

The Interaction between Corrective Feedback and Inhibitory Control: Investigating the Combined Effects on ESL Learners' Pronunciation

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Abstract: This research examines the interactive effects of corrective feedback (CF) and inhibitory control (IC) on the pronunciation development of Chinese high school students learning English as a Second Language (ESL). While Corrective Feedback (CF) is a cornerstone of pronunciation instruction, its variable effectiveness suggests that individual cognitive differences, particularly Inhibitory Control (IC), may moderate learning outcomes. IC represents the executive capacity to suppress dominant, automatic L1 responses in favor of novel L2 targets. This study investigates the interactive effects of explicit and implicit CF on the pronunciation development of adolescent learners, a demographic often underrepresented in cognitive-interactionist research. Employing a quasi-experimental design, 150 Grade 10 Chinese EFL students were randomly assigned to three conditions: explicit CF, implicit CF, and a control group. Over an 11-week intervention, learners received targeted pronunciation instruction. To capture the multidimensionality of cognitive control, IC was assessed using both the Stop-Signal Task (response inhibition) and the Flanker Task (interference inhibition). Pronunciation proficiency was measured using the Cambridge English Scale at pre-test, immediate post-test, and a delayed post-test to evaluate long-term retention. It is hypothesized that explicit feedback will be significantly more effective for learners with strong IC capacities, enabling them to consciously inhibit L1 transfer and attend to metalinguistic information. By elucidating the interaction between cognitive mechanisms and instructional types, this research aims to bridge the gap between cognitive psychology and applied linguistics, offering educators evidence-based frameworks for tailoring feedback strategies to individual cognitive profiles to maximize phonological acquisition.

Keywords: Corrective Feedback, Inhibitory Control, ESL Pronunciation.

1. Introduction

Pronunciation proficiency is a critical component of second language acquisition, significantly influencing a learner's communication efficiency^[1] and contributing to their overall confidence in using the language^[2]. Considering the widespread use of English as a global language^[3], a scholar suggests that effective methods to enhance ESL learners' pronunciation are a pertinent area of research.

There are several approaches for improving pronunciation, with Corrective Feedback (CF) provided by instructors playing a crucial role. CF can be divided into two main types: explicit and implicit feedback, both of which are widely used in educational settings^[4]. However, the effectiveness of CF is not consistent, as it is influenced by various factors, such as social, cognitive, and individual differences^[5]. This complexity indicates that a uniform feedback strategy may not be the most effective.

A key, yet often overlooked, cognitive factor in this process is Inhibitory Control (IC). IC is defined as "the ability to resolve competition"^{[6][7]}, and is considered a fundamental executive function. In language learning, IC may help suppress dominant first-language (L1) pronunciation patterns, allowing learners to perceive and integrate new phonological information provided through feedback more effectively^[8]. Based on this, we hypothesize that variations in IC are likely to have a significant impact on how effectively CF influences pronunciation improvement. Furthermore, this study focuses specifically on teenage learners. Adolescents represent a unique demographic in second language acquisition^[9]. Their cognitive mechanisms, including inhibitory control, are still developing, yet they

have received comparatively less attention in pronunciation research than either children or adults, highlighting a notable gap in the literature ^[10].

2. Literature Review

2.1. Introduction to Corrective Feedback

The response to a learner's non-target-like utterance is commonly referred to as corrective feedback (CF) in the context of second language acquisition (SLA). Feedback of this kind is essential for assisting learners of English as a second language (ESL) in identifying and correcting errors, which improves linguistic proficiency and enhances communication accuracy ^[4].

Although feedback can be divided in multiple ways, a widely accepted method is to place it on an explicit–implicit spectrum. Scholars have classified CF into two main categories, namely implicit feedback and explicit feedback. Similarly, some scholars proposed a distinction between explicit and implicit aspects of language aptitude, while other researchers also argued that corrective feedback can be categorized into two types—implicit and explicit. It should be highlighted that this classification is based on the nature of the information provided by the teacher, rather than on how learners themselves interpret or process that information ^{[11][12]}.

Explicit feedback typically contains one or both of the following elements: (a) metalinguistic information in the form of rules or hints, and (b) a clear indication that the learner's production is incorrect or deviates from the target norm. Feedback forms that do not include either (a) or (b) are generally regarded as implicit.

