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Exploring the Effect of Teacher Feedback on Students' Self-Efficacy

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Abstract: ***Teacher feedback is a critical factor influencing students self-efficacy (the belief in one ability to accomplish specific tasks). This paper, based on Bandura (Bandura) self-efficacy theory and drawing on relevant research both domestically and internationally, explores the mechanisms by which teacher feedback stimulates students self-efficacy and suggests optimization paths. The study finds that the essence of issues with teacher feedback lies in the structural contradiction between the industrial-era educational paradigm and the learning needs of the brain science era. Future reforms need to achieve three major shifts. From outcome evaluation to neurocognitive development, feedback should focus on the learning process and optimize prefrontal executive function. Only by building a feedback ecosystem that aligns with the brain learning principles can we truly unlock each student potential.***

Keywords: Teacher feedback, Self-efficacy, Motivational effects**.**

1. Introduction

Teacher feedback, as a core element of teaching interaction, is increasingly drawing attention from the academic community for its impact on students 'self-efficacy. Self-efficacy (self-efficacy), a central construct in social cognitive theory (Bandura, 2017), has been proven to be a key predictor of academic achievement (Schunk & DiBenedetto, 2020). However, current feedback models in education have significant flaws: meta-analyses show that only 29% of teacher feedback meets the criteria of being "specific, timely, and developmental" (Wisniewski et al., 2020). Recent findings in neuroeducation reveal that generalized feedback only activates the basal ganglia reward circuit without effectively stimulating the prefrontal executive function regions (Howard-Jones et al., 2018). Cross-cultural studies indicate that in East Asian educational contexts, 62% of feedback is reduced to test point hints, severely undermining students' belief in their abilities (Zhou & Urhahne., 2022). In the era of intelligent education, new issues have emerged; the emotional void in purely digital feedback results in an efficacy gain of only 32% compared to human feedback (Wang et al., 2023). Against this backdrop, exploring feedback optimization strategies that align with brain science principles holds significant theoretical value and practical significance for enhancing students' self-regulated learning abilities.

2. The Theoretical Basis of Teacher Feedback on the Stimulation Effect of Students' Self-efficacy

2.1 Bandura's Theory of Self-efficacy

An individual belief in their own abilities is influenced by four aspects: direct experience, vicarious experience, verbal persuasion, and emotional state. Teacher feedback primarily exerts its influence through verbal persuasion and emotional regulation. Among these, direct experience (success or failure experiences) is the most influential source (with a weight of about 85%), as successful experiences enhance perceived competence, while repeated successes may reduce the willingness to challenge. The key mechanism is establishing a effort-success cognitive connection through controllable challenges. Vicarious experience (observational learning) involves self-assessment by observing the performance of similar individuals. Teachers use strategies such as emphasizing the process over the outcome when presenting peer cases, employing the cognitive apprenticeship approach to demonstrate thought processes. Verbal persuasion (social evaluation) influences self-cognition through feedback from others, with significant short-term effects (especially during low-performing phases), provided it matches the actual ability; otherwise, it can lead to cognitive dissonance. Neuroscientific evidence suggests that positive feedback promotes dopamine secretion in the prefrontal cortex, enhancing learning motivation (as confirmed by EEG studies). Emotional and physiological states can activate the amygdala, inhibiting working memory function in the prefrontal cortex, particularly when anxiety is present.

3. Literary Review

Different The mechanisms by which teacher feedback influences students self-efficacy have been extensively validated in numerous studies. Bandura (2017) proposed the Self-Efficacy Theory, which suggests that the formation of efficacy beliefs is primarily influenced by four factors, with direct experience accounting for as much as 85%, followed by vicarious experience, social persuasion, and emotional states. This theoretical framework has laid the groundwork for subsequent research. Hattie and Timperley (2017) conducted a meta-analysis of 196 feedback studies and found that the effect size of formative feedback was 0.73, significantly higher than the 0.12 for mere praise, but excessive praise can actually reduce students willingness to take on challenges. Black and Wiliam (2018) further confirmed that formative feedback oriented towards process can increase student performance by 0.4 to 0.7 standard deviations, highlighting the importance of specific guidance. Dweck (2016) research on growth mindset provided a new perspective on feedback practices, finding that feedback emphasizing effort strategies can enhance students ability to cope with failure by 40%. This finding aligns with the experimental results of Schunk (2021), which showed that effort-based feedback (such as you work hard) can increase students perseverance by 35% compared to ability-based feedback (such as you are very smart). Roorda et

