frontiers | Frontiers in Education

TYPE Systematic Review
PUBLISHED 16 May 2025
DOI 10.3389/feduc.2025.1572950

OPEN ACCESS

EDITED BY
Fabienne Van Der Kleij,
Australian Council for Educational Research, Australia

REVIEWED BY
Jonathan Gutterman,
The City University of New York, United States
Anna Serbati,
University of Trento, Italy

*CORRESPONDENCE
Christian Brandmo
christian.brandmo@isp.uio.no

RECEIVED 07 February 2025
ACCEPTED 14 April 2025
PUBLISHED 16 May 2025

CITATION
Brandmo C and Gamlem SM (2025) Students' perceptions and outcome of teacher feedback: a systematic review.
Front. Educ. 10:1572950.
doi: 10.3389/feduc.2025.1572950

Students' perceptions and outcome of teacher feedback: a systematic review

Christian Brandmo [1]* and Siv M. Gamlem [2]

[1]Department of Special Needs Education, University of Oslo, Oslo, Norway, [2]Department of Education, Volda University College, Volda, Norway

This systematic review examines students' perceptions and outcomes of teacher feedback in elementary and lower secondary education (ages 10–16). The study explores how different feedback types and personal and relational factors influence students' achievement and their cognitive, emotional, and behavioral outcomes. Following PRISMA guidelines and the PICO framework, 96 empirical studies were analyzed, focusing on feedback-related student outcomes and moderating factors. Findings indicate that high-quality, tailored, and action-oriented feedback positively affects student achievement, motivation, and engagement, while negative or vague feedback can lead to demotivation and avoidance behaviors. Students prefer direct and individualized feedback, and trust in the teacher-student relationship is crucial for effective feedback uptake. Social dynamics, gender differences, and feedback interpretation influence student outcomes, emphasizing the need for adaptive feedback strategies. The review suggests that future research should focus on finding specialities and commonalities across various groups as well as on integrating AI with human feedback systems.

KEYWORDS

student assessment, teacher feedback, feedback outcome, feedback moderators, student perspective, systematic review

1 Introduction

1.1 The purpose of this review

Formative assessment in elementary and lower secondary schools is challenging for both students and teachers. It requires processes that integrate received feedback and enhance the learning experience (Black and Wiliam, 1998; Gamlem and Smith, 2013; Van der Kleij, 2022). Formative feedback is information aimed at modifying the learner's thinking or behavior to improve learning (Shute, 2008). While feedback significantly influences achievement, its effects can vary, highlighting the complexity of its optimal use (Hattie, 2009; Shute, 2008). Shute (2008) identifies various feedback types (e.g., correct answer explanations, hints), modalities (e.g., written, oral), and timings (e.g., during learning, immediately after a response). Additionally, variables like learner characteristics and task aspects interact with feedback's effectiveness. Wisniewski et al. (2020) found that high-information feedback, including self-regulation information, is most effective ($d = 0.99$).

Traditionally, teachers were solely responsible for providing evaluative feedback (Hattie and Timperley, 2007; Shute, 2008). However, the paradigm has shifted to recognize the social context of learning, where students actively seek, receive, and apply feedback (Gamlem and Smith, 2013; Lipnevich and Panadero, 2021; Van der Kleij, 2022). Van der Kleij (2022) advocates for a student-centered approach, giving students agency. Feedback is

a dynamic interaction between teacher and student aimed at facilitating learning (Andrade, 2010; Gamlem and Munthe, 2014), but it is effective only when used.

To understand how feedback impacts learning, it is essential to study the relationships among teacher feedback, student beliefs, motivation, interpretation, and responses (Yang et al., 2021). It is still unclear what kind of teacher feedback is most beneficial and what moderating factors enhance learning. This study systematically reviews empirical research on students' perceptions and outcomes related to teacher feedback for ages 10–16.

1.2 Feedback in elementary and lower secondary school

Teacher feedback is vital but insufficient without student engagement (Van der Kleij, 2022). Understanding students' perspectives is crucial to grasp how feedback is received, interpreted, and used. This approach helps identify what types of feedback work best and why (Shute, 2008). Including students' views makes research more democratic and relevant (Fielding, 2004).

We focus on students aged 10–16, a period of significant cognitive, emotional, and social development (Eccles et al., 1993). Feedback during this transitional phase from primary to secondary school is critical for adapting to new learning environments and expectations (Black and Wiliam, 1998). Understanding students' feedback perceptions can guide effective interventions to boost learning and engagement (Wigfield and Eccles, 2000). Effective feedback usually answers three questions: Where am I going? How am I going? Where do I go next? It operates at four levels: task, process, self-regulation, and self (Hattie and Timperley, 2007).

Despite its potential, feedback often fails to enhance learning (Shute, 2008). Effective feedback should be part of the teaching process, be comprehensible, be actionable, and stimulate critical thinking (Andrade, 2010; Black and Wiliam, 2018; Hattie and Gan, 2011). It should align with learning objectives (Hattie and Timperley, 2007; Gamlem and Munthe, 2014). However, not all feedback types are beneficial. Evaluative feedback like scores and rewards can hinder learning (Guskey and Brookhart, 2019; Kluger and DeNisi, 1996). Grades and scores can decrease crucial metacognitive strategies (Boekaerts and Corno, 2005). Volitional engagement is essential for persistence and managing self-esteem threats (Black and Wiliam, 2009; Boekaerts and Corno, 2005). Moreover, former research found that feedback effects vary among students, indicating diverse feedback needs (e.g., Shute, 2008; Lipnevich et al., 2016). Feedback interpretation and response involve psychological states and dispositions (Butler and Winne, 1995; Perrenoud, 1998). Prior knowledge, beliefs, and thought processes mediate feedback effectiveness (Smith et al., 2016). For feedback to be effective, it must be processed through the learner's unique cognitive lens.

1.3 The present study

In this study, we attempt to fill a gap in the assessment literature by systematically reviewing empirical research on feedback in the age group 10–16. This is based on the fact that most feedback research has been done on students in higher education and the need to systemize research on younger students. Furthermore, because we are particularly interested in what works for students, we have focused on student outcomes. Related to this is also an interest in what causes or influences student outcomes, which we have chosen to name moderators.

Much of the research and theory development in the formative assessment field has occurred over the past 25, and because we wanted to avoid being history-less and forgetting good research that goes back a bit in time, we chose the last 30 years as the search period. Since we started the work on this review in 2021, it includes articles dating back to December 1991. Furthermore, as we did not know how artificial intelligence would influence feedback processes and, consequently, the research related to feedback, we decided to end the review when ChatGPT launched in November 2022.

Given this point of departure, the following research questions have guided the review.

1. What student outcomes are measured in studies concerning teacher feedback?
2. What factors are assumed to moderate students' outcomes of teacher feedback?
3. Do the results of the studies indicate that some factors are more important than others in moderating students' various outcomes of teacher feedback?

2 Method

In this review, we followed the PRISMA guidelines and the PICO framework as far as applicable. This means that we followed the PRISMA guidelines as our primary framework for reporting. Additionally, we used the PICO framework to assess each included study, focusing on population, intervention/measure, type of comparison, and outcome. However, since this review goes beyond strictly defined interventions and includes observational and small-scale qualitative studies, the comparison component (C) and outcome components (O) of the PICO framework were not always applicable. The literature search was conducted in two rounds in the databases Eric, PsychINFO, Educational Research Complete, and Scopus, resulting in a total of 8,593 hits that went on to the title and abstract screening. The first search contained studies from December 1991 until December 2021. Later, an updated search was made for the period up to November 2022, which is the time when ChatGPT was made generally available.

In developing the search protocol, key areas of teacher feedback were identified and categorized. These areas included *teacher feedback itself,* encompassing different feedback types (e.g., achievement feedback, performance feedback) and processes in which feedback occurs (e.g., formative assessment, assessment for learning). Another key area was *students' perceptions of feedback*, which covered general perception terms as well as cognitive and emotional responses. Additionally, the *outcomes of teacher feedback* were considered, including improvements in knowledge and changes in various beliefs, changes in motivation, behavioral changes or regulation of learning, and various achievement descriptors. Lastly, possible *moderating variables of teacher feedback* were identified, incorporating feedback content and types,

task requirements, feedback mode, feedback context, individual differences, and social relation variables. Altogether, this process resulted in 138 descriptors. In the next phase, we were supported by a librarian at the Medical Library at the University of Oslo to specify and conduct the first trial search, which we scrutinized regarding the relevance of the hits, and then a final search. Further, the search criteria required that articles (a) should relate to education, (b) be published in English, (c) be peer-reviewed, and (d) for empirical studies include data from or about students (search documentation is available in the Supplementary material).

The authors and three trained research assistants used the Covidence software for the title and abstract screening. Two blinded independent reviewers had to agree on all decisions on whether the study should be included. However, some conflicts arose due to the great diversity in both content and methodological approaches and the clarity of the abstracts. These conflicts were solved through an extra round of review and discussions that included one or both authors. Inclusion criteria were "educational context, teacher feedback, feedback given through digital media by a teacher, student outcome, student achievement (tests, performance), cognitive outcome (e.g., learning, understanding, beliefs), motivational outcome (e.g., change in goals, student engagement), relational or social outcome, judgment of feedback, students' perceptions and reactions on feedback". Exclusion criteria were "lack of students' perspectives, empirical studies that do not include data from or on students, studies do not include student outcome, feedback was not given by a teacher, and computer-generated feedback." The title and abstract screening resulted in 1,501 records proceeding to the full-text review.

Through the long process of title and abstract screening, we realized the need to narrow the present study's focus. This was based on the interest in producing manageable data material. Therefore, we changed the inclusion and exclusion criteria before starting the full-text review. The narrowing involved only including empirical studies and focusing only on studies that examined the age group 10–16. The last criterion emerged after recognizing that we lack systematized knowledge about this age group. The two authors and one trained research assistant conducted the full-text review. Furthermore, we used the procedures previously described to resolve conflicts. The full-text screening resulted in 100 included records. However, four more records were excluded during the extraction process because it became clear that the feedback was not given by a teacher, or the sample exceeded the defined age range (see Figure 1 for the PRISMA flow diagram).

2.1 Extraction, coding and presentation

All key information about the studies was gathered in a spreadsheet in the extraction phase. We used the Data Analyst function in ChatGPT to extract the most significant information from each study. A PDF file of each article was uploaded to the service, after which we provided prompts to extract information. Typical prompts were "...given an overview of the study, ...what study design was used, ... main findings concerning feedback". The information was then manually coded into four main outcome categories (achievement, cognitive, emotional, and behavioral outcome), which are based on common categories from educational psychology. In addition, we coded potential moderators or causes related to the outcome (feedback mode and type, task-related, personal factors, relational factors, and contextual factors). It should be mentioned that each main category had several subcodes to ensure consistency in coding. The cognitive category was clearly the largest because it contained almost all types of motivation, perceptions, and beliefs. The emotional category was clearly the smallest because it was reserved for more purely emotional outcomes.

It should be noted that several terms are used to represent students' academic engagement. This is because the included studies differ in descriptions, conceptualization, and grain sizes regarding the operationalization of student engagement. As a point of departure, we consider student engagement a multidimensional construct containing cognitive, emotional and behavioral aspects (Fredricks, 2011; Sinatra et al., 2015). From our perspective, cognitive engagement refers to psychological investment when a student uses cognitive effort beyond the minimal requirements to understand a subject matter, use flexible problem-solving or choose a challenging task (Sinatra et al., 2015). Emotional engagement refers to students' reactions to academic activities, such as enjoyment related to tasks, that can lead to high engagement and attention (Pekrun and Linnenbrink-Garcia, 2012; Sinatra et al., 2015). Behavioral engagement refers to actions such as attendance and participation in academic activities and includes effort, persistence and overt parts of self-regulation and the use of learning strategies (Fredricks, 2011; Sinatra et al., 2015). In our presentation of the studies, we have adhered to the terminology used in the original papers. When the type of engagement is not explicitly stated, we have used the general term engagement and categorized it based on contextual information within the respective study. Additionally, we use the term "student engagement" as an overarching term in our discussion (Marks, 2000).

It should also be noted that not all the included studies had clear moderators or causes for specific outcomes. Some studies were primarily descriptive and did not define causes or outcomes. We also analyzed these studies and tried to extract key insights and conclusions that could contribute to the discussion of the current study's topics. We have nevertheless chosen to retain moderators and outcomes as the main categories in our presentation, as this has been fundamental in the thinking throughout the work with the study.

In presenting our results, we distinguish between interventions, observational studies, and small-scale qualitative studies, building on the rationale that these represent different forms of evidence. Intervention studies offer strong insights into causality, while observational studies, though weaker in establishing causality, can help identify relevant variables, correlations and trends over time (Shadish et al., 2002; Rosenberg, 2020). Qualitative studies can better understand complex phenomena and subjective experiences (Carey, 2012). Even though the quality of the studies may vary within these categories, we have treated them rather uniformly, acknowledging this approach's limitations. Finally, we

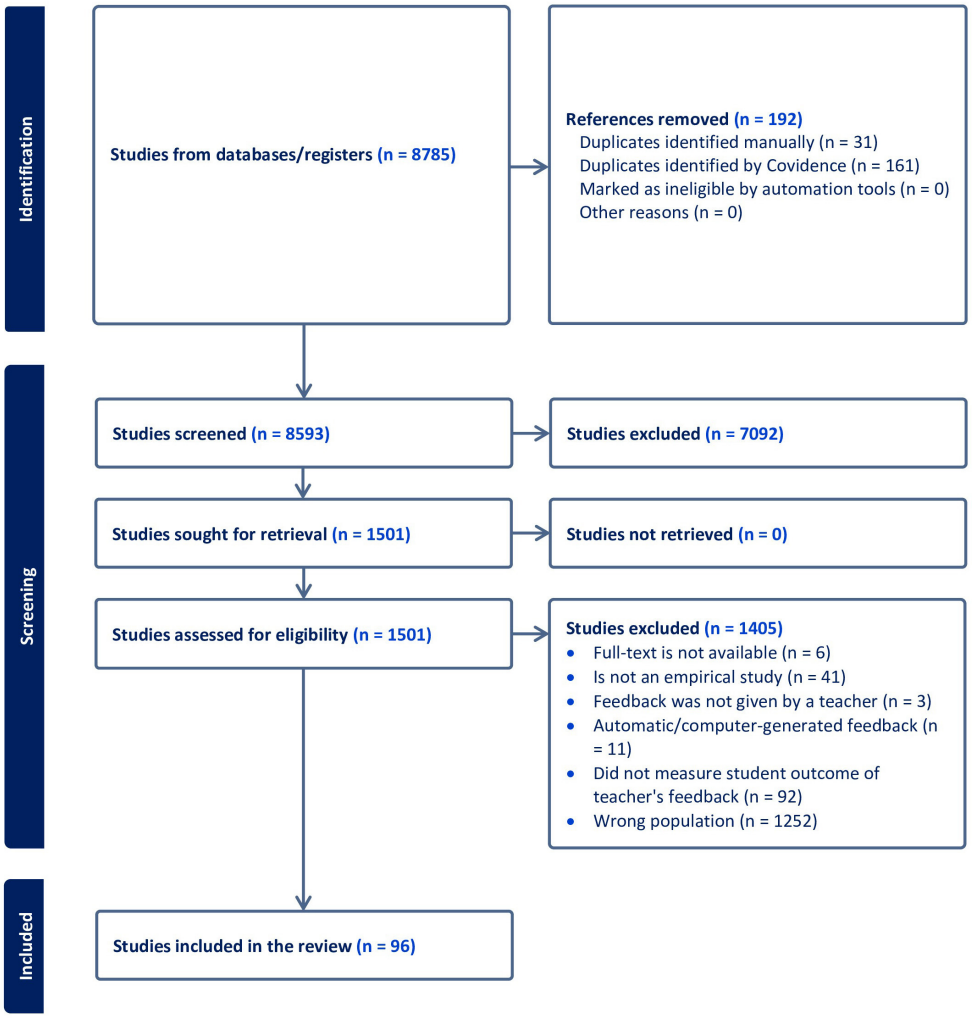

FIGURE 1
PRISMA flow diagram—students' perceptions and outcome of teacher feedback.

have marked the studies included in the review (*) in the reference list.

3 Results

3.1 Teacher feedback and student achievement

3.1.1 Teacher feedback and student achievement in intervention studies

In total, 17 intervention studies included one or more measurements of student achievement (see Table 1). For most of these studies, the manipulation (moderator) was related to the feedback per se and with variation in form, content, or both. Further, twelve of these studies report a positive effect on student achievement, four report no effect, and one report a mixed effect. Several studies that report a positive impact emphasize the content quality of the feedback given. This might be more comprehensive or explicit information about the task, task criteria, learning goals and advice on possible strategies to enhance the learning process (Al-Darei and Ahmed, 2022; Eckes and Wilde, 2019; Ozan and Kincal, 2018; Ruiz-Primo and Furtak, 2007; Siero and van Oudenhoven, 1995). One study also included a kind of student activation as part of the feedback process (Ruiz-Primo and Furtak, 2007). This can take the form of the students having to decide on and process their feedback, either as an explicit assignment or as a task solved together with peers. Another highlighted dimension is the opportunity to discuss and elaborate on the feedback with the teacher (Mikume and Oyoo, 2010), which can scaffold the students' understanding of both the feedback and the requirements of the learning task.

Several studies emphasize process-oriented feedback, but the findings regarding such feedback's influence on achievement are inconsistent. Process-oriented feedback with a clear message about strategies or how or where to go next is positively associated with achievement (Schunk and Rice, 1991, 1993). In

TABLE 1 Overview of the included invention studies that relate teacher feedback with student achievement.