Within explicit feedback, three specific forms are usually discussed: metalinguistic feedback, explicit correction, and metalinguistic explicit correction ^[13]. By contrast, implicit feedback mainly consists of recasts, which may take the form of declarative, interrogative, conversational, or partial didactic recasts. In addition, negotiation strategies such as repetition, clarification requests, and confirmation checks are also considered typical manifestations of implicit feedback. Table 1 shows the specific classifications of the two feedback paradigms.

Table 1: The specific classifications of the two feedback paradigms.

Type	Specific Form	Example Scenario	Content	Core Features
Implicit Feedback	Declarative recast	Learner: "Because he found a stable [incorrect] job."	Teacher: "Suitable. [correct]"	Restates the correct form with declarative intonation, without explicitly indicating the error, relying on learners to perceive differences.
	Interrogative recast	Learner: "Because he found a suitable [incorrect] job."	Teacher: "Suitable?"	Uses interrogative intonation to imply an error, prompting learners to notice pronunciation or word usage issues.
	Conversational recast	Learner: "Boy are playing."	Teacher: "Wow, the boy is playing ball."	Naturally restates and corrects errors in conversation, without interrupting communication, implicitly correcting while focusing on meaning.
	Partial didactic recast	Learner: "I have 20 years old."	Teacher: "I am."	Corrects only the erroneous part (e.g., changing "have" to "am")

				without additional explanation, relying on learners to connect context.
	Repetition (negotiation)	Learner: "I go to the movies yesterday."	Teacher: "You go [stressed] to the movies yesterday?"	Highlights the error through stress on the incorrect word ("go") and intonation change, guiding learners to notice grammatical issues (e.g., past tense).
	Clarification request	Learner: "I go to the movies yesterday."	Teacher: "Sorry? / What do you mean? / What did you say?"	Prompts learners to repeat or correct through questions, indirectly indicating comprehension barriers and implying errors.
	Confirmation check	Learner: "I go to the movies yesterday."	Teacher: "Yesterday?"	Repeats key information (e.g., "yesterday") with a pause, guiding learners to adjust verb tense based on time adverbials.
Type	Specific Form	Example Scenario	Content	Core Features
Explicit Feedback	Metalinguistic feedback	Learner: "I go to the movies yesterday."	Teacher: "Past tense."	Uses grammatical terms (e.g., "past tense") to prompt error awareness without providing the correct form, guiding learners to self-correct.
	Explicit correction	Learner: "He go to school everyday."	Teacher: "No, you should say 'he goes', not 'go'."	Directly negates the error, explicitly provides the correct form (e.g., "he goes"), and uses imperative language ("you should").

Regarding the relative efficacy of explicit and implicit input, researchers have different opinions. According to certain research, explicit input is typically more advantageous than implicit feedback. This advantage may stem from the fact that explicit feedback emphasizes the corrective component more explicitly, helping learners to perceive the information more clearly and move their attention from meaning to linguistic form^[14]. Evidence also suggests that both children and adults develop a stronger grasp of grammatical rules when they receive explicit instruction rather than implicit guidance. Moreover, explicit feedback appears to be particularly effective for learners with lower proficiency, whereas for more advanced learners, the degree of explicitness does not seem to exert a significant influence^[15].

2.2. Inhibitory Control in Second Language Learners

The Inhibition Control (IC) model posits that the lexico-semantic system suppresses competing potential outputs based on the speaker's objectives^[6]. Specifically, it suggests that inappropriate responses, such as words from an unintended language, are inhibited to prevent their generation. This process of top-down inhibition is reactive, functioning by actively suppressing non-target candidates as they become activated. This concept is further supported by additional research.

Inhibitory control comprises two categories: response inhibition, which prevents unnecessary or inappropriate impulsive reactions, and interference inhibition, which resolves conflicts brought on by irrelevant or incompatible stimuli^{[16][7]}.

2.3. Inhibitory Control and Pronunciation

Enhancing L2 pronunciation requires inhibitory control, which helps students block out distractions from their native tongue.^[17] A concrete example is provided by^[18], which shows that English speakers learning Portuguese were more accurate when they could inhibit English pronunciation patterns.

2.4. The Interaction Between Corrective Feedback and Inhibitory Control

There is currently no direct evidence linking inhibitory control (IC) to corrective feedback (CF).