al. (2021) found through analyzing 99 studies on teacher-student relationships that high-quality teacher-student relationships can increase feedback acceptance by 58%, with this effect being particularly significant among low-performing students. Regarding the timeliness of feedback, Shute (2018) analyzed 250 studies on digital feedback and found that immediate feedback is 29% more effective than delayed feedback, but for complex cognitive tasks, appropriate delays in feedback are necessary. Wisniewski et al. (2020) reanalyzed 435 studies and found that feedback effectiveness varies by discipline, with STEM fields requiring more specific cognitive feedback to effectively enhance self-efficacy.

The research by Chinese scholars provides important supplements to understanding the impact of cultural factors. Zhou, W. J. & Li, X. Y. (2017) found in a tracking study of five middle schools that constructive criticism must be accompanied by emotional support to effectively enhance students self-efficacy in a Chinese-speaking context. Dong, Q. & Zhou, R. L. (2023) studied Chinese elementary school students and found that specific written comments are more effective in boosting self-efficacy than simple rating scores (effect size 0.51 vs 0.23), providing empirical evidence for evaluation reforms in China basic education.

4. The Current Problem of the Effect of Teacher Feedback on Students' Self-efficacy

Teacher feedback is a critical factor in shaping students self-efficacy (self-efficacy), but current feedback practices have systemic flaws that make it difficult to effectively stimulate students belief in their abilities. These issues involve multiple dimensions, including cognitive neural mechanisms, emotional support, spatiotemporal efficiency, neurodiversity adaptation, limitations of intelligent education, and cultural adaptability, all of which urgently require in-depth analysis based on research in educational neuroscience.

4.1 Structural Imbalance of Feedback Content.

Excessive Focus on Outcome-Based Evaluation According to the OECD (2022) international study, 58% of teachers still primarily provide feedback based on outcome-based evaluations (such as scores, rankings, right or wrong judgments), rather than focusing on the learning process (such as strategy adjustments, cognitive optimization). This imbalance makes it difficult for students to establish a sustainable framework of ability cognition, instead reinforcing the fixed mindset (Dweck, 2006). Neuroscience research shows that when feedback lacks guidance on cognitive processes, the executive function activation in students prefrontal cortex is insufficient, while the activity in the dorsolateral prefrontal cortex related to error monitoring is enhanced, leading to a phenomenon known as cognitive fear (Moser et al., 2011). This feedback model is particularly detrimental to students with low self-efficacy, making them more likely to retreat when facing challenges.

4.2 The Dimension of Emotional Support is Seriously Missing.

The neuro-inhibitory effect of negative feedback: Approximately 72% of teacher feedback lacks emotional regulation strategies (such as growth-oriented language and empathetic expression), leading to strong stress responses in students when they receive negative evaluations. Brain imaging data show that when students face unbuffered criticism, their amygdala activation levels surge by 300%, while the cognitive control ability of the prefrontal cortex decreases (Immordino-Yang, 2016). This state of neuro-inhibition can last for hours and even lead to long-term decline in learning motivation. Moreover, the lack of emotional support also diminishes the motivational effect of feedback, as the activation of the dopaminergic reward system (VTA-NAcc pathway) depends on positive social interactions (Schultz, 2016).

4.3 Dislocation of Time and Space Dimensions.

Missing the neural plasticity window, 85% of classroom feedback is delayed by over 48 hours (Cambridge Assessment, 2023). Cognitive science research indicates that the first 24 hours after learning is a critical window for synaptic plasticity (LTP). Delayed feedback leads to the solidification of false memories, reducing error correction efficiency by 67%. In the context of intelligent education, although AI feedback systems respond quickly, their emotional interaction capability is only 32% of that of human feedback (MIT EdTech Lab, 2023), failing to effectively activate students socio-cognitive neural networks (such as mirror neuron systems).