Record	Reference	Country	Sample	Design	Effect on achievement	Improved quality of FB information	Activation of students in processing feedback	Dialogue with teacher	Process-oriented feedback—how to do	Process-oriented feedback- value and goal	Process-oriented with unspecified focus	Focus on correcting errors	Integrating technology	Adapted to students' special needs	Augmented feedback for motor skills learning
3	Al-Darei and Ahmed (2022)	Oman	97 (age 13–14)	A quasi-experimental design with three groups	⊕	✓									
11	Chan and Lam (2010)	Hong Kong	79 from grad eighth 77 grade seveners	Randomized controlled trial design	⊗						✓				
12	Chang et al. (2020)	Taiwan	51 fifth graders	Quasi-experimental Design.	⊕								✓		
19	Eckes and Wilde (2019)	Germany	165 students (age 12)	This is a quasi-experimental pretest-post-test study	⊕	✓									
44	Lee et al. (2022)	Taiwan	41 male students (age 15–16)	Quasi-experimental Research Design	⊕										✓
51	McLaughlin (1992)	USA	5 behaviorally disordered students (age 10–11)	Quasi-experimental design	⊕									✓	
52	Mikume and Oyoo (2010)	Tanzania	29 students (age 15–16)	The study used an action research model.	⊕	✓	✓	✓							
58	Ozan and Kincal (2018)	Turkey	45 fifth graders	A quasi-experimental design with pre-post-test and control group	⊕	✓									
60	Pinger et al. (2018)	Germany	426 ninth-grade students (age 15) 17 Teachers	Quasi-experimental design (intervention).	⊕ ⊖					✓					
61	Rakoczy et al. (2019)	Germany	620 students (age 15), 26 teachers	Intervention study with control group	⊗				✓						

(Continued)

10.3389/feduc.2025.1572950

10.3389/feduc.2025.1572950

TABLE 1 (Continued)

Record	Reference	Country	Sample	Design	Effect on achievement	Improved quality of FB information	Activation of students in processing feedback	Dialogue with teacher	Process-oriented feedback—how to do	Process-oriented feedback- value and goal	Process-oriented with unspecified focus	Focus on correcting errors	Integrating technology	Adapted to students' special needs	Augmented feedback for motor skills learning
64	Ruiz-Primo and Furtak (2007)	USA	25 students from grades 6 and 7 and 12 teachers	Intervention without any control group—mixed-methods approach	⊕	✓	✓								
68	Santanatanon and Chinokul (2022)	Thailand	26 tenth graders from an all-girls school	The study used a mixed-method experimental design	⊗							✓			
69	Schunk and Rice (1991)	USA	30 fifth graders (age 10–14)	Randomized controlled trial design	⊕				✓						
70	Schunk and Rice (1993)	USA	44 students (age 10–11)	Randomized controlled trial design	⊕				✓	✓					
73	Siero and van Oudenhoven (1995)	The Netherlands	296 fifth graders (age 10–11)	Randomized controlled trial design	⊕	✓									
92	Wiggins et al. (2017)	England	Approx. 6,500 pupils form 97 schools (age 9–11)	Randomized controlled trial design	⊗								✓		
97	Yeager et al. (2014)	USA	44 seventh graders in studies 1 and 2. 76 tenth graders in study3	Randomized field	⊕									✓	

addition, process-oriented feedback highlighting the utility of strategy use and process goals appears to influence achievement positively (Pinger et al., 2018; Schunk and Rice, 1993). However, some studies that emphasize process-oriented feedback do not find such effects. In a study where students received feedback encouraging them to make effort and self-improvement (Chan and Lam, 2010), a positive effect was seen on students' motivation and control beliefs but not on achievement. In another study made in the context of a mathematics class, the teachers did almost all the measures recommended by the assessment literature; the feedback was individualized, weaknesses and points of improvement were identified, recommendations on strategies were given, and the learning goals were highlighted (Rakoczy et al., 2019). Still, they only gained an effect on motivational variables.

A discussion related to corrective feedback is about balancing pointing out errors and recommending how to avoid such mistakes in future work. In one study conducted in the context of English language learning, the students received detailed written grammar feedback in the form of error codes and corrected sentences, but the researchers could not find any improvement in students' achievement despite increased student engagement (Santanatanon and Chinokul, 2022).

Two of the included studies explored new technology in the process of teacher feedback. In one study conducted in the context of a virtual reality design (in natural science), students who took part in a virtual reality design activity incorporating a peer assessment learning approach showed significantly better achievements in natural science than those using a conventional VR design system (Chang et al., 2020). The conventional VR design group received teacher-centered feedback to guide students in improving their VR projects and achieving better learning outcomes. In another study, an electronic handheld device that allowed teachers and pupils to provide immediate feedback during lessons was tested in 49 primary schools across several subjects (Wiggins et al., 2017). Even though both students and teachers had largely positive experiences with the system, there were no improvements in mathematics or reading performance compared to the control schools.

Two of the studies examined the effect of teacher feedback on students with learning challenges. One study on behaviorally disordered children found that positive written comments tailored to their performance and effort during reading tasks positively affected their reading accuracy in the short and long term (McLaughlin, 1992). Another study examined adapted feedback to students who had low trust in school and teachers (Yeager et al., 2014). The form of feedback they gave, named "wise feedback", reflected criticism paired with the teacher's high standards and belief in the student's potential to meet those standards. The students who received the "wise feedback" improved their performance on essay writing and revising as well as their general academic outcome compared to the control group. Finally, one study examined teacher feedback in a vocational setting. This study found that augmented teacher feedback combined with self-estimation of errors (enforced metacognitive reflection) improved students' motor skill learning and the quality of their final welding product (Lee et al., 2022).

3.1.2 Teacher feedback and student achievement in observational studies

Eleven studies used observational designs to examine teachers' feedback's relation to student achievement (see Table 2). Three of these studies were based on secondary analyzes of PISA data[1] (Cunha et al., 2019; Hu and Wang, 2022; Rohatgi et al., 2022) on 258,196 students from more than 30 countries. Furthermore, these studies consistently found a negative relationship between the teacher feedback reported by students and their achievement in science on the PISA 2015 assessment and reading on the PISA 2018 assessment. This negative association can probably be explained by the PISA items' response scale asking how often the student receives various forms of teacher feedback and that students with lower competence receive feedback more frequently than high-achieving students (Rohatgi et al., 2022).

Four studies explore teacher feedback related to homework, and their findings are pretty consistent (Cunha et al., 2019; Nunez et al., 2015; Tas et al., 2016; Xu et al., 2022). The more informative, accurate, meaningful, timely, and action-oriented the feedback is, the stronger associations are found with achievement in math (Cunha et al., 2019; Xu et al., 2022), science (Tas et al., 2016) and a collection of several subjects (Nunez et al., 2015). It should, however, be noted that several of these studies highlight student engagement as a mediating factor between feedback and achievement. If the homework feedback is clear and easily transferable into action, it supports students in engaging in the given tasks and assignments, which, in the next step, boosts their learning and performance.

However, two studies indicate that the clarity of feedback messages might be challenging. In one study where a determined system of written correcting feedback was implemented in English second language classes, most students improved their writing skills and motivation (Ganapathy et al., 2020a). However, a challenge was that some students did not always understand the feedback correctly; consequently, their performance suffered. Another study (Lui and Andrade, 2022) found that students with higher levels of achievement tended to make more constructive decisions about using the feedback they received. This included plans to reread feedback, review requirements, and make revisions, reflecting their engagement with the feedback process. These findings underscore that the perceived clarity of a feedback message can vary depending on students' individual differences, emphasizing the importance of adapting the feedback to each student's competence level to ensure it becomes meaningful and has an impact.

Finally, is there a balancing point regarding how comprehensive the feedback must be to affect students' learning and achievement? The answer, of course, would depend on many factors, such as the intention of the feedback, how the feedback is orchestrated, in which context, the mental state of the learner, etc. Two studies illustrate this complexity. In a descriptive study (Sewagegn and Dessie, 2020), the students reported that teachers often provided judgemental feedback (e.g., "excellent," "very good") or grades, which they found less effective in addressing specific learning gaps or guiding improvement. The feedback they found effective in improving their self-reported achievement was clear, specific, and constructive, highlighting learning gaps and

1 https://www.oecd.org/en/about/programmes/pisa.html

TABLE 2 Overview of the included observational and small-scale studies that relate teacher feedback with student achievement.

Record	Reference	Country	Sample	Design	FB association with achievement	PISA data	Homework FB: clear, informative, actionable	FB should be adopted to students' competence	FB content: clear, specific, actionable	Positive FB → behavior and academic outcome	Effects of direct vs. indirect feedback
Observational studies											
6	Bazán-Ramírez et al. (2022)	Peru	6,971 students (age 15)	Large scale Cross-sectional study	⊖	✓					
16	Cunha et al. (2019)	Portugal	4,288 sixth graders	Mixed methods sequential explanatory design	⊕		✓				
24	Ganapathy et al. (2020a)	Malaysia	482 students (age 16) and 15 teachers	Mixed methods convergence parallel design	⊕			✓			
33	Hu and Wang (2022)	29 OECD countries	223,807 students (age 15)	Large scale Cross-sectional study	⊖	✓					
47	Lui and Andrade (2022)	USA	93 seventh graders	Mixed-methods research design in a naturalistic classroom setting	⊕			✓			
56	Nunez et al. (2015)	Spain	454 students from three schools (ages from 10 to 16)	The cross-sectional survey	⊕		✓				
63	Rohatgi et al. (2022)	The five Nordic Countries	27,328 students (age 15)	Large scale Cross-sectional study	⊖	✓					
71	Scott and Gage (2020)	USA	Est. 27,000 students. (ages 10–16; 1,500 classrooms)	Large-scale study with multiple datatypes	⊕					✓	
72	Sewagegn and Dessie (2020)	Ethiopia	474 students from grades 5 to 8	Cross-sectional study, questionnaires and document reviews	⊕				✓		

(Continued)

10.3389/feduc.2025.1572950

TABLE 2 (Continued)

Record	Reference	Country	Sample	Design	FB association with achievement	PISA data	Homework FB: clear, informative, actionable	FB should be adopted to students' competence	FB content: clear, specific, actionable	Positive FB → behavior and academic outcome	Effects of direct vs. indirect feedback
82	Tas et al. (2016)	Turkey	S1: 618 seventh graders S2: 758 seventh graders S3: 8,318 seventh graders	Cross-sectional survey Validation of measurements	⊕		✓				
96	Xu et al. (2022)	China	823 ninth graders (mean age 15.1)	Cross-sectional questionnaires with a delayed achievement test in mathematics	⊕		✓				
Small-scale qualitative studies											
5	Bardine (1999)	USA	12 sophomore students in an Honor English class (age 15–16)	Multiple data sources (questionnaire, interviews, focus gr.)	⊕				✓		
17	Dang (2021)	Vietnam	31 tenth graders (ages 15–16)	Questionnaire and semi-structured interviews	⊕				✓		✓
46	Luan and Ishak (2018)	Malaysia	12 high school students (Est. age 13–16)	Mixed-methods research design	⊕			✓			✓

10.3389/feduc.2025.1572950

containing actionable steps for improvement, which aligns with the other findings of this review. However, in another large-scale study, where the first 15 min of the lessons were observed in ~1,500 classrooms, they found that an instructional practice of giving students positive feedback and an opportunity to respond significantly predicted school-wide outcomes (Scott and Gage, 2020). Higher rates of positive teacher feedback were associated with lower school-wide suspension rates and higher percentages of students scoring proficient or distinguished on the state academic assessments in math and reading. This association was stronger among the elementary students than secondary students. Consequently, the researchers suggest that early and frequent positive reinforcement can have long-lasting preventive effects on behavior and academic success.

3.1.3 Teacher feedback and student achievement in small-scale studies

Only three small-scale studies explored the relationship between teacher feedback and achievement (see Table 2). One study examined teachers' written feedback on students writing and found that praise could be good for their motivation, but more comprehensive feedback was needed to improve their performance (Bardine, 1999). Valuable feedback should contain constructive comments that can help students understand their mistakes and areas for improvement and help them see writing as an iterative process. The study found that teachers' feedback directly influences achievement when it is clear, actionable, and aligned with opportunities for revision.

Another study that also focused on writing found that teacher feedback played a critical role in guiding students through the discovery, correction, and rewriting processes (Dang, 2021). The students reported that teacher feedback helped them improve their grammatical accuracy and link ideas logically within their writing. However, some students indicated that over-reliance on teacher feedback could reduce independent critical thinking.

In the last study, direct vs. indirect written corrective feedback was explored in a class of English second language learners (Luan and Ishak, 2018). The researchers concluded that a blended approach with direct (e.g., marking errors and providing the correct response) and indirect (e.g., just marking the error with code without giving the correct response) feedback was the best option for improving students' writing achievement. They found that direct feedback helped students improve their revision accuracy, especially for low-proficiency students. On the other hand, the indirect feedback encouraged the students to actively engage in the feedback by cognitive processing as they worked to identify and correct errors themselves.

3.1.4 Brief summary of the findings concerning feedback and achievement

Altogether, most studies indicate that the content and quality of teacher feedback are the most important predictors of student achievement. Feedback should be tailored, informative, accurate, timely, and action-oriented. Praise and general encouragement can have a positive effect on student motivation but appear to have less direct impact on achievement. Corrective feedback should be balanced with offering guidance for improvement. For underachieving students, moderate expectations from the teacher about what they can achieve may affect both motivation and achievement.

3.2 Teacher feedback and cognitive outcome

3.2.1 Teacher feedback and cognitive outcome in intervention studies

Twenty-one intervention studies examined how teacher feedback is related to various cognitive outcomes (see Table 3). Moreover, motivation, in some form or another, was the most reported outcome (18 studies). Three studies were theoretically grounded in self-determination theory (Ryan and Deci, 2017) and with concepts such as intrinsic motivation, competence, and relatedness as outcomes (De Meester et al., 2020; Eckes and Wilde, 2019; Krijgsman et al., 2021). One study in physical education found that adding positive feedback to the corrective feedback reduced the students' frustrations related to competence and relatedness (De Meester et al., 2020). This was particularly prominent among students at low achievement levels. Conversely, another study in physical education found that oral feedback related to clarifying goals and the working process did not change students' need satisfaction (competence, autonomy, and relatedness) (Krijgsman et al., 2021). Nevertheless, a study that explored a more comprehensive form of feedback called "tutoring feedback"—which included support for strategic problem-solving, error detection and correction, reflective questioning, and encouragement for independent elaboration—found that it significantly enhanced students' intrinsic motivation, flow experiences, and perceived competence in a biology class setting (Eckes and Wilde, 2019).

Several studies have identified process-oriented feedback as significant for promoting students' self-efficacy for learning and performance. In an experimental study, self-referenced feedback (which highlighted how students could improve their performance) was tested against norm-referenced feedback (which highlighted how their performance compared to others in their group) in the context of language learning (Chan and Lam, 2010). While the self-referenced feedback had a positive effect on both students' self-efficacy and their control beliefs, the norm-referenced feedback led to a reduction in self-efficacy and lower control beliefs. Another study combined various goals with different kinds of teacher feedback in remedial reading (Schunk and Rice, 1991). The students who received process goals and progress feedback demonstrated the highest self-efficacy and control beliefs. In another experiment that targeted strategic reading, the combination of feedback on strategy utility with fading overt verbalization over time (internalization of strategies) significantly improved students' self-efficacy, comprehension skills, and self-reported strategy use (Schunk and Rice, 1993). However, self-efficacy could also serve as a mediator of the relationship between feedback and another learning-related outcome. This was illustrated in a 10-week-long intervention on mathematical reasoning with three levels of feedback (task level, process level, and

TABLE 3 Overview of the included intervention studies on students' cognitive, emotional, and behavioral outcome of teacher feedback.

Record	Reference	Country	Sample	Design	Outcome	Moderator
1	Admiraal et al. (2020) **C**	The Netherlands	47 seventh graders	Intervention/action research with mixed method approach	Low-performing students found the feedback and individualized attention beneficial	Teachers used information from learning analytics to tailor their feedback to students
3	Al-Darei and Ahmed (2022) **C**	Oman	97 (age 13–14)	A quasi-experimental design with three groups	Increase in general motivation	Explanatory feedback (correct, incorrect, and justification) compared to feedback with less information in an E-learning context
11	Chan and Lam (2010) **C**	Hong Kong	Stud1: 79 eighth graders, Stud 2: 77 seventh graders	Randomized controlled trial design	Increased self-efficacy and control beliefs	Self-referenced feedback: highlighting how students could improve their performance
12	Chang et al. (2020) **C**	Taiwan	51 fifth graders	Quasi-experimental Design	Students in the peer-collaborative feedback condition increased their self-efficacy and critical thinking	Students participated in a VR project under two conditions: classical teacher-directed or peer-collaborative feedback
18	De Meester et al. (2020) **C, E**	Belgium	277 (age 12)	An experimental 2 × 2 design	Reduced the students' frustrations related to competence and relatedness	Adding positive feedback to the corrective feedback in physical education
19	Eckes and Wilde (2019) **C**	Germany	165 (age 12)	Quasi-experimental pre-post-test design	Enhanced intrinsic motivation, flow experiences, and perceived competence	A comprehensive form of feedback called "tutoring feedback" in biology
20	Erturan-Ilker (2014) **C**	Turkey	47 (ninth graders)	Experimental study	Increased mastery-approach and performance-approach goals, reduce performance-avoidance goals	Positive feedback that emphasizes encouragement, praise, and recognition of good performance in physical education
37	Koenka (2022) **C**	Canada	161 female students (grades 7–9) in math and science	A cluster-randomized experimental study	Increase in interest and preferences for mastery goals	Feedback with a combination of grades and comments in science and math
40	Krijgsman et al. (2021) **C**	The Netherlands	492 seventh graders	Quasi-experimental 2 × 2 factorial design	No significant change	Oral feedback related to clarifying goals and the working process in physical education
58	Ozan and Kincal (2018) **C, E, B**	Turkey	45 fifth graders	A quasi-experimental design with pre-post-test and control group	Positive attitudes toward social science, students found the learning approach engaging and enjoyable. Increased self-regulated learning	Focus on goals and criteria, increased student inquiry and dialogue, and specific tailored progress feedback
60	Pinger et al. (2018) **C**	Germany	426 ninth-grade students (age 15) 17 Teachers	Quasi-experimental design	Increased interest in the study subject	Individually tailored feedback and highlighting the usefulness of the feedback in mathematics
61	Rakoczy et al. (2019) **C**	Germany	620 students (age 15), 26 teachers	Intervention study with control group	Increased interest, self-efficacy, and perceived usefulness of the feedback	Comprehensive process and product feedback in mathematics
67	Sandal et al. (2022) **C, B**	Norway	1,003 ninth graders and 40 teachers	Intervention/action research with mixed method approach	Positive changes in students' engagement but limited change in students' perceptions of feedback	Mainly a teacher intervention: Changing mindset and practice of feedback using various feedback forms
68	Santanatanon and Chinokul (2022) **C, E, B**	Thailand	26 tenth graders from an all-girls school	The study used a mixed-method experimental design	Temporary increase in students' engagement (cognitive, emotional, and behavioral) and attentiveness to error, but no change in students' attitude to feedback and learning	Strengthened grammar feedback with the use of error codes and explanations in English foreign language
69	Schunk and Rice (1991) **C**	USA	30 fifth graders	Randomized controlled trial design	Increased self-efficacy and control beliefs	Process goals combined with progress feedback in a remedial reading class
70	Schunk and Rice (1991) **C, B**	USA	44 students (age 10–11)	Randomized controlled trial design	Increased self-efficacy, comprehension skills, and self-reported strategy use	Feedback on reading strategy utility with fading overt verbalization (internalization of strategies) over time

(Continued)

TABLE 3 (Continued)

Record	Reference	Country	Sample	Design	Outcome	Moderator
73	Siero and van Oudenhoven (1995) **C**	The Netherlands	296 fifth graders (age 10–11)	Randomized controlled trial design	Increased control beliefs and attribution of success to effort, but the effect was diminishing over time	Increased clarification of goals and the feedback emphasized the contingent effort to reach the goal
74	Smit et al. (2022) **C**	Switzerland	1,261 (grades 4–6)	Quasi-experimental longitudinal design	Improved mathematical reasoning after reaching a certain level of self-efficacy	Intervention on mathematical reasoning with three levels of feedback: (1) task level, (2) process level, and (3) self-regulation level
76	Soncini et al. (2021) **C, E**	Italy	108 fifth-graders	Pre-post experimental design	Positive error-handling strategies enhanced students' perceptions of a supportive and trustful error climate and reduced anxiety levels	Positive vs neutral handling strategies. PHS = Teachers encouraged learning from errors, provided constructive feedback, and emphasized the growth potential
92	Wiggins et al. (2017) **C, B**	England	Approx. 6,500 pupils from 97 schools (ages 9–11)	Randomized controlled trial design	Students enjoyed the system and tended to increase their engagement, but it had no other academic outcomes	A handheld device allowed teachers and pupils to provide immediate feedback during lessons
94	Wollenschläger et al. (2016) **C, B**	Germany	120 eighth graders	Randomized controlled trial design	Extensive task information enhanced perceived competence, calibration accuracy, and experiment planning performance	Teacher feedback intervention with three types of rubrics

Letters in bold indicate the coding of the study, respectively cognitive (C), emotional (E), and behavioral (B) outcome.

self-regulation level). The study revealed that the learning outcome first appeared after the students had reached a certain level of self-efficacy (Smit et al., 2022).