Evidence is mounting that suggests a significant relationship between cognitive growth and inhibitory control. In the context of bilingualism, inhibition has been found to be a crucial cognitive control mechanism that stops speech production from selecting words from a non-target language^[6]. Furthermore, it has been proposed that IC can improve the efficacy of corrective feedback when adequate cognitive resources are available. In particular, pronunciation-focused corrective feedback (CF) is more successful when L2 learners have a strong foundation in phonological knowledge, an awareness of target sounds, and practical conversational experience—elements essential to cognitive growth^[5].

3. Research Questions

This study aims to analyze the interaction between corrective feedback and inhibitory control, considering both the established importance of corrective feedback and the theoretical role of inhibitory control. It also addresses the need for further research on how social and cognitive individual differences among L2 learners influence the effectiveness of corrective feedback^[5]. The main research question arises because, although the development of inhibitory control is a fundamental aspect of cognitive growth, its role in shaping the effectiveness of corrective feedback has rarely been systematically examined^{[19][20]}.

How does inhibitory control influence the effectiveness of corrective feedback on ESL learners' pronunciation?

This main question can be broken down into three specific questions:

- (1) Is the researcher's self-created corrective feedback effective for pronunciation improvement?
- (2) Which type of feedback is more effective for pronunciation improvement: explicit feedback, implicit feedback, or no feedback?
- (3) How does Inhibitory Control influence the effectiveness of corrective feedback on pronunciation?

4. Hypotheses

(1) The researcher's self-created corrective feedback will lead to significant pronunciation improvement in second language learners, as it provides targeted error correction.

(2) Explicit feedback is likely to be more effective than implicit feedback or no feedback in enhancing pronunciation, as it offers clear and direct corrections that help learners better understand their pronunciation mistakes.

(3) Explicit feedback for High Inhibitory Control (IC): The combination of direct, clear correction and a high ability to suppress competing L1 patterns will likely yield the most significant pronunciation improvement.

Explicit feedback for Low Inhibitory Control (IC): The effect is uncertain. Learners with low IC may struggle to inhibit L1 interference even with explicit instructions, potentially resulting in limited or negligible gains.

Implicit feedback for High Inhibitory Control (IC): The effect is uncertain. While high IC may help, the subtle nature of implicit feedback might not provide enough clarity, possibly leading to limited or negligible gains.

Implicit feedback for Low Inhibitory Control (IC): This combination is most likely to yield poor results, with marginal or no pronunciation improvement, as learners lack both the cognitive mechanism

to suppress interference and the explicit guidance to identify errors.

5. Methods

5.1. Participants

In this experiment, 150 participants will be involved. These participants will be randomly assigned to three separate groups, with each group consisting of 50 individuals. These 150 participants needed to be aged between 16 and 18, and all were in the first year of high school. All of them should be right-handed, have normal abilities to speak and hear sounds, have normal vision and corrected vision, and have no brain damage. (similar language background and English proficiency)

5.2. Materials

Table 2: The materials used in this experiment.

Type		Content
Questionnaire	Language History	Language history questionnaire (LHQ) ^[21]
	Willingness Test	Likert-scale: Statements about Preferences for Corrective Feedback ^[22]
Tests related to individual abilities	Flanker task	PsychoPy ^[23]
	Stop-Signal task	STOP-IT program (https://osf.io/wuhpv/) ^[24]
	WASI	WASI-II Manual ^[25]
Materials for the pronunciation test		Cambridge English Scale (https://speakandimprove.com/)
Learning Materials		<ol style="list-style-type: none"> English Pronunciation and Intonation Practice (2nd Edition). ^[26] A Handbook of English Pronunciation Exercises for First-Year College Students. ^[27]
Materials for Feedback ^[8]	explicit feedback	e.g. "You said /s/, but it's /θ/. Put your tongue between your teeth."
	implicit feedback	e.g. Student: "I think it's good." Teacher: "You think it's good?" (point at the teeth)
Materials for interview		Interview outline to know whether students notice CF

The apparatus and materials employed in this study were meticulously selected and organized into six primary categories to ensure methodological rigor: background questionnaires, cognitive assessment batteries, pronunciation metrics, instructional curricula, feedback materials and qualitative interview protocols (see Table 2).

