized factor loadings are higher than 0.60, which indicates that the factors of FLBS could explain more than 25% of the item variance (Hair et al., 2019). Measurement invariance results across gender demonstrated strict invariance and structural invariance, suggesting that the two sub-groups indeed belong to the same population in terms of the focused constructs of the FLBS (Wu et al., 2019). In terms of the education sector, partial scalar invariance was supported where university students had higher starting values in item 18 (#1 offer to provide feedback to my peer) but lower baseline in item 20 (#1 am open to reasonable criticism about my work).

One possibility is that, with the emphasis on self-regulated learning and learning-centred feedback in higher education, university students receive training and ample opportunities to provide feedback, resulting in a positive orientation towards engaging in feedback activities (Shen et al., 2023). However, high school students have limited

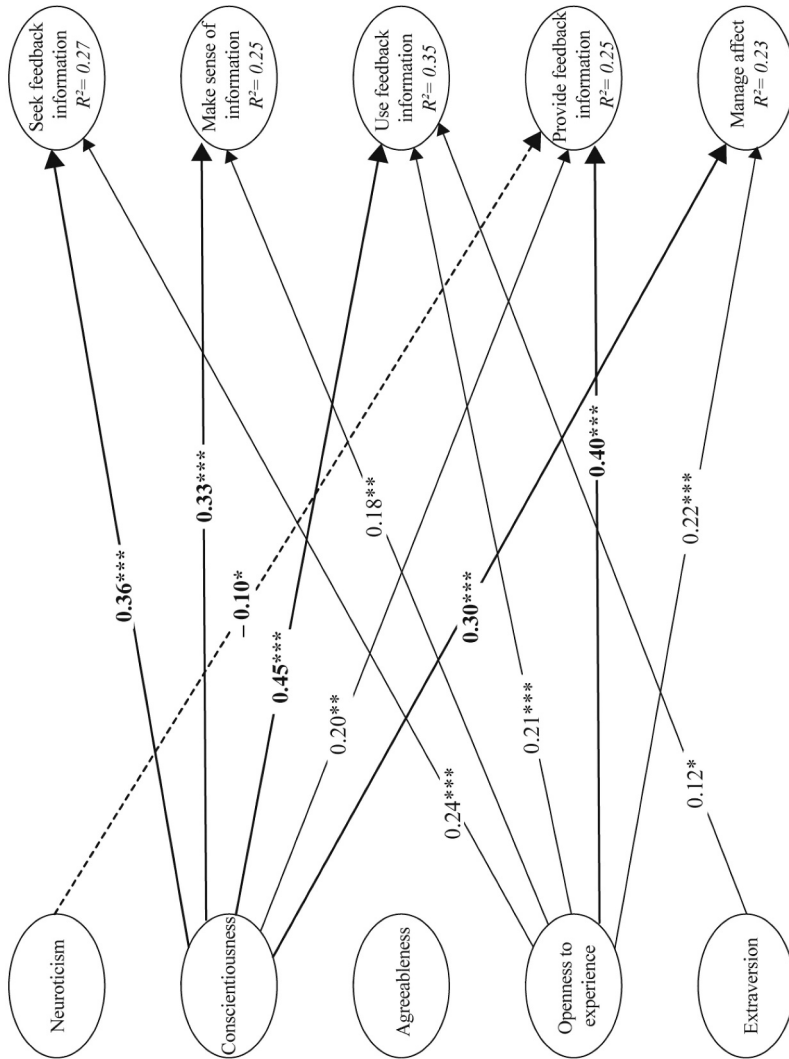


Figure 1. The schematic diagram of the structural relationship between feedback literacy behaviour and the Big Five personality. The schematic diagram of the structural relationship between feedback literacy behaviour and the Big Five personality items and factor intercorrelations were removed for simplicity; values are standardized β coefficients. Bold lines denote $\beta > 0.30$, and dashed lines indicate negative values.

opportunities to provide feedback because the prevalent teacher-centric feedback approach still plays a dominant role in high school (J. Huang, 2020). On the other hand, university students are more likely to disregard social evaluations and adopt a more independent and autonomous stance in deciding whether to accept criticism after reflecting on their work (Shen et al., 2023). This tendency may stem from a stronger sense of self-identity, which fosters a deeper attachment to their own perspectives and abilities (Marcia, 1966). Conversely, high school students may consider reasonable criticism an essential method for climbing the higher ladder in college entrance examinations due to the examination-oriented education (J. Huang, 2020; Yao & Zhu, 2024). Another speculation is that high school students are still in earlier stages of identity development and may not have a solidified self-concept; as a result, they may be more open to criticism when it is presented in a reasonable manner (Verhoeven et al., 2019).