Several studies indicate that feedback may also positively affect students' interests and attitudes when the feedback is sufficiently comprehensive, specific enough, and perceived as valuable (Al-Darei and Ahmed, 2022; Pinger et al., 2018; Rakoczy et al., 2019; Nunez et al., 2015). For example, in a quasi-experimental study of ninth graders in mathematics that focused on providing individually tailored feedback and highlighting the usefulness of the feedback, students showed increased topic interest (Pinger et al., 2018). In a more comprehensive intervention study, where feedback was individualized, weaknesses and areas for improvement were identified, strategic recommendations were provided, and learning goals were emphasized, researchers found positive effects on students' interest, self-efficacy, and perceived usefulness (Rakoczy et al., 2019). A similar comprehensive intervention study, which emphasized explaining learning objectives and success criteria, fostering inquiry and dialogue among students, providing targeted comments on assignments, and offering individualized feedback on progress, found that students developed more favorable attitudes toward social science studies, perceiving studies as more engaging and enjoyable (Nunez et al., 2015). These studies indicate that if feedback is clear and understandable for the students and perceived as valuable for one's progress, the feedback alone (or in combination with other instructional measures) may contribute to increased engagement and interest in the subject being studied.

Although we have briefly touched on how students' goal orientation can relate to teacher feedback, several studies have looked more specifically at this. In an experimental study in math and science with lower-secondary girls, four conditions of feedback (grades, comments, grades and comments, no feedback) were tested upon various motivational outcomes (Koenka, 2022). The results revealed that intrinsic motivation increased among students who received comments only. For those students who received grades and comments, their intrinsic motivation and their preferences for mastery goals increased. However, the latter group also tended to experience a decrease in self-efficacy, which was explained by the fact that many students perceived receiving grades and critical comments as overwhelming. The students who received grades only had less favorable motivational outcomes than those receiving comments, while those who did not receive any feedback highlighted performance approach goals. In another six-week intervention (Erturan-Ilker, 2014) conducted in the context of physical education, the researchers tested the relationship between positive and negative feedback and different goal orientations. Positive feedback emphasized encouragement, praise, and recognition of good performance, effort, and ability, while negative feedback highlighted deficiencies or underperformance, focusing on individual effort, ability, and outcome. Not so surprisingly, positive feedback led to increased preferences for mastery goals (focus on improving yourself) and performance approach goals (outperform others), a reduction in performance-avoidance goals (focus on avoiding failure), and a more mastery-oriented climate in the class. Negative feedback increased the student's performance-avoidance goals and reduced their preferences for mastery goals.

Results from several studies indicate that changing students' and teachers' beliefs, attitudes, or practices more permanently is challenging. For instance, four different conditions were tested in a study of contingent feedback (making the connection between the feedback and task performance more visible to the student) (Siero and van Oudenhoven, 1995). In the most successful condition, which contained increased visibility, explicit references to the effort as a cause for performance outcomes, and introduction of clear

goals, students boosted their control beliefs and improved their achievement. However, the positive effect seemed to diminish over time. In another intervention focusing on improving grammar in English writing, the researchers found an immediate increase in student engagement and use of strategies (Santanatanon and Chinokul, 2022). Still, the effect eventually waned because students forgot the strategies they had learned, and the new practice was not maintained. Finally, in a more extensive intervention study with 40 teachers and more than 1,000 students, the researchers aimed to change teachers' and students' perceptions and beliefs of feedback from the more traditional summative thinking to formative thinking (Sandal et al., 2022). The project included teacher seminars, school-based workshops on goal setting, and various formative feedback forms/activities (e.g., formative use of tests, planned dialogues, and use of learning partners). During the 7-month intervention period, one revealed improved practices and changes in the teachers' awareness of formative feedback's function to enhance learning, self-regulation, and student engagement. Even though an increased engagement was seen among the students, their attitude toward feedback did not change. They still primarily viewed feedback as summative, focusing on grades rather than as a tool for learning.

Several studies have included technology or tools to assist with the feedback, and the outcomes are mixed. In one study (Admiraal et al., 2020), teachers used information based on learning analytics to tailor students' learning tasks and their feedback. The results revealed that the adapted tasks and feedback benefited low-performing students, as they experienced improved understanding, increased engagement, and effort, and they valued the feedback more. On the other hand, high-performing students did not see adapted tasks and feedback as much value added. However, the results indicated that these students improved their self-confidence and pride by helping their peers. Another common tool in formative assessment and feedback is rubrics (Wollenschläger et al., 2016). A study tested three variations of rubrics in science education, ranging from the most limited—providing only the learning goal (Condition 1)—to the most extended (Condition 3), which included specific feedback on the student's current performance, explicit instructions for improvement, and a rubric indicating achieved levels while leaving uncompleted levels unmarked. The results revealed that the students in the third condition improved their planning ability over time, increased their perceived competence, and improved their ability to evaluate their performance. Moreover, the researchers concluded that task improvement information was the most critical component for successful teacher-given rubric feedback.

Finally, we want to mention two studies (also mentioned in the achievement section) where technology is a key feature or encapsulates the feedback. In the first study, an electronic handheld device that allowed teachers and students to provide immediate feedback during lessons was tested across several subjects in a large number of schools (Wiggins et al., 2017). Even though both students and teachers had largely positive experiences with the system, and one saw short-term positive effects on student motivation, particularly in terms of engagement and enjoyment, these were insufficient to overcome the broader challenges or lead to sustained improvements in academic performance. Lastly, we want to mention the study made in the context of a virtual reality design in natural science, where researchers tested a peer assessment instructional design upon a more classical instructional design with teacher feedback (Chang et al., 2020). Their findings indicated that the teacher feedback approach provided clear and directed support, but the peer assessment approach yielded better outcomes in fostering critical thinking, self-reflection, and deeper engagement. These latter findings may indicate that the success of feedback also might depend on the learning content and how the instruction is orchestrated.

3.2.2 Teacher feedback and cognitive outcome in observational studies

Overall, 47 of the included observational studies dealt with cognitive phenomena (see Table 4), and due to the large number of studies in this category, we cannot, for reasons of space, elaborate on all of the studies but rather present the main features of these studies. Though most observational studies are based on students' perceptions through the data (e.g., self-reported data, questionnaires, interviews), 17 studies focused specifically on students' perceptions or experiences of feedback. This is, for instance, about how students with different personal characteristics and backgrounds experience various types of feedback. In addition, some studies compare students' and teachers' feedback experiences.

Four studies indicate that males and females may perceive the feedback differently or actually receive different feedback. A Chinese study found that female students felt they received more directive feedback and less criticism than males (Guo, 2021). Another study from France (Nicaise et al., 2007) revealed that girls reported more encouragement after errors, while boys noted more criticism and felt ignored. Moreover, two studies from Denmark reported that girls sensed that they received less feedback than boys (Sortkaer, 2019; Sortkær and Reimer, 2021), which the authors explained by unconscious teacher bias. The studies from Denmark also indicated that students with higher SES and high-achieving students received less feedback than those with lower SES and low-achieving students.

Two studies compared teachers' and students' perceptions of feedback (Pat-El et al., 2015; Van der Kleij, 2019) and found that teachers often believe they provide clear and constructive feedback, but students may not perceive it similarly. Instead, the students often find the feedback insufficiently tailored and actionable or too focused on grades. An interesting finding in one of these studies (Pat-El et al., 2015) was that students with higher language proficiency experience feedback more similarly to teachers, which may indicate a challenge in communication and individual adaptation.

Several studies explored students' perceptions of a specific feedback form and linked them to particular outcomes. One study focused on students' conception of feedback (Lee, 2021) and found that students linked process feedback to formative and summative assessment. In contrast, corrective feedback was associated with summative assessment, while outcome feedback was related to surface-level learning. Another study (Krijgsman et al., 2019) linked process feedback to the satisfaction of students' basic psychological needs (the concepts of self-determination theory, Ryan and Deci,

TABLE 4 Overview of the included observational studies on students' cognitive, emotional, and behavioral outcome of teacher feedback.

Record	Reference–coding	Country	Sample	Design	Outcome—Main findings	Moderators
7	Beghetto (2006) **C**	USA	1,322 middle school students (mean age 14)	Cross-sectional design: Questionnaire	Positive feedback from teachers about creativity predicted students' creative self-efficacy and their belief that they could generate creative ideas	Positive feedback about creativity
8	Brooks et al. (2019) **C**	Australia	691 five graders (age 9–10)	Cross-sectional design: Questionnaire	Students rate explicit feedback focused on improvement and the next steps over prompts for self-reflection and self-regulation. Students are less familiar with practices for self-regulated learning	Students' feedback preferences
9	Burner (2016) **C, B**	Norway	100 eighth and nine graders and their teachers (English Classes)	Mixed-methods design: Questionnaire, interviews, focus groups, observations	Students preferred frequent writing practice and valued feedback that focused on improvement. Due to a lack of understanding, students often do not follow up on teacher feedback	Students feedback preferences. There is a gap between teachers' intentions in formative assessment and students' actual experiences
10	Carrillo-López et al. (2022) **C**	Spain	172 students (age 10–13) (Physical Education)	Cross-sectional design: Questionnaire and attention test	Students with lower attention levels perceived more metacognitive feedback from their teachers, which helped them better understand the tasks and their learning progress	Students' level of attention in physical education
13	Chi et al. (2021) **C, E**	China	9,841 students (age 15)	Large scales cross-sectional design: Questionnaire (PISA 2015)	Frequent teacher feedback was positively related to a more sophisticated understanding of science and higher interest and enjoyment in science	Teacher feedback moderated the relationship between inquiry-based science practices and students' epistemological beliefs about science
14	Cowie (2005a) **C, B**	New Zealand	106 seven- to ten-graders (Science Education)	Case design. Interviews with teachers and students and classroom observations	Students preferred tailored feedback with suggestions rather than direct instructions or evaluative comments. Negative evaluative feedback is damaging to motivation. Students were likelier to act on feedback from teachers they trusted and respected	Students' feedback preferences: Tailored and one-to-one feedback, simple language, and mutual trust and respect in the teacher-student relationship
16	Cunha et al. (2019) **C, B**	Portugal	4,288 sixth graders, 170 mathematics teachers	Mixed methods sequential explanatory design. Questionnaires and interviews	Praise was associated with emotional engagement, while constructive criticism was related to cognitive engagement. Checking homework was associated with cognitive and behavioral engagement	Teachers' feedback on homework: Positive feedback, checking homework, grading, and individualized feedback
22	Gamlem and Munthe (2014) **C, B**	Norway	19 classrooms (age 13–16), 28 teachers	Video-based classroom observation study of 56 lessons	Feedback was predominantly encouraging, with limited emphasis on learning or understanding. Teachers' communication of learning goals was weak, and students' opportunities to engage in deep thinking, reflection, and self-regulation were limited. A positive correlation was found between a positive classroom climate and feedback quality	The quality of teacher-student interactions
24	Ganapathy et al. (2020a) **C**	Malaysia	482 students (age 16) and 15 teachers.	Mixed methods convergence parallel design using questionnaire and focus group interviews	Students prefer comprehensive feedback, marking all grammar, content, and vocabulary errors. Teachers and students are misaligned about the perceived practice	Students' feedback preferences. Teachers' written corrective feedback to English second language learners
25	Ganapathy et al. (2020b) **C**	Malaysia	720 students (age 16)	Cross-sectional design using a questionnaire	Most students preferred and benefited from direct feedback. Clear and detailed corrections made errors more straightforward to understand	Students' feedback preferences. Teachers' written corrective feedback to English second language learners
26	Guo (2021) **C, B**	China	444 tenth graders (ages 15–16) using a questionnaire	Cross-sectional design using a questionnaire	Female students felt they received more directive feedback and less criticism than males. Males reported greater use of critical thinking strategies, while females emphasized self-resource management	Gender differences: Scaffolding feedback (hints or clues to help students arrive at the correct answers independently)
28	Harris et al. (2014) **C, E**	New Zealand	193 students from grades 5 to 10 (ages 9–15).	Mixed-methods design. Questionnaire on student conceptions	Students preferred teacher-led feedback. Feedback was seen as task-oriented, focusing on performance, standards, and improvements. Constructive feedback was	Student conceptions of feedback

(Continued)

TABLE 4 (Continued)

Record	Reference–coding	Country	Sample	Design	Outcome—Main findings	Moderators
				of feedback, checklist, and free-response drawing	associated with positive emotions	
29	He et al. (2023) **C, B**	China	236 seventh graders	Intervention design, but the intervention effect is not examined—correlation analyzes of questionnaire data	Positive feedback perceptions promote cognitive and self-regulation strategies, with self-efficacy and mastery goals mediating its link to self-regulated learning	Perceptions of feedback in web-based science learning
30	Helm et al. (2022) **C**	Germany	34,771 students (age 15)	Large scale Cross-sectional study (PISA 2000)	Students' perception of individualized teacher-framed feedback positively correlates with their academic self-concept. The relationship is more substantial for high-achieving students	Students' perception of individualized teacher-framed feedback (emphasizes individual progress and effort), achievement level
31	Henry et al. (2020) **C**	USA	An unspecified number of sixth to eighth graders and a special education class	Cross-sectional mixed methods design with questionnaire and group interviews	Both feedback modes were well-received: students valued asking questions in face-to-face sessions and appreciated digital feedback's privacy and replayability. However, due to time constraints, face-to-face conferencing did not reach all students, while screen-casting conferencing suffered from a lack of student-teacher interaction and missing clarification	Students' perceptions of face-to-face and screen casting (digital) conferencing in a writing workshop
34	Jang et al. (2015) **C, E**	Canada	44 fifth- and sixth-graders and their teachers and parents	Mixed method design with questionnaires, interviews and reading achievement test	Mastery-oriented students engaged critically with feedback, while performance-oriented students saw it as a competence measure, expressed a fixed view of intelligence, and were less likely to engage with improvement. The feedback triggered several emotional outcomes (frustration, surprise) related to over- and underestimation of competence	Holistic diagnostic feedback: Students' perceived abilities, goal orientations, perceptions of their parents' goal orientations, and sociocultural and linguistic backgrounds
35	Jiang et al. (2021) **C**	6 Western and 6 East Asian countries	89,869 students (age 15)	Large scale Cross-sectional study (PISA 2015)	Teacher feedback significantly positively impacted student motivational beliefs in both Western and East Asian contexts. However, the correlation between feedback and instrumental motivation was somewhat higher for East Asian students	Cultural differences in feedback associations with beliefs
38	Koka and Hein (2003) **C, E**	Estonia	783 students (age 12–15)	Cross-sectional correlational study with questionnaire variables	Positive general feedback boosted perceived competence and enjoyment, whereas specific feedback had less motivational impact. Positive feedback reinforced students' sense of self-worth	Positive general feedback (praise, encouragement) and positive specific feedback (detailed, targeted instruction) in physical education
39	Koka and Hein (2006) **C**	Estonia	302 students (age 11–15)	Longitudinal design was done with a questionnaire two times over two years	Positive general feedback at time 1 positively affected students' intrinsic motivation at time 2. Informational feedback had no direct effect on motivation	Perceived positive general feedback and perceived informational feedback (specific instructions on how to improve performance) in physical education
41	Krijgsman et al. (2019) **C**	The Netherlands	570 seventh to tenth graders (mean age 13.76—few students are older than 16)	Longitudinal design with six repeated measurements using questionnaires	Perceived process feedback and goal clarification were positively associated with the satisfaction of students' basic psychological needs and negatively associated with need frustration	Perceived process feedback and goal clarification physical education
42	Lee (2008) **C**	Hong Kong	58 seventh graders (ages 12–13) and their teachers	A mixed-method design over 9 months with questionnaires, checklists, and observation, interviews	Students preferred comments with solutions and explanations alongside error feedback and grades, while error-focused feedback demotivated low-performing students	High- and low-performing students in English as foreign language writing

(Continued)

TABLE 4 (Continued)