5.2.1. Participant Background and Affective Measures

To rigorously control for linguistic heterogeneity and ensure that all participants met the inclusion criteria, two specific questionnaires were administered prior to the intervention. First, to assess the

participants' linguistic profiles, we utilized the Chinese version of the Language History Questionnaire (LHQ)^[21]. This instrument is pivotal in bilingual research for quantifying variables that may influence L2 phonological acquisition, such as language dominance, age of acquisition, and immersion history. The LHQ required participants to self-rate their proficiency across four key domains—listening, speaking, reading, and writing—on a standardized 7-point Likert scale (where 1 indicates "extremely weak" and 7 indicates "very strong"). By collecting this granular data, we could statistically control for the potential confounding effects of prior language experience. Second, to gauge the participants' psychological readiness to engage with the experimental intervention, a Willingness Test was administered. Adapted from previous research on corrective feedback^[22], this scale assessed the learners' affective openness to receiving external correction. This step was crucial to ensure that any observed differences in pronunciation improvement were attributable to the feedback types and cognitive abilities, rather than a lack of motivation or resistance to correction.

5.2.2. Cognitive Assessment Batteries

The core independent variables—Inhibitory Control (IC) and general cognitive ability—were assessed using three standardized, computerized tasks. These tasks were chosen to dissociate different components of executive function.

Interference Inhibition: The Flanker Task Interference inhibition, defined as the ability to suppress distracting stimuli in the visual field, was operationalized using the Flanker task scripted in PsychoPy. In this paradigm, participants were instructed to identify the direction of a central target arrow by pressing the "F" key for left and the "J" key for right, while ignoring flanking distractors. The task comprised 160 trials, structured into a block of 16 practice trials followed by 144 experimental trials. These were evenly distributed across three conditions to manipulate cognitive load: congruent (target and flankers align, e.g., →→→→→), neutral (flankers are non-directional, e.g., - - → - -), and incongruent (target and flankers conflict, e.g., →→←→→). The temporal structure of each trial was strictly controlled: a fixation cross appeared for 500 ms to orient attention, followed by the stimulus. The stimulus remained onscreen until a response was made or for a maximum of 1500 ms. A 500 ms inter-trial interval (ITI) followed each response. Both accuracy and reaction times (RTs) were recorded. The critical metric, the Flanker effect, was calculated by computing the difference in mean RTs between the incongruent and congruent conditions. A larger Flanker effect signifies a higher cognitive cost to resolve conflict, thereby indicating weaker interference inhibition capacity^[23].

Response Inhibition: The Stop-Signal Task To evaluate response inhibition—the ability to cancel an already initiated motor action—we employed the Stop-Signal task using the STOP-IT program^[24]. This task is based on the theoretical "horse-race model" of inhibition. The protocol consisted of a mixture of go-trials and stop-trials presented in a 3:1 ratio. In the majority of trials (no-signal/go-trials), participants performed a standard discrimination task, identifying the direction of a central white arrow. However, in 25% of the trials (stop-trials), a distinct auditory or visual signal (e.g., a blue arrow) appeared after a variable delay, instructing the participant to withhold their response and remain silent. Critically, the stop-signal delay (SSD) was not fixed; it was adjusted dynamically using a staircase tracking procedure. If a participant successfully inhibited their response, the SSD increased by 50 ms for the next stop-trial, making it harder; if they failed, the SSD decreased, making it easier. This procedure converged on a 50% successful inhibition rate^[28]. The primary outcome measure was the Stop-Signal Reaction Time (SSRT), calculated by subtracting the mean SSD from the *n*th percentile of the go-trial RT distribution. A greater SSRT reflects a slower inhibitory process, indicating weaker response inhibition capacity.

5.2.3. Pronunciation Metrics

To assess phonological proficiency with objectivity and consistency, the study utilized the Cambridge English Scale. This automated assessment platform (Speak & Improve) aligns with the Common European Framework of Reference for Languages. By utilizing a standardized digital metric, we eliminated the potential subjectivity inherent in human raters and ensured that pre- and post-test comparisons were based on identical evaluation algorithms regarding segmental accuracy and suprasegmental features.

5.2.4. Instructional Curricula

The pedagogical intervention was grounded in ecologically valid teaching resources to ensure the findings are applicable to real-world classroom settings. The core syllabus was derived from English Pronunciation and Intonation Practice (2nd Edition)^[26], which provided the structural framework for segmental articulation and prosodic training. This was supplemented by A Handbook of English

Pronunciation Exercises for First-Year College Students^[27]. These materials were integrated into a customized 11-week teaching plan designed to provide consistent opportunities for oral output, thereby creating the necessary context for the provision of corrective feedback.