According to the latent mean comparisons results across the education sector, university students had significantly higher factor means in SF, UF, PF, and MA but not in MS. The findings echoed the recent shift in feedback literature to the learning-centred feedback paradigm in higher education (N. Winstone & Carless, 2019). University students exhibit agency and engagement in seeking and using feedback, likely because they perceive seeking feedback as a component of self-regulated learning and are willing to leverage this dialogic feedback process to regulate their cognitive intelligence (Jonsson, 2013; Shen et al., 2023). High school students possibly avoid seeking feedback for fear of others' negative comments or threatening their self-ego (Yao & Zhu, 2024). Moreover, high school students either apply feedback ineffectively – such as by merely copying corrective answers – or experience confusion regarding its practical implementation, though receiving feedback frequently (Burke, 2009; Lee, 2008).

Research indicated that university students are willing to engage in providing feedback for praising or encouraging their peers' strengths with higher emotional resilience towards critical comments (Han & Xu, 2020; Wei et al., 2021; Zhan, 2021). This may be due to the advocacy of a learning-centred feedback paradigm and self-regulated learning in higher education (Ministry of Education, 2020). Nevertheless, high school students may have limited opportunities for providing feedback and remain heavily dependent on teacher feedback, as the teacher-centred context highlights power distance and one-way transmission of knowledge (G. T. Brown et al., 2015; Man et al., 2018; E. D. Zhang et al., 2023). Compared with university students, high school students are more anxious, stressed, and sensitive to negative comments in such an examination-oriented environment, so they are less emotionally resilient in response to negative comments, which prevents them from obtaining insights from these comments and feed them forward in further learning (S. Chen, 2019; C. C. Huang et al., 2019).

Contrary to our expectations, university and high school students did not show a prominent difference in understanding feedback. This may be because both strive to engage in appreciating feedback, with their actual mean close to 4.16. We infer that both university students and high school students show high conscientiousness, influenced by Confucian heritage culture, which underlines academic performance, personal efforts and discipline, and teacher authority (D. Y. K. Chong & McArthur, 2023; Ho, 2020; Zhan, 2021). As a consequence, both groups tend to acknowledge the value of feedback and put more cognitive engagement into understanding feedback (Lipnevich et al., 2021).

In addition, university students are often mastery-goal-oriented and more likely to receive indirect feedback, enabling them to show great interest in understanding queries or informative content to develop their competence (Luo et al., 2023). However, high school students tend to be performance-approach-oriented, externally driven by the school climate that is featured by uniform assignment of tasks and examinations, lack of autonomy, and recognition and evaluation. These conditions compel them to grasp feedback as a means to outperform peers and succeed in the National College Entrance Examination (J. Wang & Rao, 2019).

The relationships between the FLBS factors and each dimension of the Big Five personality supported the external validity of the FLBS. Correlation results showed that the factors of the FLBS and the factors of the CBF-PI-15 were not highly associated, suggesting that they do not measure the same underlying construct. Consistent with prior studies (Dawson et al., 2023; Lipnevich et al., 2021), our SEM results suggested that the Big Five personality dimensions significantly impacted the factors of student feedback literacy, signifying that personality traits, as a concept relevant to behavioural dispositions, is a critical factor in predicting and explaining human behaviours through three antecedents of intentions of the TPB theory: attitude, subjective norm, and perceived behavioural control (Ajzen, 1991, 2005).

Specifically, conscientiousness and openness to experience play a facilitating role in enhancing students' feedback literacy. This suggests that students who are more "strong-willed", purposeful, achievement-striving, and intellectually curious about new information tend to seek, understand, provide, and use feedback while exhibiting greater capacities in managing emotions in response to received feedback. One viable explanation is that conscientious and open students are highly focused on achievement, discipline, and the pursuit of novel ideas. As a result, they tend to have a favourable attitude towards the value of feedback, stronger intentions to engage with feedback effectively to achieve learning goals, and higher perceived control when dealing with negative feedback (Lipnevich et al., 2021; Swift & Peterson, 2018; N. E. Winstone et al., 2019). Extraverts are characterized by sociability, a drive for status, competitiveness, and a sense of adventure (Erevik et al., 2023). Given these traits, extroverted students are more likely to use feedback for interpersonal interactions and outperform others (Arun Kumar & Lavanya, 2024; Bell & Arthur, 2008)