Record	Reference–coding	Country	Sample	Design	Outcome—Main findings	Moderators
43	Lee (2021) **C**	Taiwan	313 eighth graders (age 14)	Cross-sectional design, questionnaire	Outcome feedback was associated with surface-level learning, corrective feedback with summative assessment, and process feedback with both formative and summative assessment	Students' perception and conception of outcome, corrective and process feedback
47	Lui and Andrade (2022) C, E, B	USA	93 seventh graders (ages 12–13)	Mixed-methods design with questionnaires and think-aloud protocols	Most students had positive emotions (interest, calm, hope) about their teacher's feedback and attributed it to controllable factors (effort, strategies). Task value influenced their responses to feedback	Perceptions of feedback, emotions, attribution, value consideration
48	Mælan et al. (2021) **C**	Norway	1,755 eighth to tenth graders	Cross-sectional design with questionnaire	Students received less feedback during homeschooling, mainly written. Low-achieving students rated the feedback higher but suffered most from the lack of oral feedback and direct interaction	Homeschooling during the COVID-19 pandemic, written feedback vs. oral feedback and direct interaction. Students' achievement level
49	Mak (2019) **C, B**	Hong Kong	63 students (ages 11 and 12) and two teachers	One-year longitudinal mixed methods design with questionnaires, interviews and observations	Students shifted to valuing focused coded feedback, appreciating clear criteria before, constructive input during, and reflection after writing. This change increased students' motivation, engagement, and confidence	A three-stage feedback model replaced traditional feedback (pre-feedback, during-feedback, post-feedback) in writing. Goal-setting sheets and error logs were used
50	Martin et al. (2022) **C, B**	Australia	61,879 seventh to tenth graders	Longitudinal survey design with two data collection time points	Feedback-feedforward enhanced growth goal setting and academic engagement directly and indirectly. Growth goal setting mediates the relationship between feedback-feedforward and engagement outcomes	Feedforward-feedback and growth goal setting
53	Monteiro et al. (2021) **C, B**	Portugal	1,188 sixth to tenth graders	Cross-sectional design with questionnaire and multi-level analyzes	Effective feedback targeting task, process, and self-regulation enhances autonomy, self-efficacy, and learning strategies and fosters a supportive classroom. Efficient feedback relates to engagement and identification	Classroom-level dynamics, various feedback practices
55	Nicaise et al. (2007) **C, E, B**	France	325 tenth graders (mean age of 16 years)	Cross-sectional design with a questionnaire and teacher report on student performance	Praise and attention boosted perceived competence, effort, and enjoyment, while criticism reduced enjoyment and performance. Girls reported more encouragement after errors, while boys noted more criticism and felt ignored	Positive Feedback (praise and invested time) vs. negative feedback (criticism and encouragement) and gender in physical education
56	Nunez et al. (2015) **C, B**	Spain	454 students in grades 5–12 schools (ages from 10 to 16)	The cross-sectional survey	Increased homework was completed, and time management during homework improved. Students perceived a lower amount of feedback with increasing grade levels	Regular homework review by the teacher with tailored and constructive feedback
57	Oinas et al. (2021) **C, E, B**	Finland	132 fifth and sixth graders	Cross-sectional mixed methods design with questionnaires and group interviews	Technology-enhanced feedback often promotes external behavior regulation over fostering self-regulated learning. Positive notes sparked positive emotions, while critical or unclear feedback caused negative ones. FB practices varied across classrooms	Technology-enhanced feedback that includes the use of emojis
59	Pat-El et al. (2015) **C**	The Netherlands	650 students (mean age 13,8). 38 teachers	Cross-sectional design with questionnaires to students and teachers	Teachers often believe they provide clear and constructive feedback, but students may not perceive it similarly. Students with higher language proficiency exhibit closer alignment with teachers' perceptions of feedback	Students' and teachers' perceptions of feedback practices. Students' language proficiency
71	Scott and Gage (2020) **B**	USA	Est. 27,000 students. (ages 10–16; 1,500 classrooms)	Large-scale study with multiple datatypes	Schools with higher rates of positive feedback provided by teachers had lower suspension rates	Emphasizing a high ratio of positive to negative feedback in general
72	Sewagegn and Dessie (2020) **C, B**	Ethiopia	474 fifth to eighth graders	Cross-sectional study, questionnaire and document reviews	Students found timely, detailed feedback most useful for identifying learning gaps, revising assignments, and planning future strategies. The most effective feedback clarified grades, offered detailed suggestions, and showed how to improve	Students' preferences. The specificity and content of the feedback (quality)

(Continued)

TABLE 4 (Continued)

Record	Reference–coding	Country	Sample	Design	Outcome—Main findings	Moderators
75	Sokmen (2021) **C, E, B**	Turkey	407 students (mean age 13.25) (sciences classrooms)	Cross-sectional design with questionnaires	Teacher feedback positively influenced all aspects of student engagement, including behavioral, emotional, cognitive, and agentic engagement. Effective feedback helped students gain confidence in their ability to perform science tasks	Clear, comprehensible, and constructive feedback focused on learning and understanding rather than correction
77	Sortkaer (2019) **C**	Denmark	1,101 students (ages 14–15)	Cross-sectional study using a questionnaire	Students with higher cultural capital received more teacher feedback than their peers with lower cultural capital, possibly due to unconscious teacher bias. Girls perceived less feedback than boys, reflecting potential classroom dynamics or communication differences	Cultural capital, amount and quality of feedback, gender and classroom dynamic
78	Sortkær and Reimer (2021) **C**	Denmark	1,098 eighth and ninth graders (ages 14–15)	Cross-sectional design using a questionnaire	Boys reported receiving more teacher feedback than girls, while girls perceived more peer feedback. In higher-SES classrooms, students noted less teacher feedback but increased peer feedback. Higher-performing students perceived receiving less feedback	Student perceptions related to gender differences. Socioeconomic status and performance level
81	Tan et al. (2019) **C, B**	Australia	32 ninth graders (ages 14–15)	Cross-sectional study with semi-structured interviews	Two-way feedback fosters dialogues, clarifies understanding, and enhances student agency, empowering them to develop self-regulation skills	Students' preferences regarding two-way feedback vs. one-way feedback
82	Tas et al. (2016) **C, B**	Turkey	S1: 618 seventh graders, S2: 758 seventh graders, S3: 8,318 seventh graders	Cross-sectional survey Validation of measurements	Teacher feedback on homework was positively associated with students' homework self-regulation. The feedback helped students adopt mastery and performance goals, deep learning, and management strategies during homework	Effective homework feedback included regular checks, timely evaluations, and performance insights on strengths and weaknesses
84	Tay and Lam (2022) **C, B**	Singapore	45 students (ages 14–15)	Longitudinal qualitative design. Data based on students' written assignments and focus group interviews	Personal feedback, like "Good effort," was unhelpful without specific improvement suggestions. Highlighting strengths boosted motivation, while actionable feedback drove improvement. Class discussions, consultations, and pre-feedback tools like success criteria checklists aided feedback processing	A mix of corrective feedback and personal-level feedback, pre-task feedback (rubrics, success criteria checklists, and reflection), post-task feedback (class discussions, worksheets, individual consultations)
88	Van der Kleij (2019) **C**	Australia	186 students from grades 7–10 (ages 12–16) and 59 teachers	Cross-sectional mixed method with a questionnaire, open-ended questions, and grade information	Teachers viewed feedback quality and facilitation more positively than students. Self-efficacy, intrinsic motivation, and self-regulation strongly influenced student perceptions of feedback quality. Many students found feedback insufficiently tailored and actionable or too focused on grades	Students' and teachers' perceptions of feedback, students' characteristics
89	Vattøy and Smith (2019) **C**	Norway	1,137 students in English foreign language classrooms (age 13–16)	Cross-sectional design: Questionnaire	Perceived learning goal support, subject interest and perceived self-regulation skills in English predicted students' perceived usefulness of teacher feedback	Subject interest, learning goal clarification and self-regulation skills
90	Vergara-Torres et al. (2021) **C, E, B**	Mexico	890 sixth graders (age 11–13)	A cross-sectional design, questionnaire	High-quality task presentations were positively linked to the amount of corrective feedback students found legitimate. Autonomy, competence, and relatedness mediated the impact of feedback on students' energy, enthusiasm, and wellbeing	Quality task presentations. Students' perception of feedback legitimacy and basic psychological needs in physical education
91	Vergara-Torres et al. (2020) **C**	Mexico	742 students (ages 10–13)	Cross-sectional design, questionnaire	Corrective feedback was positively linked to perceived legitimacy (fairness and reasonableness). Perceived legitimacy mediated the relationship between corrective feedback and students' psychological needs (competence and relatedness)	Students' perception of feedback legitimacy and basic psychological needs in physical education

(Continued)

TABLE 4 (Continued)

Record	Reference–coding	Country	Sample	Design	Outcome—Main findings	Moderators
93	Williams (2010) **C**	New Zealand	56 eighth graders (ages 12–13)	Cross-sectional mixed-methods study combining a questionnaire with semi-structured interviews	Students saw feedback as vital for improving work and understanding goals, identifying strengths, areas for improvement, and next steps. Though preferences varied, they preferred individualized, actionable, and corrective feedback. Girls found feedback more helpful and were more aware of its type and frequency than boys	Students' perceptions and judgement of useful feedback, Gender differences
95	Xu (2022) **C, B**	China	3,018 eighth graders	Cross-sectional design with student questionnaire	Feedback quality played a more significant role in promoting homework purposes compared to feedback quantity. The quantity of feedback impacted self-regulatory and approval-seeking, while quality impacted students' motivation and purposes	Feedback quality and quantity on homework
96	Xu et al. (2022) **C, B**	China	823 ninth graders (mean age 15.1)	Cross-sectional questionnaires with a delayed achievement test in mathematics	Latent profile analyzes with covariates reveal that students who reported higher perceived teacher homework involvement demonstrated significantly higher homework effort and completion than those in lower-involvement profiles	Students' perceptions of teacher homework involvement and their homework behavior
99	Zohra and Fatiha (2022) **C**	Algeria	40 students (ages 11–15) and 40 teachers.	A cross-sectional descriptive research design with a quantitative approach	60% of learners preferred direct corrective feedback (explicit corrections). 70% of learners preferred unfocused feedback (all errors are corrected). 15% of learners preferred indirect feedback (non-corrections). Teachers mostly preferred indirect feedback (prompting self-correction) or focused feedback	Students' and teachers' preferences for corrective feedback English as a Foreign Language
100	Zumbrunn et al. (2016) **C, E, B**	USA	598 sixth to tenth graders	Cross-sectional mixed-methods design, questionnaire with closed and open-ended questions	Writing feedback perceptions mediated the link between self-efficacy and self-regulation. Students valued feedback for skill improvement (80%) or emotional benefits (17%) but disliked it due to disregard (65% - dislike of negative or critical feedback) or negative emotions (23%)	Students' perception and experiences of feedback in writing

Letters in bold indicate the coding of the study, respectively cognitive (C), emotional (E), and behavioral (B) outcome.

2017). However, other studies indicate that corrective feedback can also positively impact students' basic psychological needs if the feedback holds sufficiently high quality (Vergara-Torres et al., 2021, 2020). In these latter studies, students' judgement of the feedback's legitimacy was conceptualized as a mediator between the feedback given and the psychological outcome. Two studies linked positive perceptions of teacher feedback to the use of cognitive strategies (He et al., 2023) and intrinsic motivation (Koka and Hein, 2006), while another study linked the perceptions of individualized feedback to academic self-concepts (Helm et al., 2022). Finally, one study linked perceived learning goal support, subject interest and perceived self-regulation skills in English to students' perceived usefulness of teacher feedback (Vattøy and Smith, 2019). Although these findings are interesting in their own right, we will remark that many of them reveal from explorative studies, appear isolated or are made in specific contexts, making it difficult to draw generalizable conclusions.

Thirteen studies concern students' own preferences for feedback, and a consistent finding is that students prefer direct, individualized, comprehensive, and detailed feedback with suggestions for improvement (Brooks et al., 2019; Burner, 2016; Cowie, 2005a; Ganapathy et al., 2020b,a; Lee, 2008; Sewagegn and Dessie, 2020; Tay and Lam, 2022; Williams, 2010; Zohra and Fatiha, 2022; Zumbrunn et al., 2016). According to some studies, students rate explicit feedback focused on improvement over prompts for self-reflection and self-regulation (Brooks et al., 2019), which might be the type of feedback teachers often prefer. However, studies also indicate that more indirect feedback, e.g., prompting self-reflection or further processing, can also be valued by students if it's given systematically and the students are made familiar with the type of processing it requires (Mak, 2019). Some studies indicate that students sometimes struggle to understand teachers' feedback (Burner, 2016; Cowie, 2005a), and consequently, the possibility of dialogue between teachers and students is about the things the students value (Tan et al., 2019). Such a dialogue provides opportunities to elaborate on the feedback and clarify the message. Furthermore, in some studies, mutual respect and trust between teacher and student are highlighted as essential to translating feedback into action (Cowie, 2005a). When it comes to feedback students dislike, they highlight error-focused feedback or criticism they don't understand or consider unfair (Cowie, 2005a; Lee, 2008). Such feedback is considered demotivating, particularly for low-performing students (Lee, 2008). Conversely, highlighting strengths is seen as motivating (Tay and Lam, 2022). However, it should be mentioned that some studies conducted in the context of language learning reveal that students appreciate correcting feedback and marking errors (Ganapathy et al., 2020b,a; Lee, 2008; Zohra and Fatiha, 2022).

Several studies relate feedback to motivation. For example, studies indicate that constructive critique (Cunha et al., 2019), a high preference for mastery goals (Jang et al., 2015), and clear and comprehendible feedback (Sokmen, 2021) are positively associated with cognitive engagement with feedback. On the other hand, performance-oriented students tend to see feedback as a competence measure, expressing a fixed view of intelligence and being less likely to engage in improvement (Jang et al., 2015). One study suggests effective feedback should target both the task level, the process level, and self-regulation. Furthermore, the results indicate that such feedback can enhance students' autonomy, self-efficacy, the use of learning strategies and foster a supportive classroom environment (Monteiro et al., 2021). Another study suggests that feed-forward (e.g., Hattie and Timperley, 2007) enhances growth goal setting and academic engagement. Studies also indicate that positive feedback in the form of praise can enhance students' perceived competence and effort, particularly in physical education (Koka and Hein, 2003; Nicaise et al., 2007). Finally, we would like to highlight a large-scale study (Jiang et al., 2021, data from PISA 2015) that examined the relationship between perceived feedback and various motivational beliefs among students in East-Asian and Western countries. For students from both hemispheres, the most substantial relation was found with intrinsic motivation. In Western countries, this was followed by self-efficacy, instrumental motivation, and achievement motivation, while in East-Asian countries, the order was instrumental motivation, self-efficacy, and achievement motivation. These findings suggest that some relations between teacher feedback and student motivation are valid across diverse cultures.

The last topic we will address in this section is feedback related to homework, which is the focus of five studies (Cunha et al., 2019; Nunez et al., 2015; Tas et al., 2016; Xu, 2022; Xu et al., 2022). Three studies indicate that regular or frequent teacher reviews of students' homework can increase cognitive engagement and completion rates (Cunha et al., 2019; Nunez et al., 2015; Tas et al., 2016; Xu et al., 2022). Furthermore, if feedback is tailored and of high quality, it can contribute to a higher degree of self-regulation and influence the student's beliefs about the homework purpose (Nunez et al., 2015; Tas et al., 2016; Xu, 2022). Consequently, teachers' engagement in feedback seems to be a key factor that can positively affect students' homework outcomes.

3.2.3 Teacher feedback and cognitive outcome in small-scale studies

In total, 20 small-scale studies explored the relationship between teacher feedback and cognitive outcomes (see Table 5). One study found that students prefer specific, timely, clear, and actionable feedback with opportunities to revise and improve. General praise might be frustrating, while a lack of feedback is demotivating or confusing (Torkildsen and Erickson, 2016). Three studies (Ruthmann, 2008; Tan et al., 2019; Tay and Kee, 2019) pointed to findings where students' knowledge and understanding could increase based on teacher feedback. The first study was a cross-sectional case study highlighting several key factors in music education (Ruthmann, 2008). It emphasized the importance of teachers' feedback style and respect for student agency. Additionally, the study noted the significance of negotiating creative intent, the classroom environment, and the pedagogical design of composing experiences. These factors supported the development of musical knowledge, creative expression, reflective and metacognitive skills, and problem-solving skills in music technology. The second study, an instrumental case study, showed that students with high-functioning autism spectrum disorder benefitted from teachers' precision in questioning, step-by-step guidance, extended wait time, use of visual supports, and capitalizing on interests (Tay and Kee, 2019). In addition, students benefitted from affirmative and personalized teacher feedback as it enhanced their focus and engagement, increasing the student's knowledge and understanding. The third study (Tan et al., 2019), built on self-determination theory, emphasized that in addition to teachers' asking thought-provoking and open-ended questions, the use of attentive listening was valued and increased students' metacognitive knowledge and understanding (knowledge and regulation of cognition).

One small-scale quasi-experimental study examined the effects of direct and indirect written corrective feedback on students' written performance in English and found that students' attitudes toward feedback, beliefs about what the corrections entailed, and types of scaffolding increased students' knowledge and motivation in writing (Luan and Ishak, 2018). Another quasi-experimental study that focused on reading performance among behaviorally disordered students found that when teachers provided positive written comments on reading assignments each day, in addition to emphasizing contingent upon improved performance and maintained high outcomes, the students improved the accuracy of reading performance, and developed a favorable attitude toward the written feedback process (McLaughlin, 1992).

Three studies (Aedo and Millafilo, 2022; Honora, 2003; Mikume and Oyoo, 2010) found that teacher feedback could enrich students' cognitive-motivational changes. One action research study found that using self-correction and conferencing to supplement teacher written feedback improved the quality of students' written compositions and increased motivation and confidence in writing English as a second language (Mikume and Oyoo, 2010). Another qualitative study found that students who identify with the school's academic culture were more motivated to achieve and experience higher educational gains (Honora, 2003). This could be moderated based on students' gender and achievement level, positive or negative identification with the school and their perceptions of teacher feedback, support and accessibility. The third study, based on a descriptive research design (Aedo and Millafilo, 2022), found that teacher feedback that fosters self-correction helped students develop metacognitive skills, allowed them to analyze their thought processes and learn more effectively. Explicit oral corrections directly addressed gaps in knowledge and helped students understand their mistakes and learn the correct form or approach. This study also found that positive reinforcement boosted student motivation by fostering a supportive atmosphere and encouraging engagement without fear of criticism. Feedback that involved the student actively (e.g., self-correction) made the process collaborative and increased their sense of ownership and intrinsic motivation.

TABLE 5 Overview of the included small-scale studies on students' cognitive, emotional, and behavioral outcome of teacher feedback.