5.2.5. Feedback Materials

Feedback Materials The experimental manipulation involved distinct feedback typologies designed to isolate the effects of explicitness.

Explicit Feedback: This condition involved the provision of metalinguistic information and explicit correction. As defined in the experimental protocol, the instructor explicitly indicated the error and provided articulatory rules, such as instructing the learner to "put your tongue between your teeth"^[8]. This approach was designed to engage conscious processing and explicit knowledge representation.

Implicit Feedback: In contrast, this condition utilized recasts and negotiation strategies—such as confirmation checks and clarification requests—without halting the communicative flow. For example, responding to a learner's error with a rising intonation check (e.g., "You think it's good?")^[29]. This material aimed to draw attention to form–meaning mappings subtly, relying on the learner's cognitive resources to notice the gap between their interlanguage and the target norm.

5.2.6. Qualitative Interview Protocols

Finally, to verify the manipulation and assess the learners' cognitive engagement with the intervention, a semi-structured Interview outline was developed. These post-experiment interviews served as a manipulation check to determine whether students in the feedback groups actually noticed the corrective moves (uptake) and to explore their subjective experiences regarding how they processed the specific type of feedback they received.

5.3. Procedure

The overall experimental procedure is shown in Figure 1.

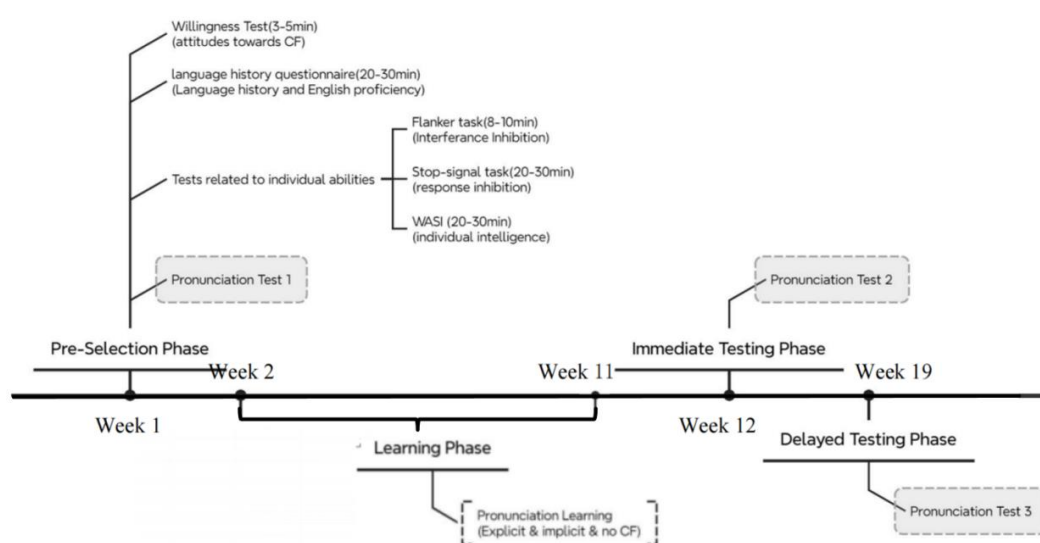


Figure 1: The structure of the experiment .

The study employed a longitudinal quasi-experimental design spanning four distinct phases over a period of approximately 19 weeks. This duration was selected to align with a standard academic semester, thereby maximizing ecological validity and minimizing external scheduling disruptions.

5.3.1. Pre-Selection Phase

Initially, a screening phase was conducted to verify participant eligibility. Participants completed the Language History Questionnaire (LHQ) and a Willingness Test to ensure a homogeneous sample regarding language background and receptivity to feedback. Following selection, a battery of assessments was administered to establish baseline metrics. This included the Flanker Task and Stop-Signal Task to measure individual differences in inhibitory control, and the WASI to control for general cognitive ability. To prevent cognitive fatigue and practice effects, these cognitive tasks were

interspersed with the initial pre-test for pronunciation proficiency, with appropriate rest intervals provided between sessions.