4.4 Insufficient Adaptability of Neurodiverse Groups.

The current feedback systems severely under-support students with neurodiversity conditions such as ADHD and autism spectrum disorder. These students typically require differentiated feedback methods (like structured prompts, multisensory input), but standardized feedback patterns often lead to overloading their prefrontal executive functions. Research indicates the anxiety levels of neurodiverse students in traditional feedback environments

5. Teacher Feedback Countermeasures to Stimulate Students' Self-efficacy

In order to solve the current dilemma, it is necessary to build a precise feedback system oriented by neuro-education, and systematically optimize it from the dimensions of content design, emotional support, technology integration and cultural adaptation.

5.1 Adopt the "Process-Strategy-Emotion" Three-Dimensional Feedback Model.

Increase the proportion of process feedback to over 70% (Hattie, 2017, effect size 0.73), and apply the STAR rule: Specific (Specific Behavior): Avoid vague evaluations (such as "good job"), instead use "You drew a diagram when solving the problem, which helped with logical organization." Technique (Strategy Value): Explain the cognitive benefits of strategies, such as "You used the analogy method, which activated the abstract reasoning area of your prefrontal cortex." Advance (Progress Path): Provide actionable improvement

suggestions, such as “Next time, try reverse thinking to verify.” Relate (Experience Connection): Relate to previous successful experiences, such as “This is similar to the problem you solved last week.” Insert reflective questions every 20 minutes (such as “What strategies did you use? Where can you optimize?”), to enhance the self-monitoring function of the prefrontal cortex.

5.2 Biofeedback Technology and Emotion Regulation Strategies.

Monitor students ‘stress levels through galvanic skin response (GSR) or heart rate variability (HRV), dynamically adjusting the feedback intensity (such as using the “sandwich feedback method” for high anxiety: affirmation + advice + encouragement). Replace “error” with “not yet mastered” (not yet) to activate students’ growth mindset neural circuits (Dweck, 2014). Incorporate empathetic expressions in feedback (e.g., “I understand this part is quite challenging”) to reduce amygdala activation.

5.3 Emotional Computing and Multimodal Feedback.

Set the emotional valence range (0.7-0.8, referring to the Russell model) to ensure that the feedback is both clear and motivating.

5.4 Reconstruct Collective Efficacy Feedback.

“Group breakthrough” rhetoric, such as “Your method provides new ideas for the group”, reduces social evaluation anxiety. Anonymous peer feedback. Reduces face pressure and promotes open discussion.

5.5 Cultivate “Cognitive Coach” Skills.

Neuroscience training. Accounts for 15% of faculty training hours, focusing on: neural mechanisms of error handling; dopamine incentive strategies; neurodiversity adaptation methods. Feedback micro-skills training. Such as “3-second wait” (giving ample thinking time after asking a question), “non-verbal reinforcement” (smiling, nodding).

6. Conclusions

The issue of teacher feedback is essentially a structural contradiction between the educational paradigm of the industrial age and the learning needs of the brain science era. The current feedback system overly relies on outcome evaluation, lacks neuroscientific basis, and overlooks individual differences, leading to low efficiency in boosting self-efficacy. Future reforms need to achieve three major shifts. From outcome evaluation to neurocognitive development, feedback should focus on the learning process and optimize prefrontal executive function. From experience-driven to evidence-based, feedback strategies should be designed based on educational neuroscience research. From a uniform model to one adapted to neural diversity, providing customized feedback for students with different cognitive styles. The application of intelligent technologies (such as affective computing and biofeedback) can enhance the precision of feedback, but the emotional warmth of human interaction remains an irreplaceable core. Teachers need to transform into cognitive coaches, optimizing feedback practices under the guidance of neuroscience. Ultimately, an efficient feedback system should reduce amygdala threat responses and decrease learning anxiety; enhance prefrontal regulatory functions and improve metacognitive abilities; activate dopamine reward circuits and strengthen learning motivation. Only by building a feedback ecosystem that aligns with brain learning principles can we truly unlock the potential of every student.

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