Record	Reference	Country	Sample	Design	Outcome—Main findings	Moderator
2	Aedo and Millafilo (2022) **C,E,B**	Chile	20, (age 11–12), 6th graders, English as a foreign language	Descriptive research design	Self-correcting feedback enhances motivation but affects emotions based on tone and timing. Immediate correction may stress younger learners; delayed correction reduces engagement anxiety. Positive feedback boosts participation, while critical feedback lowers engagement	Supportive feedback reduces anxiety, while harsh delivery can harm wellbeing. Positive feedback fosters participation and communication
4	Bansilal et al. (2010) **C**	South Africa	5, 9th graders, Mathematics	Explorative: Naturalistic, qualitative, interpretive, case study design	Teacher feedback might build or break self-confidence	Teacher feedback style
5	Bardine (1999) **C,E,B**	USA	12 (age 15–16) Sophomore, Honor English class	Multiple qualitative methods design	Clear, positive feedback builds confidence, encourages participation, and supports revision. It validates effort and helps students replicate successful strategies	Clear, actionable written feedback balances praise and criticism, reinforcing effort and progress. Constructive feedback builds resilience and supports revision. Tone, clarity, and depth are key
15	Cowie (2005b) **C**	New Zealand	106, 7th—10th graders (10 classes), Science, 10 teachers	Sequential qualitative design	Influenced students' self-perception as competent knowers of science, and engagement with learning	The level of trust and respect in teacher-student interactions, the social dynamics of the classroom, and self-perception and identity: beliefs about learning and identification with school culture affected engagement with feedback
17	Dang (2021) **C**	Vietnam	31, (age 16), 10th graders	Mixed methods research design	Students' perceptions of their engagement in a correcting process increased understanding (accuracy improvement) and learning motivation	A collaborative correcting process incorporating teacher mediation and peer collaboration led to positive student cognitive outcomes. Student engagement is the most important variable contributing to students' learning outcomes
21	Fergus and Petrick Smith (2022) **C,E,B**	USA	5 (age 12–13), self-identified math anxiety	Multiple Case Study Design	Clear feedback, learning objectives, and reassessment opportunities reduce math anxiety and build confidence. Reassessment motivates active learning and improved understanding	Teaching practices, parental beliefs, cognitive skills, and self-efficacy shape math outcomes. Clear, actionable feedback boosts confidence and reduces frustration. Teachers focus on individual growth, avoid comparisons, and offer choices in tasks
23	Gamlem and Smith (2013) **C,E,B**	Norway	150 (age 13–15), 8th—10th, (n = 11, interviews)	Qualitative research design, observation and interview	Clear, actionable feedback fosters competence and motivation, while unclear or critical feedback creates anxiety. Supportive environments boost engagement, and peer feedback encourages cooperation	Classroom climate and clear, actionable feedback shape emotional responses and motivation. Timing, framing, and alignment with learning goals influence engagement and practical application
32	Honora (2003) **C,E,B**	USA	16, 9th graders (higher- and lower-achieving students)	Comparative qualitative research design	Students connected to school culture show higher motivation and achievement. Lower-achieving students, feeling unsupported, view school as restrictive, leading to disengagement and reduced help-seeking	Students' identification with school depends on teacher feedback, support, and accessibility. Lack of support fosters alienation and disidentification. Perceived unfairness and inconsistent behavior create distrust, affecting emotional engagement
36	Kerr (2017) **C,E,B**	United Kingdom	4 (age 13–14), high achieving, History	Multiple Case Study Design	Students prefer dialogue for feedback, linking positive emotions to increased motivation. Teacher stress or peer judgment can deter students from seeking clarity. Classroom atmosphere impacts feedback behaviors	Emotion, atmosphere, and expectations affect the feedback process. Clear, dialogic feedback boosts confidence and understanding. Teacher stress influences students' emotional states and willingness to ask questions. Peer dynamics and classroom atmosphere shape task avoidance and help-seeking behavior

(Continued)

TABLE 5 (Continued)

Record	Reference	Country	Sample	Design	Outcome—Main findings	Moderator
45	Lefroy (2020) **C,E,B**	United Kingdom	28 (age 14–15), high-achieving English	Qualitative Case Study Design	Audio feedback boosts resilience, participation, and motivation in learning English by fostering support and collaboration. Its informal, conversational tone reduces stress and builds trust. While audio feedback encourages active learning and applying advice, some students prefer written feedback for its clarity and ease of reference	With its empathetic tone, audio feedback fosters a trusting teacher-student relationship, making students feel supported and confident. Detailed and clear audio feedback reduces anxiety and encourages improvement. Some prefer written feedback for clarity and to avoid misinterpretation, while the supportive tone of audio helps students handle criticism and become more resilient
46	Luan and Ishak (2018) **C,E,B**	Malaysia	12 (age 13), second language, writing	Quasi-experimental design	Written corrective feedback boosts writing skills, with mixed reactions. Indirect feedback fosters independence, while direct feedback is clear but sometimes limiting. Over-relying on corrections can lead to passive learning, while scaffolding supports development	Students' reactions to feedback depend on its clarity, alignment with expectations, and required effort. Indirect feedback can cause frustration but fosters persistence and collaboration. The type of feedback and scaffolding influence learning strategies and engagement
51	McLaughlin (1992) **C**	USA	5 (age 10–11), behaviorally disordered, reading performance	Quasi-experimental pre-post-test design	Improved the accuracy of reading performance, and favorable attitude toward the written feedback process	Providing positive written comments on reading assignments each day; contingent upon improved performance, maintaining high outcomes, students worked hard/was attentive
52	Mikume and Oyoo (2010) **C**	Tanzania	4 (age 10), English Second Language	Action research design (longitudinal)	Improved quality of students' written compositions and increased motivation and confidence in writing	Using self-correction and conferencing to supplement teacher written feedback
54	Murtagh (2014) **C**	United Kingdom	12 (age 10–11), Literacy, two teachers	Cross-sectional Case Study	Activation of beliefs about learning, knowledge, and learning process: understanding of learning objectives, self-regulation, improvement in specific literacy skills (grammar, punctuation, writing style)	Student engagement with feedback. Classroom culture. Type and quality of feedback provided by teachers during literacy lessons: Descriptive feedback, modeling and examples
62	Rathel et al. (2014) **B**	USA	4 (age 6, 10, 12, 13), Special education; Serving students with mild disabilities, four teachers	The study used a multiple baseline design across four teachers	Improvement in Task Engagement. Students' task engagement levels were closely linked to teachers' positive-to-negative communication ratios	Primarily attributed to changes in teachers' communication behaviors, specifically the increased ratio of positive-to-negative communication behaviors and the use of behavior-specific praise
65	Ruthmann (2008) **C**	USA	16 (age 10–11), Music Technology, one teacher	Case study, multifaceted qualitative approach	Development of musical knowledge, creative expression, reflective and metacognitive skills, and problem-solving skills	Teacher feedback style, respect for student agency, negotiation of creative intent, classroom environment, pedagogical design of composing experiences in music education
79	Sutherland et al. (2000) **B**	USA	9, (age 10–11), 5th grade, one teacher	An ABAB withdrawal design, (single-case experimental design)	Students' on-task behavior consistently improved during the intervention phases when the teacher's behavior-specific praise (BSPS) increased	Teacher's increased use of behavior-specific praise (BSPS). Positive reinforcement, clarity of expectations, and consistent teacher practice of BSPS were included
81	Tan et al. (2019) **C**	Australia	32 (age 14–15), 9th grade	Qualitative research design, interview	*In*creased knowledge and understanding of metacognition (knowledge and regulation of cognition)	Build on Self-Determination Theory. In addition to asking thought-provoking and open-ended questions, use attentive listening
83	Tay and Kee (2019) **C,E,B**	Singapore	6, (age 10–14) students with high-functioning autism spectrum disorder (ASD), six teachers	Instrumental case study	Feedback enhances focus, engagement, and understanding, reducing anxiety. It boosts comfort in social interactions and increases participation, focus, and task completion	Clear guidance, extended wait time, visual support, and affirmative feedback create a supportive environment. Tailored feedback helps manage emotional pressures, while thoughtful strategies improve outcomes

(Continued)

TABLE 5 (Continued)

Record	Reference	Country	Sample	Design	Outcome—Main findings	Moderator
85	Torkildsen and Erickson (2016) **C, E**	Sweden	29 + 25, five to nine graders	Action research design: focus group interview and dialogical meeting	Students prefer specific, timely, clear, and actionable feedback with opportunities to revise and improve. General praise might be frustrating, while a lack of feedback is demotivating or confusing. Sometimes the language used in feedback is a challenge	Students' perceptions of teacher feedback
86	Van der Kleij (2023) **C**	Australia	7 students (age 13-14) in two classrooms: English and Mathematics. Two teachers	Case study design: Video-stimulated recall interviews	Discrepancies in teachers' and students' perceptions of feedback. Students saw questions as attention checks, causing embarrassment. Students saw themselves as feedback recipients rather than active participants. Students' emotional reactions to feedback significantly influenced their engagement	Dialogic feedback: Teachers used questions to foster thinking and inclusivity and emphasised reformulating responses
87	Van Der Kleij and Adie (2020) **C, E**	Australia	7 students (age 13-14) in two classrooms: English and Mathematics. Two teachers	Case study design: Video-stimulated recall interviews	Over 30% of the feedback went unrecognised by students. Math feedback was more often correctly understood than English, likely due to its factual nature. Students preferred clear, corrective explanations over open, discussion-based feedback. Dialogic feedback had mixed effectiveness	Students' perceptions of teacher feedback. Students' background knowledge, confidence, feelings, and personal beliefs shaped how they receive and interpret feedback

Letters in bold indicate the coding of the study, respectively cognitive (C), emotional (E), and behavioral (B) outcome.

Two studies found the activation of students' beliefs about learning by the provisions of teacher feedback (Fergus and Petrick Smith, 2022; Murtagh, 2014). One of these studies, a Multiple Case Study Design, found that math-anxious students can benefit from effective feedback and clear learning objectives (Fergus and Petrick Smith, 2022). This study emphasized that especially three main factors were moderators. These were environmental factors: teacher's instructional practice, parental attitudes and beliefs in their child's math ability. Intellectual factors: Cognitive abilities and spatial reasoning skills, and personal factors: Self-efficacy and attitudes toward mathematics. The other study, a cross-sectional case study, investigated students' experiences of teacher feedback and found that it could enhance students' activation of beliefs about learning, knowledge, and the learning process (Murtagh, 2014). These improvements included understanding of learning objectives, self-regulation, and specific literacy skills (grammar, punctuation, writing style).

Two studies emphasize students' preferences for dialogic feedback interactions (Gamlem and Smith, 2013; Kerr, 2017). One small-scale qualitative study found that students' preferences for teacher feedback were dialogic feedback interactions that support their perceptions of learning and understanding (Gamlem and Smith, 2013). The participating students explained that the classroom climate, including honesty and objective feedback, is essential for the uptake. In addition, the teacher's feedback practice of providing opportunities and time to apply feedback, feedback type, and information about assessment criteria becomes central to students' perceptions of the quality of this feedback. The second multi-case study found that students prefer dialogue with the teacher, where the students can seek clarity through verbal feedback (Kerr, 2017). This study emphasized that variables like emotion, atmosphere, and expectations impacted the feedback process.

Two studies found how teacher feedback can strengthen students' perceptions of self-confidence (Bansilal et al., 2010; Bardine, 1999). One of these studies, an explorative naturalistic case study design in mathematics, found that students perceived teachers' assessment feedback as important in scaffolding their learning process and the teachers' feedback as instrumental in either building or breaking their self-confidence (Bansilal et al., 2010). The effect the feedback may have in building or breaking a student's self-confidence emphasizes the need for educators to provide constructive feedback that focuses on students' progress while avoiding derogatory comments that harm self-esteem. Another study, built on a multiple qualitative methods design, examined students' perceptions of written teacher comments on their papers and found that the teachers' feedback empowered students' self-confidence and encouraged active participation in learning tasks (Bardine, 1999). This study emphasized that the teachers' written feedback was clear, descriptive, and actionable and that the teachers managed to balance between praise and criticism. In addition, the students were given opportunities for revision and redrafting, and the teacher's tone and attitude were perceived as supporting. Similar results were found in an action research study (Torkildsen and Erickson, 2016). They found that students prefer specific, timely, clear, and actionable feedback with opportunities to revise and improve. General praise might be frustrating, while a lack of feedback is demotivating or confusing.

Two case studies focusing on classroom interactions and dialogues, probably based on the same data material, found that teachers and students often perceive feedback differently and that students do not always understand teachers' intentions (Van Der Kleij and Adie, 2020; Van der Kleij, 2023). Over 30% of the feedback went unrecognised by students. Math feedback was more often correctly understood than English feedback, likely due to its factual nature. Students often saw teachers' questioning as attention checks and themselves as feedback recipients rather than active

participants. Students preferred clear, corrective explanations over open, discussion-based feedback.

Finally, three studies on teachers' feedback and students' engagement are found (Cowie, 2005b; Dang, 2021; Lefroy, 2020). One study, a sequential qualitative design in science, found that teacher feedback influenced students' self-perception as competent knowers of science and engagement with learning (Cowie, 2005b). This study revealed that the level of trust and respect in teacher-student interactions was essential for students' engagement and classroom social dynamics. Regarding students' self-perception and identity, this study found that students' beliefs about learning and identification with school culture affected engagement with feedback. Another study, a mixed methods research design, found that students' engagement with teacher feedback in a correcting process increased understanding (accuracy improvement) and increased learning motivation (Dang, 2021). This study found that the collaborative correcting process, incorporating teacher mediation and peer collaboration, led to positive student cognitive outcomes. In addition, it was emphasized that student engagement with teacher feedback was the most crucial variable contributing to students' learning outcomes. A third study, with a qualitative case study design with a sample of high-achieving English students, found that teachers' audio feedback and overwritten feedback enhanced students' resilience and active participation in learning English (Lefroy, 2020). The students explained that a sense of being valued, in addition to a positive and trusting relationship between teacher and student, was important for their value of the type of teacher feedback.

3.2.4 Brief summary of the findings concerning feedback and cognitive outcome

Overall, the review of the studies on cognitive outcomes indicates that teacher feedback can influence students' motivation and learning in several ways. Process-oriented and individualized feedback appears to strengthen students' competency-based motivation, such as self-efficacy and control beliefs. Clear, detailed, and actionable feedback can increase students' interest and positive attitudes toward learning. Self-referenced feedback (focusing on one's development) increases students' confidence more than norm-referenced feedback (compared with others/grades). Feedback tailored to goal orientation may shape learning preferences, with positive feedback promoting mastery goals and negative feedback increasing avoidance tendencies. In general, harsh critique and negative feedback destroy students' motivation and engagement. Most students prefer direct, constructive, and actionable feedback. Teacher engagement in the feedback appears to be important for student engagement and follow-up on feedback, as is trust and respect in the relationship between student and teacher. Dialogic feedback can also increase student engagement and is considered helpful for clarifying and elaborating the feedback message and increasing students' understanding. Feedback may also indirectly influence the classroom climate through student's behavior. Gender, achievement level, and student perceptions may impact students' uptake and outcome of feedback. Finally, students and teachers may sometimes perceive the quality of feedback differently.

3.3 Teacher feedback and emotional outcome

3.3.1 Teacher feedback and emotional outcome in intervention studies

Only four of the intervention studies present explicit emotional outcomes. One study (De Meester et al., 2020) shows that including positive comments in corrective feedback can reduce students' frustrations. Another study shows that the pupils enjoyed improved assessment practice with explicit criteria, rewards, more student activity, dialogue and interaction (Ozan and Kincal, 2018). The third study found that strengthened grammar feedback with error codes and explanations in English foreign language was associated with increased students' emotional engagement (Santanatanon and Chinokul, 2022). The last study found that a positive approach to error handling, like learning from errors, led to a more trustful classroom climate and reduced students' level of anxiety (Sokmen, 2021). Although the number of studies is limited, the findings are consistent with previous research and various motivation theories.

3.3.2 Teacher feedback and emotional outcome in observational studies

Twelve of the observational studies reported findings related to emotions. Most of these reported emotions as an outcome of a specific feedback type. Frequent feedback (Chi et al., 2021), positive general feedback (Koka and Hein, 2003), and praise and increased attention (Nicaise et al., 2007) were found to be positively associated with students' enjoyment. Conversely, criticism was negatively associated with students' enjoyment (Nicaise et al., 2007) and positively related to negative emotions (Zumbrunn et al., 2016). Constructive feedback (Harris et al., 2014) and positive comments (Oinas et al., 2021) were positively associated with positive emotions in students, while one study found that process feedback and goal clarification were negatively associated with need frustration (Krijgsman et al., 2019). Building on self-determination theory, one study suggests that autonomy, competence, and relatedness are mediators between corrective feedback and students' wellbeing (Vergara-Torres et al., 2021). Another study found that positive emotions were most frequent when students received feedback but that various emotions were at play, such as hope and calm (Lui and Andrade, 2022). Moreover, the same study found that positive emotions were positively related to favorable judgement of the feedback (e.g., the meaningfulness). One study found that the emotional outcome of the feedback was related to under- and overestimation of competence (Jang et al., 2015). If the student overestimated their competence, the feedback could cause negative emotions such as frustration, while the opposite could cause positive emotions like surprise and pride. Finally, positive feedback, like praise (Cunha et al., 2019) and clear and understandable feedback (Sokmen, 2021), was related to increased emotional engagement.

3.3.3 Teacher feedback and emotional outcome in small-scale studies

Eleven small-scale studies explored the relationship between teacher feedback and students' emotional responses. Across the

eleven studies (Aedo and Millafilo, 2022; Bardine, 1999; Fergus and Petrick Smith, 2022; Gamlem and Smith, 2013; Honora, 2003; Kerr, 2017; Lefroy, 2020; Luan and Ishak, 2018; Tay and Kee, 2019; Torkildsen and Erickson, 2016; Van Der Kleij and Adie, 2020), teacher feedback emerges as a multifaceted tool influencing students' emotional outcomes. Most of the studies reported several emotional outcomes. Thus, this text presents representative themes with integrated findings from the nine studies, providing a cohesive overview of emotional outcomes and their underlying causes.

Five studies demonstrate that clarity and specificity of feedback are fundamental to students' emotional responses to feedback and that clear, detailed feedback promotes confidence (Bardine, 1999; Fergus and Petrick Smith, 2022; Gamlem and Smith, 2013; Lefroy, 2020; Luan and Ishak, 2018). One study highlights how ambiguous comments frustrate students, while detailed feedback fosters trust and confidence (Bardine, 1999). Similarly, two studies (Fergus and Petrick Smith, 2022; Gamlem and Smith, 2013) demonstrate that actionable feedback alleviates anxiety and reassures students about their abilities. One study found that while audio feedback can be motivating due to its relational tone, unclear messages can increase stress (Lefroy, 2020). Finally, one study found that direct feedback instills confidence but may sometimes undermine independent thought (Luan and Ishak, 2018).

Four studies found that positive vs. negative feedback is an essential theme for students' emotional outcomes (Aedo and Millafilo, 2022; Bardine, 1999; Gamlem and Smith, 2013; Luan and Ishak, 2018). The tone and framing of feedback significantly influence students' emotional states. Positive and supportive teacher feedback reduces anxiety, as seen in Aedo and Millafilo (2022), where non-threatening feedback fosters positive emotions. One study found that specific praise validates effort, boosting motivation (Bardine, 1999), while another indicates that constructive feedback enhances competence (Gamlem and Smith, 2013). Conversely, as noted in Aedo and Millafilo (2022), Gamlem and Smith (2013), Luan and Ishak (2018), harsh or overly critical comments lead to frustration or discouragement, emphasizing the need for a constructive approach.

Five studies demonstrate that feedback's timing and delivery method affects how students process and respond to it (Aedo and Millafilo, 2022; Kerr, 2017; Lefroy, 2020; Luan and Ishak, 2018; Torkildsen and Erickson, 2016). Immediate feedback can increase stress, especially for younger learners, as indicated in Aedo and Millafilo (2022). Students' mood and readiness influence their receptiveness to teacher feedback, with one-to-one sessions reducing anxiety (Kerr, 2017). Audio feedback is often appreciated for its personal touch but may overwhelm students compared to written feedback (Lefroy, 2020). Timing and effort required to decode indirect feedback initially frustrate students but lead to satisfaction upon mastery (Luan and Ishak, 2018).

Three studies found that trust and emotional safety in the classroom are pivotal in shaping students' emotional responses (Gamlem and Smith, 2013; Honora, 2003; Lefroy, 2020). Studies show that a trusting teacher-student relationship fosters receptiveness to feedback, while distrust undermines this (Gamlem and Smith, 2013; Lefroy, 2020). One study underscores how a lack of teacher support or perceived differential treatment contributes to alienation and distrust, particularly among lower-achieving students (Honora, 2003).

Three studies demonstrate that students' emotional states and engagement readiness significantly influence feedback's impact (Kerr, 2017; Luan and Ishak, 2018; Van Der Kleij and Adie, 2020). One study highlights how personal stressors or a poor mood can block feedback processing, emphasizing the need for emotional readiness (Kerr, 2017). Similarly, another study suggests that alignment with students' expectations about feedback determines whether the response is positive or negative (Luan and Ishak, 2018).