On the other hand, our findings indicated that students' neuroticism only significantly and negatively predicted the provision of feedback information. Neurotic students are often characterized by intense self-consciousness, uncertainty about feedback information, and negative attitudes towards interpersonal interactions (Brunson et al., 2016; Krasman, 2010). Their inclination towards feedback and social interaction may lead them to resist group collaboration and feel insecure about providing feedback. This outcome seems to contrast with Yang's (1986) review, which shows that Chinese students generally have higher neuroticism and emotionality than Americans.

This may be because our study did not involve a cross-cultural sample but depended on a Mainland China sample from high school to higher education. High school students are acknowledged as emotionally sensitive, while university students tend to show stronger resilience that helps them solve problems and adapt to the new environment with a positive mindset (M. Wang et al., 2022). Thus, the effect of neuroticism may not be higher, with university students' higher "recovery power" mitigating its negative effect. As

Yang (1986) stated, we cannot definitely portray Chinese students as more or less emotional, anxious, and neurotic because such confounding factors (rating criteria for emotional stability, social and cultural differences) may cause the contrary to be true (Yang, 1986).

In addition, agreeableness did not yield significant links with each factor of the FLBS, which contrasts with prior studies that show the facilitator role of agreeableness for students' dispositions of seeking, using, and providing feedback (Bell & Arthur, 2008; Krasman, 2010). Agreeableness has been linked to effortful control (Rothbart & Ahadi, 1994). In this sense, agreeableness individuals may allocate more cognitive resources to maintain harmony by pretending positive emotions consistently (Bell & Arthur, 2008), which prevents them from attending to or processing feedback information that could benefit their learning performance and developing emotional resilience when faced with negative comments.

In short, the imperative role of student feedback literacy in facilitating students' learning is evident, though the current tool measuring student feedback literacy as enacted for Chinese students is still in its infancy. Since cultural differences impact students' development of student feedback literacy, such as their understanding and competence to use feedback (D. Y. K. Chong & McArthur, 2023; Harrison et al., 2016; Ho, 2020; Luque & Sommer, 2000; Zhan, 2021), validating a Chinese version of the FLBS is crucial for understanding Chinese students' feedback literacy behaviours.

With the validated Chinese version of FLBS, researchers and practitioners can further investigate how Chinese students could seek, provide, and process feedback information in their learning experiences. A sound understanding of students' feedback literacy would enhance research in this field and promote the effective use of feedback as a learning strategy in classroom instruction in different educational settings (H. Chen et al., 2024; Han & Xu, 2020; Hattie & Timperley, 2007). With the support of the FLBS, educators can explicitly provide instructions and interventions for students to improve their feedback literacy. Henceforth, this study can shed light on future research about feedback literacy in the Chinese context.

Limitations and future directions

Similar to the original validation of the FLBS, we have not tested the consequential validity of the FLBS, as we did not have relevant criterion data. Students can be taught to regulate their learning, but less evidence shows how changes in students' feedback perceptions influence their behavioural or academic outcomes (G. T. Brown & Zhao, 2023). Future research is encouraged to explore whether the intervention of feedback literacy contributed to greater self-efficacy (Howell & Shepperd, 2016; King et al., 2009), self-regulated learning (G. T. Brown et al., 2016; Zhu & Mok, 2018), and academic performance (e.g., GPA, mathematical performance, and language proficiency) (A. M. Adams et al., 2020; G. T. Brown et al., 2016), or more positive emotional responses (King et al., 2009).

Secondly, our study focuses on the novel concept of student feedback literacy without reviewing other similar concepts elaborately that have been discussed in earlier research across fields like education, psychology, and business (Anseel et al., 2015; G. T. Brown & Zhao, 2023; Gao & Brown, 2023; Lipnevich & Lopera-Oquendo, 2022). Hence, future research may consider conducting a systematic review of

student feedback literacy to avoid the jingle-jangle effect. Limited grade variability existed in our high school sample, of which only 9% were in grade 12. Future research can test whether the findings can be replicated in other sociocultural contexts with more diverse samples across grades, regions, or linguistic backgrounds included.