Two studies found that perceived effort and self-appraisal are outcomes based on teacher feedback (Honora, 2003; Luan and Ishak, 2018). Feedback that challenges students' effort or supports self-appraisal elicits mixed emotional responses. One study shows how lower-achieving students often associate their worth with compliance rather than academic success, leading to disengagement (Honora, 2003). Another study found that students express frustration with indirect feedback but later report pride and satisfaction upon mastering its challenges, highlighting the importance of balancing effort and guidance (Luan and Ishak, 2018).

Two studies demonstrate that affirmative feedback reduces anxiety and fosters engagement (Fergus and Petrick Smith, 2022; Tay and Kee, 2019). One study demonstrates that specific feedback and reassessment opportunities reduce math anxiety by shifting focus from grades to mastery (Fergus and Petrick Smith, 2022). Another study emphasizes how affirming feedback, such as verbal praise or physical gestures, creates a safe environment that reduces stress and fosters confidence (Tay and Kee, 2019).

Finally, two studies demonstrate that feedback that integrates relational and social dynamics positively impacts students' emotional responses (Kerr, 2017; Lefroy, 2020). Audio feedback might strengthen motivation through its empathetic tone (Lefroy, 2020), while the value of informal feedback sessions in reducing intimidation and enhancing engagement (Kerr, 2017). Overly formal settings can create barriers, and thus, suggestions for a need for balance are argued for (Kerr, 2017).

3.3.4 Brief summary of the findings concerning feedback and emotional outcome

Teacher feedback significantly influences students' emotional outcomes, shaping confidence, engagement, and anxiety levels. Intervention studies highlight that positive comments reduce frustration, clear assessment criteria improve emotional engagement, and a constructive approach to errors fosters a supportive classroom climate. Observational studies find frequent, clear, and encouraging feedback enhances enjoyment, while criticism leads to negative emotions. Self-perception plays a role, with overestimated competence leading to frustration and underestimated competence fostering positive emotions. Small-scale studies emphasize the importance of clarity, tone, and timing in feedback delivery. Clear and actionable feedback builds confidence, while harsh or ambiguous feedback can cause stress. Trust in teacher-student relationships and an emotionally safe environment increase receptiveness to feedback. Personalized and relational feedback, including audio and informal sessions, can boost motivation and engagement. Ultimately, constructive and

empathetic feedback fosters emotional wellbeing, while negative or unclear feedback risks alienation and disengagement.

3.4 Teacher feedback and behavioral outcome

3.4.1 Teacher feedback and behavioral outcome in intervention studies

Six of the intervention studies reported some form of behavioral outcome, and all these studies are previously mentioned in Section 2.1 and some in Section 3.1. Three of the studies reported increased engagement/behavioral engagement. In one study, the increased engagement was related to a comprehensive intervention to change students' beliefs about feedback (Sandal et al., 2022). In another study, engagement change was related to strengthened grammar feedback using error codes and explanations in English foreign language learning (Santanatanon and Chinokul, 2022). Lastly, one study found that feedback technology in the classroom, a handheld device for direct communication with the teacher, temporarily increased students' engagement (Wiggins et al., 2017).

Two studies reported improved strategic learning behavior. One study found increased self-regulated learning due to an intervention focusing on goals and criteria, increased student inquiry and dialogue, and specific tailored progress feedback (Ozan and Kincal, 2018). Another study found an increased use of reading strategies after feedback on reading strategy utility with fading overt verbalization (Schunk and Rice, 1993). In addition to these studies, a study tested three types of rubrics in science education and found that the most comprehensive rubric increased students' performance in planning experiments (Wollenschläger et al., 2016).

3.4.2 Teacher feedback and behavioral outcome in observational studies

Twenty-three observational studies reported some form of behavioral outcome; most studies are already mentioned in the previous sections (see Table 4). However, in this section, we will highlight these studies' behavioral aspects, hopefully without repeating too much information. We will start with six studies that report associations between teacher feedback and students' behavioral engagement and actions. In one study (Cunha et al., 2019), the researchers found that regular checking of homework combined with positive feedback increased students' homework engagement and effort. Similar results were reported in another study that found that teachers' homework engagement predicted homework effort and completion (Xu et al., 2022). A longitudinal study (Mak, 2019) found that an improved feedback practice, including clear criteria before, constructive input during, and reflection after writing assignments, increased students' engagement in writing. A fourth study found a positive relationship between clear, comprehensible, and constructive feedback and behavioral engagement (Sokmen, 2021), while a fifth study found that feed-forward enhanced students' engagement both directly and indirectly through growth goal setting (Martin et al., 2022). Finally, one study found that students' task value consideration influenced their actions on feedback (Lui and Andrade, 2022). Together, these studies highlight some properties of teacher feedback that hopefully can promote students' behavioral engagement. Conversely, a study found that a lack of understanding of the feedback message can lead to students not following up on feedback (Burner, 2016), and another study outlines that students' inclination to act on the feedback sometimes depends on trust in the teacher-student relationship (Cowie, 2005a). Finally, one study found that teachers' praise increased students' efforts in physical education, while criticism reduced their performance (Nicaise et al., 2007). These are aspects that may be worth taking note of.

We have previously presented findings indicating that girls and boys may perceive teacher feedback differently. A study thus finds that girls and boys also may act differently (Guo, 2021). In the setting of scaffolding feedback (hints or clues to help students arrive at the correct answers independently), male students reported higher use of critical thinking strategies. In comparison, females reported higher use of self-resource management strategies. This leads us to teacher feedback's function in relation to self-regulated learning.

Seven other studies report outcomes related to students' strategic learning. One study found that students' positive feedback perceptions promoted their use of self-regulation strategies in the context of science learning (He et al., 2023). Another study considered students' feedback perceptions as a mediator between self-efficacy and self-regulation in the context of writing (Zumbrunn et al., 2016). A third study found that comprehensive feedback targeting the task, process, and self-regulation level enhanced students' use of learning strategies and facilitated positive classroom behavior (Monteiro et al., 2021). Moreover, a fourth study reported that students found timely, detailed feedback most valuable for revising assignments and planning future strategies (Sewagegn and Dessie, 2020). Two studies found that regular homework reviews by the teacher with tailored and constructive feedback enhanced students' self-regulation (time management, deep learning strategies) and homework performance (Nunez et al., 2015; Tas et al., 2016). Finally, one study emphasized that two-way feedback could empower students to develop self-regulation skills (Tan et al., 2019).

Finally, we have five studies that are not so easy to categorize. One study reported that actionable feedback drove improvement, while success criteria checklists can enhance students' feedback processing (Tay and Lam, 2022). Another study found that the quantity of homework feedback predicts self-regulation and approval-seeking, while the quality of the feedback predicts students' motivation and purposes (Xu, 2022). One study found that the constructs of self-determination theory, autonomy, competence, and relatedness were mediators between corrective feedback and students' energy and enthusiasm (Vergara-Torres et al., 2021). Another study pointed out that technology-enhanced feedback may not contribute to students' self-regulation but rather make them externally regulated (Oinas et al., 2021). Finally, we would like to mention a large-scale study that found that systematic use of positive teacher feedback was associated with lower suspension rates across 1,500 classrooms (Scott and Gage, 2020).

3.4.3 Teacher feedback and behavioral outcome in small-scale studies

In total, 11 small-scale studies explored the relationship between teacher feedback and students' behavioral responses (Aedo and Millafilo, 2022; Bardine, 1999; Fergus and Petrick Smith, 2022; Gamlem and Smith, 2013; Honora, 2003; Kerr, 2017; Lefroy, 2020; Luan and Ishak, 2018; Rathel et al., 2014; Sutherland et al., 2000; Tay and Kee, 2019). These studies found a variety of student behavioral outcomes such as engagement and participation, emotional and social impact, task completion and focus, gender, and individual differences.

Six studies found that positive and constructive teacher feedback plays a crucial role in fostering active participation and engagement among students (Aedo and Millafilo, 2022; Bardine, 1999; Fergus and Petrick Smith, 2022; Gamlem and Smith, 2013; Lefroy, 2020; Tay and Kee, 2019). Two studies demonstrate that actionable and encouraging feedback enhances classroom participation, risk-taking, and a willingness to engage with tasks (Aedo and Millafilo, 2022; Bardine, 1999). Similarly, one study highlights how formative assessments promote self-assessment and active learning (Fergus and Petrick Smith, 2022), while another study shows that useful teacher feedback encourages task revision and deeper involvement in learning activities (Gamlem and Smith, 2013). Feedback provided in dynamic formats, such as audio feedback (Lefroy, 2020) and strategies tailored to students' interests (Tay and Kee, 2019), further strengthened participation and engagement. However, studies warn that negative or judgmental feedback can lead to avoidance and reduced classroom effort (Aedo and Millafilo, 2022; Gamlem and Smith, 2013).

Five studies demonstrate that the format and clarity of teacher feedback significantly shape students' behavioral responses (Bardine, 1999; Lefroy, 2020; Luan and Ishak, 2018; Rathel et al., 2014; Sutherland et al., 2000). One study found that clear, specific, and actionable feedback helps students effectively revise their work and understand expectations—and conversely, vague or ambiguous feedback can lead to task avoidance and superficial edits (Bardine, 1999). One study highlights that audio feedback encourages students' active engagement and resilience (Lefroy, 2020), whereas another study found that written feedback supports structured revisions for students who prefer clarity (Luan and Ishak, 2018). Two studies demonstrate how well-defined guidance improves task engagement and focus using behavioral-specific praise (Rathel et al., 2014; Sutherland et al., 2000). These findings indicate that teacher feedback's actionable nature and format directly influence how students respond and engage.

Six studies demonstrate that teacher feedback profoundly impacts students' emotional and social behaviors (Aedo and Millafilo, 2022; Gamlem and Smith, 2013; Honora, 2003; Kerr, 2017; Lefroy, 2020; Luan and Ishak, 2018). One study found that positive and empathetic feedback fosters resilience and trust (Lefroy, 2020), while three studies demonstrate that judgmental or overly critical feedback reduces engagement (Aedo and Millafilo, 2022; Gamlem and Smith, 2013; Honora, 2003). One study found that teachers' facilitation of peer feedback encourages collaboration and mutual support when framed constructively, though overly cautious feedback can hinder its effectiveness (Gamlem and Smith, 2013). One study demonstrates that scaffolding and teacher modeling nurture proactive learning behaviors (Luan and Ishak, 2018). However, trust issues or negative perceptions of teacher actions can reduce help-seeking behavior and limit academic engagement, underscoring the importance of supportive and non-judgmental feedback practices (Honora, 2003; Kerr, 2017).

Three studies demonstrate that students' ability to stay on task and complete assignments is closely tied to clear guidance and structured interventions (Rathel et al., 2014; Sutherland et al., 2000; Tay and Kee, 2019). Two studies highlight the importance of behavioral-specific praise in improving on-task behavior, particularly among students with emotional and behavioral challenges (Rathel et al., 2014; Sutherland et al., 2000). One study found that interest-based learning and tailored strategies further support students' task retention and focus by aligning instructional activities with students' preferences (Tay and Kee, 2019).

Three studies demonstrate that students' behavioral responses to teacher feedback are moderated by gender and individual preferences (Honora, 2003; Kerr, 2017; Luan and Ishak, 2018). One study reveals that boys often engage socially rather than academically, while girls focus more on academic outcomes (Honora, 2003). One study found that feedback preferences, such as direct or indirect, also impact engagement, with some students thriving on explicit corrections. In contrast, others prefer indirect feedback that fosters independent problem-solving (Luan and Ishak, 2018). One study demonstrates that classroom dynamics and peer expectations further shape responses, with students avoiding help-seeking behaviors in less supportive environments (Kerr, 2017).

3.4.4 Brief summary of the findings concerning feedback and behavioral outcomes

Intervention studies show comprehensive feedback interventions, grammar feedback, and classroom technology can enhance behavioral engagement, while strategic feedback improves learning behaviors like self-regulation and students' use of reading strategies. Observational studies highlight regular homework checks, clear feedback, and praise boost behavioral engagement, while unclear feedback and lack of trust prevent students from effectively applying feedback. Gender differences emerge; for instance, boys seem to use more critical thinking strategies, and girls focus on self-management based on the same feedback. Small-scale studies confirm that clear, positive, and actionable feedback fosters participation, while judgmental feedback discourages engagement. Audio and written feedback formats form students' responses, with structured feedback aiding focus and revision. Trust and empathetic feedback enhance resilience, while critical feedback reduces help-seeking behavior. Task retention improves with behavioral-specific praise and interest-based strategies, though engagement varies by gender and individual preferences. Ultimately, constructive and tailored feedback supports student engagement, learning behaviors, and classroom participation.

4 Discussion

The purpose of this review study was to systematize and synthesize empirical research related to students' outcomes from

teacher feedback for the age group 10 to 16. In what follows, we will answer the research questions and address some aspects of the results that we think are worth noting.

4.1 What student outcomes are measured in studies concerning teacher feedback?

The review of the included studies shows that many different student outcomes have been investigated, as well as many other features of feedback that cannot necessarily be described as student outcomes. We have chosen to focus on achievement, cognitive, emotional and behavioral outcomes because these cover central processes and activities in student learning. Nevertheless, we acknowledge that this perspective and this categorization may have meant that we have not covered all types of outcomes.

In the studies in this review, achievement is measured in the form of average academic grades, grades in individual subjects, performance on the PISA test, writing skills, improvement on assignments, tests or assignments adapted to the specific research setting, and other student products like a welding result. Most studies use ecological measurements (measurement in a natural setting) of achievement, something we find reassuring and which strengthens the validity of the findings. Furthermore, it is also positive that most studies report significant correlations between feedback and achievement, which strengthens the assumption that teacher feedback actually impacts students' learning and academic performance. However, potential publication bias remains uncertain, as non-significant or negative findings may be underrepresented.

The review reveals that the existing research measures several cognitive components of teacher feedback, most commonly motivational factors like self-efficacy (Bandura, 1997), self-concept, task value, interest (Wigfield and Eccles, 2000), engagement (Fredricks, 2011; Marks, 2000), goal orientation (Elliot and Hulleman, 2017; Pintrich, 2000) and concepts in self-determination theory such as autonomy, competence, relatedness, and intrinsic motivation (Ryan and Deci, 2017).

Studies also examine students' beliefs about feedback (e.g., Lee, 2021; Pat-El et al., 2015; Sandal et al., 2022), critical thinking (Hitchcock, 2020), and preferences for feedback (e.g., Brooks et al., 2019; Gamlem and Smith, 2013; Kerr, 2017; Tan et al., 2019). Some studies also test a number of cognitive components as potential mediators or moderators in larger models without necessarily having a solid theoretical basis, highlighting the cognitive complexity of feedback situations. Some phenomena on which there is more limited research are students' cognitive processing and metacognition (Dunlosky and Metcalfe, 2008) related to feedback and how different personality characteristics may affect students' uptake and processing of feedback (e.g., Guo, 2021; Van der Kleij, 2019). An interesting focus area in this regard is the emerging research on internal feedback, which concerns how students generate internal feedback by comparing their current knowledge against some reference information (Nicol, 2020; Laudel and Narciss, 2023).

A limited number of studies include emotional components in their investigations. Most research is conducted on common academic emotions (Pekrun, 2024), like anxiety, frustration, pride, enjoyment, surprise or, more generally, positive and negative emotions, and wellbeing. Moreover, most of these studies examine emotions or affective factors as outcomes of feedback. However, among the included studies, we also find affective components related to social relations (e.g., Gamlem and Smith, 2013; Kerr, 2017; Lefroy, 2020), typically the relation between student and teacher, which points out that concepts like trust and respect might affect the student outcome, although these concepts also contain cognitive aspects. Finally, some studies see emotional states, for instance, mood, as a kind of filter for feedback. It typically affects students' receptiveness and can, therefore, be regarded as a moderator. Nevertheless, there is still little research on the emotional aspects of feedback, and we, therefore, need more studies that integrate what we know about students' emotions in education (e.g., Pekrun, 2024) with what is special for feedback situations (e.g., Lipnevich et al., 2021).

The most common behavioral outcome is engagement, often seen as a key mediator between feedback and learning or achievement. However, many studies lack clarity on whether engagement refers to cognitive, emotional, or behavioral aspects (Fredricks, 2011). Although these aspects of engagement are often integrated, a clarification could have been needed. Other common measured behavioral outcomes are processes related to students' self-regulated learning (Pintrich, 2000). This is often students' use of various learning strategies or more general processes such as planning, time management or effort regulation. A weakness of these results, however, is that the majority of these studies are based on student self-reports. More intervention studies and studies that actually measure observed behavior should, therefore, be a goal for future research. Other behavioral outcomes identified in the studies include suspension rates from school, classroom behavior, help-seeking, social behavior, and effort related to specific learning activities such as revising writings or completing assignments.

4.2 What factors are assumed to moderate students' outcomes of teacher feedback?

The most significant group of moderators of students' feedback outcome is related to the form and content of the feedback given. Teacher feedback can vary along several dimensions: its individualization, comprehensiveness, clarity, and whether it is constructive, judgmental, corrective, general, specific, positive, negative, direct, indirect, or action-oriented. Additionally, feedback can differ by mode (oral or written), timing, and medium—such as in class, on assignments, online, or via recordings. This review highlights that effective feedback must be tailored to the learning task, context, and learner, rejecting a one-size-fits-all approach. Lastly, we mention a few conceptual models that several studies seem to use as models for improved feedback practice or developing interventions. First is the Hattie and Timperley (2007) model of feed-up, feedback, and feedforward. Feed-up clarifies learning objectives and expectations before a task, feedback assesses current performance against goals, and feedforward outlines steps

for improvement. Another model from the same article that several studies referred to was the levels of feedback model, which categorizes feedback into task, process, self-regulation, and personal levels. We acknowledge that these conceptualizations may be useful for both research and practical purposes but encourage researchers and practitioners to also draw inspiration from more recent models (e.g., Lipnevich and Panadero, 2021; Lui and Andrade, 2022; Lipnevich and Smith, 2022).

Another group of moderators is related to students' characteristics (Kelley and McLaughlin, 2011). The included studies reveal that students may perceive the same feedback differently. This might be related to what type of feedback they prefer and what feedback they like or find most useful. A number of studies also show that students' motivation, beliefs, and conceptions can influence how feedback is understood and, not least, whether feedback is followed up with action. In addition, several studies also indicate that the student's level of achievement in the subject in question can influence how students both understand and use the feedback. Finally, gender differences are highlighted as potential moderators in a few studies. However, an important question is whether the difference lies in the perception of feedback or if males and females are treated differently and receive distinct feedback. From the perspective of tailored feedback, it can be a good thing that feedback varies in form and content, but we need more research to clarify how these differences actually manifest themselves.

A third group of moderators involves social interactions and communication. Studies highlight trust, respect, and teacher engagement as key factors influencing how feedback is received and acted upon (e.g., Cowie, 2005b; Van der Kleij, 2023). Teachers and students often perceive feedback differently, with many students struggling to understand or use it effectively, partly due to unclear language or insufficient tailoring. One way to address these issues is through teacher-student dialogue. Multiple studies emphasize that opportunities for discussion are crucial for students' comprehension of feedback, as dialogue can help clarify misunderstandings and provide deeper insights. Overall, communication—both in delivering and discussing feedback—appears to be a significant moderating factor.

The fourth group of moderators that we will mention is related to the learning context, although few studies focus on this (e.g., Chang et al., 2020). However, a few studies mention that the classroom climate may affect student response and uptake of feedback. This concerns students' opportunity to feel safe and learn without fear of teasing or making a fool of themselves. Previous research on classroom goals and the collective climate for learning can thus be helpful in unpacking this (e.g., Ames, 1992; Gamlem and Munthe, 2014). In addition, this can be about structures and how feedback is given and organized.

4.3 Do the results of the studies indicate that some factors are more important than others in moderating students' various outcomes of teacher feedback?

The review of the 96 studies clearly indicates that feedback quality has the greatest potential for increasing students' outcomes of teacher feedback. The intervention studies show that tailored, clear, informative, and action-oriented feedback positively affects student achievement. In addition, the review shows that more or less the same factors contribute to positive motivation and engagement among students. As if that's not enough, it's also the type of feedback students most want.

Some studies show that teachers are not always as clear in their feedback as they think, and many students do not always understand the feedback they receive. This indicates that feedback is also a matter of communication and that teachers must be sensitive to students' prerequisites and needs, although we recognize that this might be demanding on a busy school day. Dialogical feedback or dialogue about the feedback is pointed out as a measure to prevent such challenges.

Finally, we want to point out the negative consequences of criticism and negative feedback. Several of the studies in this review show, quite in unison, that negative feedback kills students' motivation and can lead to anxiety and avoidance behavior.

4.4 What is particular for students at ages 10–16

In this study, we have focused especially on the age group 10–16. Students in this age group are in a critical developmental stage where they are forming their academic identity, self-concept, and motivation for learning (Black and Wiliam, 1998; Eccles et al., 1993). Unlike younger children, this age group may be more self-conscious and sensitive to criticism, making them more likely to react defensively to feedback perceived as negative. At the same time, they seek autonomy and respect, so overly directive or controlling feedback can be demotivating (Ryan and Deci, 2017).

Our review reveals that effective feedback for this age group should be specific, constructive, and focused on effort and strategies rather than innate ability. It should also emphasize strategies that support self-regulated learning (Brandmo et al., 2020). Moreover, students in this age group need guidance on planning, monitoring, and evaluating their own learning processes, which means feedback should highlight effective study techniques, problem-solving approaches, and ways to overcome challenges (e.g., Chan and Lam, 2010; Ozan and Kincal, 2018; Tan et al., 2019). When framed as an opportunity for growth, feedback can enhance resilience and motivation, particularly if it fosters a sense of competence and ownership of learning.

This review emphasizes the importance of social dynamics in adolescence, highlighting the need for feedback that preserves students' sense of competence and ownership. Private, personalized feedback is often the most effective, strengthening the teacher-student relationship and fostering engagement. Public feedback should be handled carefully to avoid embarrassment. When presented as a tool for growth rather than evaluation, feedback fosters motivation and supports academic development.

4.5 Limitations and future perspectives

We have previously mentioned limitations related to using a restricted set of categories, variation in the quality of the

included studies, and the possibility of publication bias. Further, for pragmatic reasons, we have only focused on peer-reviewed articles published in English. Although peer-reviewed articles may represent the most substantial evidence, we may have missed interesting findings in doctoral dissertations and other gray literature. Moreover, because of keeping to English only, studies from the French- and Spanish-speaking populations may be underrepresented. Only three studies from South America and four from Africa were included.

Even though we have focused on a specific age group, we assume that some of the findings may also be valid for older students. This particularly applies to the quality aspects of feedback and the motivational mechanisms. Therefore, a goal in future research may be to map what is special in various groups and whether there exist more or less universal characteristics of feedback (Black and Wiliam, 2018). Further, it remains to explore how the most essential factors of feedback can be turned into sustainable classroom practices, the available resources taken into account.

In our approach to this review, we stopped when ChatGPT became publicly available. This was because we did not know how it would affect teacher feedback and the following research. After working on this study for a while, we see aspects of teacher feedback that can be replaced with chatbots. Artificial Intelligence (AI) can provide actionable feedback and process-focused guidance and efficiently deliver corrective feedback and strategy suggestions (Engeness and Gamlem, 2025; Hopfenbeck et al., 2023). However, it often lacks the emotional sensitivity and individualized encouragement necessary for student engagement. Teacher feedback, by contrast, is personalized, relational, and emotionally nuanced—key factors in student motivation and self-regulated learning. A future challenge would be finding working methods and systems where AI can be integrated into teaching and feedback in a sensible and appropriate way.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

CB: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. SG: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Writing – original draft, Writing – review & editing.

Funding

The author(s) declare that financial support was received for the research and/or publication of this article. The work is financially supported by the Department of Special Need Education and the DEAL research group at the University of Oslo.

Acknowledgments

We would like to thank Therese N. Hopfenbeck at the University of Melbourne for helpful input at the beginning of this work.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that Gen AI was used in the creation of this manuscript. We used the Data Analyst function in ChatGPT to extract the most significant information from each study. A PDF file of each article was uploaded to the service, after which we provided prompts to extract information. Typical prompts were "…given an overview of the study, …what study design was used, …main findings concerning feedback". The information was then manually coded in a spreadsheet into four main outcome categories (achievement, cognitive, emotional, and behavioral).

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2025.1572950/full#supplementary-material

References

*Admiraal, W., Vermeulen, J., and Bulterman-Bos, J. (2020). Teaching with learning analytics: How to connect computer-based assessment data with classroom instruction? *Technol. Pedag. Educ.* 29, 577–591. doi: 10.1080/1475939X.2020.1825992

*Aedo, P., and Millafilo, C. (2022). What type of oral corrective feedback do chilean EFL young learners prefer? HOW. *Colomb. J. Teach. English*. 29, 81–100. doi: 10.19183/how.29.2.643

*Al-Darei, I. S., and Ahmed, A. M. (2022). The effect of feedback type in the e-learning evironment on students' achievement and motivation. *J. Educ. Technol. Online Learn.* 5, 694–705. doi: 10.31681/jetol.11 11527

Ames, C. (1992). Classrooms: goals, structures, and student motivation. *J. Educ. Psychol.* 84, 261–271. doi: 10.1037/0022-0663.84.3.261

Andrade, H. (2010). "Students as the definitive source of formative assessment," in *Handbook of Formative Assessment*, eds. H. Andrade, G. Cizek. (New York: Routledge), 90–105.

Bandura, A. (1997). *Self-Efficacy, The Exercise of Control*. New York: W.H. Freeman and Company.

*Bansilal, S., James, A., and Naidoo, M. (2010). Whose voice matters? Learners. *S. Afr. J. Educ.* 30, 153–165. doi: 10.15700/saje.v30n1a236

*Bardine, B. A. (1999). Students' perceptions of written teacher comments: what do they say about how we respond to them? *High School J.* 82, 239–247.

*Bazán-Ramírez, A., Hernández-Padilla, E., Bazán-Ramírez, W., and Tresierra-Ayala, M. (2022). Effects of opportunities to learn on Peruvian students' science achievement in Program for International Student Assessment 2015 [Original Research]. *Front. Educ.* 7:897473. doi: 10.3389/feduc.2022.897473

*Beghetto, R. A. (2006). Creative self-efficacy: correlates in middle and secondary students. *Creat. Res. J.* 18, 447–457. doi: 10.1207/s15326934crj1804_4

Black, P., and Wiliam, D. (1998). Assessment and classroom learning. *Assess. Educ. Princip. Policy Pract.* 5, 7–74. doi: 10.1080/0969595980050102

Black, P., and Wiliam, D. (2009). Developing the theory of formative assessment. *Educ. Assess. Eval. Account.* 21, 5–31. doi: 10.1007/s11092-008-9068-5

Black, P., and Wiliam, D. (2018). Classroom assessment and pedagogy. *Assess. Educ. Princip. Policy Pract.* 25, 551–575. doi: 10.1080/0969594X.2018.1441807

Boekaerts, M., and Corno, L. (2005). Self-regulation in the classroom: a perspective on assessment and intervention. *Appl. Psychol.* 54, 99–231. doi: 10.1111/j.1464-0597.2005.00205.x

Brandmo, C., Panadero, E., and Hopfenbeck, T. N. (2020). Bridging classroom assessment and self-regulated learning. *Assess. Educ. Princip. Policy Pract.* 27, 319–331. doi: 10.1080/0969594X.2020.1803589

*Brooks, C., Huang, Y., Hattie, J., Carroll, A., and Burton, R. (2019). What Is My Next Step? School Students' Perceptions of Feedback. *Front. Educ.* 4, 96. doi: 10.3389/feduc.2019.00096

*Burner, T. (2016). Formative assessment of writing in English as a foreign language. *Scand. J. Educ. Res.* 60, 626–648. doi: 10.1080/00313831.2015.1066430

Butler, D. L., and Winne, P. H. (1995). Feedback and self-regulated learning: a theoretical synthesis. *Rev. Educ. Res.* 65, 245–281. doi: 10.3102/00346543065003245

Carey, M. (2012). *Qualitative Research Skills for Social Work: Theory and Practice*. London: Routledge.

*Carrillo-López, P. J., Maneiro-Dios, R., and Moral-García, J. E. (2022). Formative assessment in Physical Education and its relation to the level of attention of primary school children. *Specijalna Educacija Rehabilitacija.* 21, 147–161. doi: 10.5937/specedreh21-36486

*Chan, J. C., and Lam, S. (2010). Effects of different evaluative feedback on students' self-efficacy in learning. *Instruct. Sci.* 38, 37–58. doi: 10.1007/s11251-008-9077-2

*Chang, S-. C., Hsu, T-. C., and Jong, M. S-. Y. (2020). Integration of the peer assessment approach with a virtual reality design system for learning earth science. *Comput. Educ.* 146, 103758. doi: 10.1016/j.compedu.2019.103758

*Chi, S., Wang, Z., and Liu, X. (2021). Moderating effects of teacher feedback on the associations among inquiry-based science practices and students' science-related attitudes and beliefs. *Int. J. Sci. Educ.* 43, 2426–2456. doi: 10.1080/09500693.2021.1968532

*Cowie, B. (2005a). Pupil commentary on assessment for learning. *Curric. J.* 16, 137–151. doi: 10.1080/09585170500135921

*Cowie, B. (2005b). Student commentary on classroom assessment in science: a sociocultural interpretation. *Int. J. Sci. Educ.* 27, 199–214. doi: 10.1080/0950069042000276721

*Cunha, J., Rosario, P., Nunez, J. C., Vallejo, G., Martins, J., Hogemann, J., et al. (2019). Does teacher homework feedback matter to 6th graders' school engagement?: A mixed methods study. *Metacogn. Learn.* 14, 89–129. doi: 10.1007/s11409-019-09200-z

*Dang, T. T. D. (2021). Secondary students' perceptions of their engagement in a correcting process. *Int. Educ. Stud.* 14, 78–92. doi: 10.5539/ies.v14n12p78

*De Meester, A., Van Duyse, F., Aelterman, N., De Muynck, G. J., and Haerens, L. (2020). An experimental, video-based investigation into the motivating impact of choice and positive feedback among students with different motor competence levels. *Phys. Educ. Sport Pedag.* 25, 361–378. doi: 10.1080/17408989.2020.1725456

Dunlosky, J., and Metcalfe, J. (2008). *Metacognition*. Thousand Oaks: Sage Publications.

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., et al. (1993). Development during adolescence: The impact of stage-environment fit on young adolescents' experiences in schools and in families. *Am. Psychol.* 48, 90–101. doi: 10.1037/0003-066X.48.2.90

*Eckes, A., and Wilde, M. (2019). Structuring experiments in biology lessons through teacher feedback. *Int. J. Sci. Educ.* 41, 2233–2253. doi: 10.1080/09500693.2019.1668578

Elliot, A. J., and Hulleman, C. S. (2017). "Achievement goals," in *Handbook of Competence and Motivation: Theory and Application (2 Edn.)*, eds. A. J. Elliot, C. Dweck, D. S. Yeager (New York, N.Y.: Guilford Press), 43–60.

Engeness, I., and Gamlem, S. M. (2025). Exploring AI-driven feedback as a cultural tool: a cultural-historical perspective on design of AI environments to support students' writing process. *Integr. Psychol. Behav. Sci.* 59:23. doi: 10.1007/s12124-025-09894-8

*Erturan-Ilker, G. (2014). Effects of feedback on achievement goals and perceived motivational climate in physical education. *Issues Educ. Res.* 24, 152–161.

*Fergus, S., and Petrick Smith, C. (2022). Characteristics of proficiency-based learning and their impacts on math anxiety in the middle grades. *RMLE Online Res Middle Level Educ.* 45:4. doi: 10.1080/19404476.2022.2045810

Fielding, M. (2004). Transformative approaches to student voice: theoretical underpinnings, recalcitrant realities. *Br. Educ. Res. J.* 30, 295–311. doi: 10.1080/0141192042000195236

Fredricks, J. A. (2011). Engagement in school and out-of-school contexts: a multidimensional view of engagement. *Theory Pract.* 50, 327–335. doi: 10.1080/00405841.2011.607401

*Gamlem, S. M., and Munthe, E. (2014). Mapping the quality of feedback to support students' learning in lower secondary classrooms. *Camb. J. Educ.* 44, 75–92. doi: 10.1080/0305764X.2013.855171

*Gamlem, S. M., and Smith, K. (2013). Student perceptions of classroom feedback. *Assess. Educ. Princip. Policy Pract.* 20, 150–169. doi: 10.1080/0969594X.2012.749212

*Ganapathy, M., Tan, D. A. L., and Phan, J. (2020a). Impact of written corrective feedback on Malaysian ESL secondary students' writing performance. *3L: Lang. Linguist. Literat.* 26, 139–153. doi: 10.17576/3L-2020-2603-11

*Ganapathy, M., Tan, D. A. L., and Phan, J. (2020b). Students' perceptions of teachers' written corrective feedback in the Malaysian ESL classroom. *Malays. J. Learn. Instruct.* 17, 103–136. doi: 10.32890/mjli2020.17.2.4

*Guo, W. (2021). Gender differences in teacher feedback and students' self-regulated learning. *Educ. Stud.* 50, 341–361. doi: 10.1080/03055698.2021.1943648

Guskey, T. R., and Brookhart, S. M. (2019). *What We Know About Grading: What Works, What Doesn't and What's Next*. Alexandria, VA: ASCD

*Harris, L. R., Brown, G. T., and Harnett, J. A. (2014). Understanding classroom feedback practices: a study of New Zealand student experiences, perceptions, and emotional responses. *Educ. Assess. Eval. Account.* 26, 107–133. doi: 10.1007/s11092-013-9187-5

Hattie, J. (2009). *Visible Learning: A Synthesis of Over 800 Meta-Analyzes Relating to Achievement*. London: Routledge.

Hattie, J., and Gan, M. (2011). "Instruction based on feedback," in *Handbook of Research on Learning and Instruction*, eds. R. E. Mayer and P. A. Alexander (New York: Routledge), 249–271.

Hattie, J., and Timperley, H. (2007). The power of feedback. *Rev. Educ. Res.* 77, 81–112. doi: 10.3102/003465430298487

*He, J., Liu, Y., Ran, T., and Zhang, D. (2023). How students' perception of feedback influences self-regulated learning: the mediating role of self-efficacy and goal orientation. *Eur. J. Psychol. Educ.* 38, 1551–1569. doi: 10.1007/s10212-022-00654-5

*Helm, F., Wolff, F., Möller, J., Zitzmann, S., Marsh, H. W., Dicke, T., et al. (2022). Individualized teacher frame of reference and student self-concept within and between school subjects. *J. Educ. Psychol.* 115, 309–329. doi: 10.1037/edu0000737

*Henry, E., Hinshaw, R., Al-Bataineh, A., and Bataineh, M. (2020). Exploring teacher and student perceptions on the use of digital conferencing tools when providing feedback in writing workshop. *TOJET: Turk Online J. Educ. Technol.* 19:41–50.

Hitchcock, D. (2020). "Seven philosophical conceptions of critical thinking: themes, variations, implications," in *Critical Thinking and Reasoning*, ed. D. Fasko, F. Fair (Leiden, The Netherlands: Brill), 9–30.

*Honora, D. (2003). Urban African American adolescents and school identification. *Urban Educ.* 38, 58–76. doi: 10.1177/0042085902238686

Hopfenbeck, T. N., Zhang, Z., Sun, S. Z., Robertson, P., and McGrane, J. A. (2023). Challenges and opportunities for classroom-based formative assessment and AI: a perspective article. *Front. Educ.* 8:1270700. doi: 10.3389/feduc.2023.12 70700

*Hu, J., and Wang, Y. (2022). Influence of students' perceptions of instruction quality on their digital reading performance in 29 OECD countries: a multilevel analysis. *Comput. Educ.* 189, 1–15. doi: 10.1016/j.compedu.2022.104591

*Jang, E. E., Dunlop, M., Park, G., and van der, B. (2015). How do young students with different profiles of reading skill mastery, perceived ability, and

goal orientation respond to holistic diagnostic feedback? *Lang. Test.* 32, 359–383. doi: 10.1177/0265532215570924

*Jiang, Y., Lee, C. K. J., Wan, Z. H., and Chen, J. (2021). Stricter teacher, more motivated students? Comparing the associations between teacher behaviors and motivational beliefs of Western and East Asian Learners. *Front. Psychol.* 11:564327. doi: 10.3389/fpsyg.2020.564327

Kelley, C. M., and McLaughlin, A. C. (2011). Individual differences in the benefits of feedback for Learning. *Hum. Factors* 54, 26–35. doi: 10.1177/0018720811423919

*Kerr, K. (2017). Exploring student perceptions of verbal feedback. *Res. Papers Educ.* 32, 444–462. doi: 10.1080/02671522.2017.1319589

Kluger, A. N., and DeNisi, A. (1996). The effects of feedback interventions on performance: a historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychol. Bull.* 119, 254–284. doi: 10.1037/0033-2909.119.2.254

*Koenka, A. C. (2022). Grade expectations: the motivational consequences of performance feedback on a summative assessment. *J. Exp. Educ.* 90, 88–111. doi: 10.1080/00220973.2020.1777069

*Koka, A., and Hein, V. (2003). Perceptions of teacher's feedback and learning environment as predictors of intrinsic motivation in physical education. *Psychol. Sport Exerc.* 4, 333–346. doi: 10.1016/S1469-0292(02)00012-2

*Koka, A., and Hein, V. (2006). Perceptions of teachers' general and informational feedback and intrinsic motivation in physical education: two-year effects. *Percept. Mot. Skills.* 103, 321–332. doi: 10.2466/pms.103.2.321-332

*Krijgsman, C., Mainhard, T., Borghouts, L., van Tartwijk, J., and Haerens, L. (2021). Do goal clarification and process feedback positively affect students' need-based experiences? A quasi-experimental study grounded in self-determination theory. *Phys. Educ. Sport Pedag.* 26, 483–503. doi: 10.1080/17408989.2020.1823956

*Krijgsman, C., Mainhard, T., van Tartwijk, J., Borghouts, L., Vansteenkiste, M., Aelterman, N., et al. (2019). Where to go and how to get there: goal clarification, process feedback and students' need satisfaction and frustration from lesson to lesson. *Learn. Instruct.* 61, 1–11. doi: 10.1016/j.learninstruc.2018.12.005

Laudel, H., and Narciss, S. (2023). The effects of internal feedback and self-compassion on the perception of negative feedback and post-feedback learning behaviour. *Stud. Educ. Eval.* 77:101237. doi: 10.1016/j.stueduc.2023.101237

*Lee, I. (2008). Student reactions to teacher feedback in two Hong Kong secondary classrooms. *J. Second Lang. Writing.* 17, 144–164. doi: 10.1016/j.jslw.2007.12.001

*Lee, M. H. (2021). Lower secondary school students' perceptions of science assessment feedback and their conceptions of science assessment: a transitional phase of developing an understanding of assessment. *Res. Sci. Technol. Educ.* 41, 928–945. doi: 10.1080/02635143.2021.1973401

*Lee, Y-. F., Altschuld, J. W., Chiang, F. S., Yue, C-. S. J., Sung, H-. T., Chang, C-. H., et al. (2022). Effects of augmented feedback with error self-estimates on vocational high school students' motor skill learning. *Vocat. Learn.* 15, 1–20. doi: 10.1007/s12186-021-09273-5

*Lefroy, R. (2020). Audio or written feedback? The secondary school english student experience. *English Educ.* 54, 321–333. doi: 10.1080/04250494.2019.1585184

Lipnevich, A., and Panadero, E. (2021). A Review of feedback models and theories: descriptions, definitions, and conclusions. *Front. Educ.* 6:720195. doi: 10.3389/feduc.2021.720195

Lipnevich, A. A., Berg, D. A. G., and Smith, J. K. (2016). "Toward a model of student response to feedback," in *The Handbook of Human and Social Conditions in Assessment*, eds. G. T. L. Brown, L. R. Harris (Milton Park: Routledge), 169–185.