Lastly, the data used in this study was, in nature, cross-sectional. There is a possible limitation that human memory may distort the accuracy of self-reported scales due to its seven basic “sins” (transience, absentmindedness, blocking, misattribution, suggestibility, bias, and persistence), which represents different types of forgetting, distortion, and intrusive recollections (Schacter, 1999). For example, graduate students, although constituting only a small portion of our sample, may struggle to recall teacher feedback due to a few course arrangements but high pressure of preparing for postgraduate entrance exams or job-hunting.

Secondly, students in a Confucian-influenced society are more likely to rate items related to criticism and neuroticism higher if they have traumatic memories related to assessment from a third party in their past experiences; these intrusive recollections possibly lead to bias for current judgement of the questionnaire (Ho, 2020; Schacter, 1999). Thus, we recommended that future research adopt a longitudinal design (e.g., testing temporal stability), carefully considering appropriate time intervals. This also should be supplemented with a mixed-method approach (e.g., reflective writing, interview, and class observation) to further understand how accurate these self-reports are.

Conclusions

This study supports the five-factor structure of the FLBS and extends its applicability in a Chinese context. Measurement invariance across gender and education sector is supported, suggesting the FLBS can be used in meaningful comparison for Chinese students across gender and education sectors. The Chinese version of the FLBS has the potential to benefit Chinese researchers and practitioners by facilitating the assessment of students’ feedback literacy and providing insights into training students to become more feedback literate.

Note

1. The Junior High School Scholastic Aptitude Examination, commonly abbreviated as the Zhongkao, is the examination for junior high school graduation in China. The exam scores are used for both junior high school graduation and senior high school admissions. It is the academic examination held in the People’s Republic of China to admit junior high school graduates. The examination is a must for entrance into educational institutions at senior high school level. This includes secondary skill schools, vocational and technical high schools as well as common senior high schools. This is taken by students in the last year of junior high school. On an annual basis, numerous students take zhongkao (Extract information from <https://www.chinaeducation.info/standardised-tests/k12-tests/zhong-kao-examination.html> and <https://en.wikipedia.org/wiki/Zhongkao>).

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author, [YZ]. The data are not publicly available due to restrictions, e.g., their containing information that could compromise the privacy of research participants.

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Appendix

Appendix A 反馈素养量表

下列问题想请您根据自己的学习习惯来回答,并评价您做这些事情的频率。

寻求反馈

1. 我会反思自己的学习表现,并将反思作为改善自身学习表现的一种信息。
2. 我会搜寻他人优秀的学习案例,来提升自己的学习表现。
3. 当他人提供关于我的学习表现的意见时,我会仔细聆听或浏览。
4. 当我忙于一个学习任务时,我会参考之前完成类似任务时所收到的评语。
5. 我会询问有关于我学习表现具体某些方面的意见。

理解反馈

6. 我会仔细思考有关于我学习表现的意见,再决定是否采纳。
7. 从不同渠道获得的关于我学习表现的评语自相矛盾时,我会自行判断采纳哪些评语。
8. 我会考虑有关于我学习表现意见来源的可信度,再决定如何利用它们。
9. 我会思考评语和评价标准或准则之间的关系。

利用反馈

10. 采纳意见,付诸行动之后,我会审视我的学习表现是否有所提高。
11. 我会采纳有关于我学习表现的意见,去更好理解什么是好的学习成果。
12. 收到评语之后,我会计划如何利用它们提高我将来的学习表现,而不仅仅是为了当下的学习任务。
13. 我会保留对我之前学习表现的评语,以备将来再次使用。
14. 收到他人评语后,我会利用它们来改进我当下的学习表现。

给予反馈

15. 评论他人学习表现,我会给具有建设性的批评意见。
16. 当他人邀请我时,我会评价他人的学习表现。
17. 我会参照标准或准则来评价他人的学习表现。
18. 我会主动提供反馈给我的同伴。
19. 给予其他人提供反馈意见时,我尽量说得清楚。

管理情绪

20. 我乐意接受对我学习表现的合理批评。
21. 我能处理好由反馈信息而带来的任何负面情绪。
22. 如果反馈信息对我有价值,但令人恼怒或厌烦,我仍然会想办法利用这些反馈信息。
23. 批评意见激励我改进我的学习表现。
24. 即便接受起来很难,但我仍会好好利用批评意见。