Lipnevich, A. A., Murano, D., Krannich, M., and Goetz, T. (2021). Should I grade or should I comment: links among feedback, emotions, and performance. *Learn. Individ. Differ.* 89:102020. doi: 10.1016/j.lindif.2021.102020

Lipnevich, A. A., and Smith, J. K. (2022). Student–feedback interaction model: revised. *Stud. Educ. Eval.* 75:101208. doi: 10.1016/j.stueduc.2022.101208

*Luan, N. L., and Ishak, S. N. A. (2018). Instructor's direct and indirect feedback: how do they impact learners' written performance? *3L: Lang. Linguist. Literat.* 24, 95–110. doi: 10.17576/3L-2018-2403-08

*Lui, A. M., and Andrade, H. L. (2022). Inside the next black box: examining students' responses to teacher feedback in a formative assessment context. *Front. Educ.* 7:751549. doi: 10.3389/feduc.2022.751549

*Mælan, E. N., Gustavsen, A. M., Stranger-Johannessen, E., and Nordahl, T. (2021). Norwegian students' experiences of homeschooling during the COVID-19 pandemic. *Eur. J. Spec. Needs Educ.* 36, 5–19. doi: 10.1080/08856257.2021.1872843

*Mak, P. (2019). From traditional to alternative feedback: What do L2 elementary students think? *Int. J. Applied Linguist.* 29, 109–129. doi: 10.1111/ijal.12250

Marks, H. M. (2000). Student engagement in instructional activity: patterns in the elementary, middle, and high school years. *Am. Educ. Res. J.* 37, 153–184. doi: 10.3102/00028312037001153

*Martin, A. J., Burns, E. C., Collie, R. J., Bostwick, K. C. P., Flesken, A., McCarthy, I., et al. (2022). Growth goal setting in high school: a large-scale study of perceived instructional support, personal background attributes, and engagement outcomes. *J. Educ. Psychol.* 114, 752–771. doi: 10.1037/edu0000682

*McLaughlin, T. F. (1992). Effects of written feedback in reading on behaviorally disordered students. *J. Educ. Res.* 85, 312–316. doi: 10.1080/00220671.1992.9941131

*Mikume, B. O., and Oyoo, S. O. (2010). Improving the practice of giving feedback on ESL learners' written compositions. *Int. J. Learn.* 17, 337–354. doi: 10.18848/1447-9494/CGP/v17i05/47066

*Monteiro, V., Carvalho, C., and Santos, N. N. (2021). Creating a supportive classroom environment through effective feedback: effects on students' school identification and behavioral engagement. *Front. Educ.* 6:661736. doi: 10.3389/feduc.2021.661736

*Murtagh, L. (2014). The motivational paradox of feedback: teacher and student perceptions. *Curric. J.* 25, 516–541. doi: 10.1080/09585176.2014.944197

*Nicaise, V., Bois, J. E., Fairclough, S. J., Amorose, A. J., and Cogerino, G. (2007). Girls' and boys' perceptions of physical education teachers' feedback: effects on performance and psychological responses. *J. Sports Sci.* 25, 915–926. doi: 10.1080/02640410600898095

Nicol, D. (2020). The power of internal feedback: exploiting natural comparison processes. *Assessment and Evaluation in Higher Education*, 46, 756–778. doi: 10.1080/02602938.2020.1823314

*Nunez, J. C., Suarez, N., Rosario, P., Vallejo, G., Cerezo, R., Valle, A., et al. (2015). Teachers' feedback on homework, homework-related behaviors, and academic achievement. *J. Educ. Res.* 108, 204–216. doi: 10.1080/00220671.2013.878298

*Oinas, S., Ahtiainen, R., Vainikainen, M-. P., and Hotulainen, R. (2021). Pupils' perceptions about technology-enhanced feedback: do emojis guide self-regulated learning? *Scand. J. Educ. Res.* 65, 1037–1051. doi: 10.1080/00313831.2020.1788149

*Ozan, C., and Kincal, R. Y. (2018). The effects of formative assessment on academic achievement, attitudes toward the lesson, and self-regulation skills. *Kuram ve Uygulamada Egitim Bilimleri.* 18, 85–118.

*Pat-El, R. J., Tillema, H., Segers, M., and Vedder, P. (2015). Multilevel predictors of differing perceptions of Assessment for Learning practices between teachers and students. *Assess. Educ. Princip. Policy Practce.* 22, 282–298. doi: 10.1080/0969594X.2014.975675

Pekrun, R. (2024). Control-value theory: from achievement emotion to a general theory of human emotions. *Educ. Psychol. Rev.* 36:83. doi: 10.1007/s10648-024-09909-7

Pekrun, R., and Linnenbrink-Garcia, L. (2012). "Academic emotions and student engagement," in *Handbook of Research on Student Engagement*, eds. S. L. Christensen, A. L. Reschley, C. Wylie (New York, NY: Springer), 259–282.

Perrenoud, P. (1998). From formative evaluation to a controlled regulation of learning processes: towards a wider conceptual field. *Assess. Educ. Princip. Policy Pract.* 5, 85–102. doi: 10.1080/0969595980050105

*Pinger, P., Rakoczy, K., Besser, M., and Klieme, E. (2018). Implementation of formative assessment–effects of quality of programme delivery on students' mathematics achievement and interest. *Assess. Educ. Princip. Pol. Pract.* 25, 160–182. doi: 10.1080/0969594X.2016.1170665

Pintrich, P. R. (2000). "The role of goal orientation in self-regulated learning," in *Handbook of Self-Regulation*, eds. M. Boekaerts, P. R. Pintrich and M. Zeidner. (San Diego, C.A.: Academic Press), 450–502.

*Rakoczy, K., Pinger, P., Hochweber, J., Klieme, E., Schutze, B., Besser, M., et al. (2019). Formative assessment in mathematics: mediated by feedback's perceived usefulness and students' self-efficacy. *Learn. Instruct.* 60, 154–165. doi: 10.1016/j.learninstruc.2018.01.004

*Rathel, J. M., Drasgow, E., Brown, W. H., and Marshall, K. J. (2014). Increasing induction-level teachers' positive-to-negative communication ratio and use of behavior-specific praise through E-mailed performance feedback and its effect on students' task engagement. *J. Posit. Behav. Interv.* 16, 219–233. doi: 10.1177/1098300713492856

*Rohatgi, A., Hatlevik, O. E., and Björnsson, J. K. (2022). Supportive climates and science achievement in the Nordic countries: lessons learned from the 2015 PISA study. *Large-Scale Assess. Educ.* 10:1. doi: 10.1186/s40536-022-00123-x

Rosenberg, P. R. (2020). *Design of Observational Studies (2nd Edn.)*. Philadelphia, PA: Springer.

*Ruiz-Primo, M. A., and Furtak, E. M. (2007). Exploring teachers' informal formative assessment practices and students' understanding in the context of scientific inquiry. *J. Res. Sci. Teach.* 44, 57–84. doi: 10.1002/tea.20163

*Ruthmann, S. (2008). Whose agency matters? Negotiating pedagogical and creative intent during composing experiences. *Res. Music Educ.* 30, 43–58. doi: 10.1177/1321103X08089889

Ryan, R. M., and Deci, E. L. (2017). *Self-Determination Theory: Basic Psychological Needs in Motivation, Development, and Wellness*. New York: The Guilford Press.

*Sandal, A. K., Helleve, I., Smith, K., and Gamlem, S. M. (2022). Feedback practice in lower secondary school: Exploring development of perceptions of feedback practice among students and teachers. *Cogent Educ.* 9, 1–19. doi: 10.1080/2331186X.2022.2101236

*Santanatanon, T., and Chinokul, S. (2022). Exploring and analysis of student engagement in english writing grammar accuracy based on teacher written corrective feedback. *PASAA: J. Lang. Teach. Learn. Thailand*. 63, 35–65. doi: 10.58837/CHULA.PASAA.63.1.2

*Schunk, D. H., and Rice, J. M. (1991). Learning goals and progress feedback during reading comprehension instruction. *J. Read. Behav*. 23, 351–364. doi: 10.1080/10862969109547746

*Schunk, D. H., and Rice, J. M. (1993). Strategy fading and progress feedback: effects on self-efficacy and comprehension among students receiving remedial reading services. *J. Spec. Educ*. 27, 257–276. doi: 10.1177/002246699302700301

*Scott, T. M., and Gage, N. (2020). An examination of the association between teacher's instructional practices and school-wide disciplinary and academic outcomes. *Educ. Treat. Child*. 43, 223–235. doi: 10.1007/s43494-020-00024-0

*Sewagegn, A. A., and Dessie, A. A. (2020). The value of feedback in primary schools: students' perceptions of the practice. *Int. J. Learn. Teach. Educ. Res*. 19, 338–354. doi: 10.26803/ijlter.19.10.19

Shadish, W. R., Cook, T. D., and Campbell, D. T. (2002). *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Boston/New York: Houghton Mifflin Company.

Shute, V. J. (2008). Focus on formative feedback. *Rev. Educ. Res*. 78, 153–189. doi: 10.3102/0034654307313795

*Siero, F., and van Oudenhoven, J. P. (1995). The effects of contingent feedback on perceived control and performance. *Eur. J. Psychol. Educ*. 10, 13–24. doi: 10.1007/BF03172792

Sinatra, G. M., Heddy, B. C., and Lombardi, D. (2015). The challenges of defining and measuring student engagement in science. *Educ. Psychol.* 50, 1–13. doi: 10.1080/00461520.2014.1002924

*Smit, R., Dober, H., Hess, K., Bachmann, P., and Birri, T. (2022). Supporting primary students' mathematical reasoning practice: the effects of formative feedback and the mediating role of self-efficacy. *Res. Math. Educ*. 25, 277–300. doi: 10.1080/14794802.2022.2062780

Smith, K., Gamlem, S. M., Sandal, A. K., Engelsen, K. S., and Tong wai, K. (2016). Educating for the future: a conceptual framework of responsive pedagogy. *Cogent Educ*. 3:1. doi: 10.1080/2331186X.2016.1227021

*Sokmen, Y. (2021). The role of self-efficacy in the relationship between the learning environment and student engagement. *Educ. Stud*. 47, 19–37. doi: 10.1080/03055698.2019.1665986

*Soncini, A., Matteucci, M. C., and Butera, F. (2021). Error handling in the classroom: an experimental study of teachers' strategies to foster positive error climate. *Eur. J. Psychol. Educ*. 36, 719–738. doi: 10.1007/s10212-020-00494-1

*Sortkær, B., and Reimer, D. (2021). Gender differences in students' perceptions of teacher and peer feedback in mathematics: lessons from Denmark. *Oxf. Rev. Educ*. 48, 184–200. doi: 10.1080/03054985.2021.1948396

*Sortkaer, B. (2019). Cultural capital and the perception of feedback. *Br. J. Sociol. Educ*. 40, 647–663. doi: 10.1080/01425692.2019.1566867

*Sutherland, K. S., Wehby, J. H., and Copeland, S. R. (2000). Effect of varying rates of behavior-specific praise on the on-task behavior of students with EBD. *J. Emot. Behav. Disord. 8:2–8*, 26. doi: 10.1177/106342660000800101

*Tan, F. D. H., Whipp, P. R., Gagne, M., and Van Quaquebeke, N. (2019). Students' perception of teachers' two-way feedback interactions that impact learning. *Soc. Psychol. Educ. Int. J*. 22, 169–187. doi: 10.1007/s11218-018-9473-7

*Tas, Y., Sungur, S., and Oztekin, C. (2016). Development and validation of Science Homework Scale for Middle-School Students. *Int. J. Sci. Math. Educ*. 14, 417–444. doi: 10.1007/s10763-014-9582-5

*Tay, H. Y., and Kee, K. N. N. (2019). Effective questioning and feedback for learners with autism in an inclusive classroom. *Cogent Educ*. 6:1. doi: 10.1080/2331186X.2019.1634920

*Tay, H. Y., and Lam, K. W. L. (2022). Students' engagement across a typology of teacher feedback practices. *Educ. Res. Policy Pract*. 21, 427–445. doi: 10.1007/s10671-022-09315-2

*Torkildsen, L. G., and Erickson, G. (2016). 'If they'd written more.'—On students' perceptions of assessment and assessment practices. *Educ. Inq*. 7, 137–157. doi: 10.3402/edui.v7.27416

Van der Kleij, F. (2022). "Reimagining classroom assessment and feedback to meet learner needs", in *Research Conference 2022: Reimagining Assessment: Proceedings and Program*, ed. K. Burns (Camberwell: Australian Council for Educational Research).

*Van der Kleij, F. (2023). Teacher and student perceptions of oral classroom feedback practices: a video-stimulated recall study. *Aust. Educ. Res*. 50, 353–370. doi: 10.1007/s13384-021-00478-0

*Van der Kleij, F. M. (2019). Comparison of teacher and student perceptions of formative assessment feedback practices and association with individual student characteristics. *Teach. Teach. Educ*. 85, 175–189. doi: 10.1016/j.tate.2019.06.010

*Van Der Kleij, F., and Adie, L. (2020). Towards effective feedback: an investigation of teachers' and students' perceptions of oral feedback in classroom practice. *Assess. Educ. Princip. Policy Pract*. 27, 252–270. doi: 10.1080/0969594X.2020.1748871

*Vattøy, K-. D., and Smith, K. (2019). Students' perceptions of teachers' feedback practice in teaching English as a foreign language. *Teach. Teach. Educ*. 85, 260–268. doi: 10.1016/j.tate.2019.06.024

*Vergara-Torres, A. P., Tristán, J., López-Walle, J. M., González-Gallegos, A., Pappous, A., Tomás, I., et al. (2020). Students' perceptions of teachers' corrective feedback, basic psychological needs and subjective vitality: a multilevel approach. *Front. Psychol*. 11:558954. doi: 10.3389/fpsyg.2020.558954

*Vergara-Torres, A. P., Tristán, J., López-Walle, J. M., González-Gallegos, A., Pappous, A. S., Tomás, I., et al. (2021). Quality of the physical education teacher's instruction in the perspective of self-determination. *Front. Psychol*. 12:749678. doi: 10.3389/fpsyg.2021.749678

Wigfield, A., and Eccles, J. S. (2000). Expectancy–value theory of achievement motivation. *Contemp. Educ. Psychol.* 25, 68–81. doi: 10.1006/ceps.1999.1015

*Wiggins, M., Sawtell, M., and Jerrim, J. (2017). *Learner Response System: Evaluation Report and Executive Summary*. London: Education Endowment Foundation. Available online at: https://files.eric.ed.gov/fulltext/ED581136.pdf

*Williams, J. A. (2010). 'You know what you've done right and what you've done wrong and what you need to improve on': New Zealand students' perspectives on feedback. *Assess. Educ. Princip. Policy Pract*. 17, 301–314. doi: 10.1080/0969594X.2010.496249

Wisniewski, B., Zierer, K., and Hattie, J. (2020). The power of feedback revisited: a meta-analysis of educational feedback research. *Front. Psychol*. 10:3087. doi: 10.3389/fpsyg.2019.03087

*Wollenschläger, M., Hattie, J., Machts, N., Möller, J., and Harms, U. (2016). What makes rubrics effective in teacher-feedback? Transparency of learning goals is not enough. *Contemp. Educ. Psychol.* 44–45, 1–11. doi: 10.1016/j.cedpsych.2015.11.003

*Xu, J. (2022). Investigating factors that influence math homework purposes: a multilevel analysis. *J. Exp. Educ*. 90, 862–883. doi: 10.1080/00220973.2020.1810604

*Xu, J., Wang, C., Du, J., and Núñez, J. C. (2022). Profiles of student-perceived teacher homework involvement, and their associations with homework behavior and mathematics achievement: a person-centered approach. *Learn. Individ. Differ*. 96:102159. doi: 10.1016/j.lindif.2022.102159

Yang, L., Chiu, M. M., and Yan, Z. (2021). The power of teacher feedback in affecting student learning and achievement: insights from students' perspective. *Educ. Psychol.* 41, 821–824. doi: 10.1080/01443410.2021.1964855

*Yeager, D. S., Purdie-Vaughns, V., Garcia, J., Apfel, N., Brzustoski, P., Master, A., et al. (2014). Breaking the cycle of mistrust: wise interventions to provide critical feedback across the racial divide. *J. Exp. Psychol. Gener*. 143, 804–824. doi: 10.1037/a0033906

*Zohra, R. F., and Fatiha, H. (2022). Exploring learners' and teachers' preferences regarding written corrective feedback types in improving learners' writing skill. *Arab World English J*. 13, 117–128. doi: 10.24093/awej/vol13no1.8

*Zumbrunn, S., Marrs, S., and Mewborn, C. (2016). Toward a better understanding of student perceptions of writing feedback: a mixed methods study. *Read. Writ. Interdiscip. J*. 29, 349–370. doi: 10.1007/s11145-015-9599-3

*refers to studies included in the review.