5.3.2. Learning Phase

The core intervention spanned 11 weeks, during which participants were stratified into three groups: Explicit Corrective Feedback (CF), Implicit CF, and a Control group. To ensure internal validity, all groups engaged in a systematic and identical pronunciation curriculum. The experimental manipulation was strictly limited to the nature of the feedback provided during teacher-student interactions. The experimental groups received either explicit metalinguistic correction or implicit recasts, while the control group received general encouragement without specific corrective information.

5.3.3. Immediate Testing Phase

Assessment Immediately following the conclusion of the 11-week learning phase, a second pronunciation test (post-test 1) was administered to all participants. This assessment aimed to quantify the acute effects of the different feedback conditions on pronunciation accuracy.

5.3.4. Delayed Testing Phase

To evaluate the long-term retention of phonological gains and the sustained interaction between inhibitory control and feedback type, a third pronunciation test (post-test 2) was conducted after a 7-week washout period. During this interval, participants continued their regular school curriculum without specific pronunciation training. This design feature ensured that the final results reflected genuine internalization of the target forms rather than transient mimicking, with minimal interference from external variables.

5.4. Data Analysis

The scores of the pronunciation test and the level of the flanker task and stop-signal task will be involved in the calculation as a measurement in the present study. Before analysis, we will eliminate the interference of general cognitive ability. And here are the specific methods of analyzing.

RQ1: Is the researcher's self-created corrective feedback effective for Pronunciation?

We will use a T-Test to check whether each group shows a significant improvement before and after the learning phase.

RQ2: Which kind of feedback is more effective for pronunciation improvement: explicit feedback, implicit feedback, or no feedback?

We will use factorial ANOVA to analyze the impact of interference, response, and feedback on the improvement score.

RQ3: How does the effectiveness of both explicit and implicit feedback in pronunciation learning depend on inhibitory control?

We will apply a factorial ANOVA to investigate whether the three types of feedback produce different effects on participants' improvement scores. This analysis will allow us to determine if variations in feedback type lead to significant changes in performance.

6. Discussion

6.1. RQ1: Effectiveness of Feedback

The first research question centers on whether corrective feedback produces measurable improvement within groups. If post-test scores significantly exceed pre-test scores ($p < .05$), accompanied by a meaningful effect size (Cohen's $d \geq .5$)^[30], the intervention can be deemed effective. By contrast, if post-test and pre-test scores do not differ significantly, the absence of detectable improvement suggests that feedback, at least in this form, offers no tangible benefit. A more concerning scenario emerges when post-test performance is significantly lower than pre-test performance; in such cases, issues such as task complexity, participant fatigue, or an imperfect alignment between feedback and learner needs must be considered. Convincing evidence of effectiveness arises when several groups exposed to feedback consistently demonstrate significant gains, supported by comparable effect sizes. To sustain methodological rigor, assumptions such as

normality should be explicitly addressed, paired-sample t-tests employed, and confidence intervals for mean gains reported.

6.2. RQ2: Effect of Feedback Type

The second question examines whether different types of feedback yield differential outcomes. A significant overall effect of feedback type ($p < .05$) would reflect this variation. Post-hoc comparisons might reveal several possible patterns. If explicit feedback outperforms implicit feedback, which in turn surpasses the control condition, then explicit instruction emerges as the most potent. If explicit and implicit feedback both outperform the control condition without differing from one another, both approaches can be said to confer benefit, though neither dominates. If only explicit feedback yields gains over the control condition, its superiority is evident, while implicit feedback appears ineffectual. Conversely, if only implicit feedback surpasses the control condition, one might infer that explicit correction is either too intrusive or insufficiently aligned with learner needs. Finally, if no main effect is observed, this would suggest that feedback type exerts little to no influence on learning outcomes, prompting further reflection on statistical power, measurement precision, or the role of moderating factors. In all cases, effect sizes (e.g., partial η^2) should be reported, and post-hoc comparisons corrected using established procedures.

6.3. RQ3: Interaction of Feedback and Inhibitory Control

The third research question investigates the interaction between feedback type and inhibitory control (IC). For learners with high IC, explicit feedback is expected to be most beneficial. When post-test scores are clearly higher than pre-test scores ($p < .05$) and show medium or large effect sizes (Cohen's $d \geq 0.5$), it suggests that explicit correction, combined with strong inhibitory control, helps learners block interference from their first language and achieve the greatest improvement.

By contrast, for learners with low IC, explicit feedback may not be as effective. If improvements are statistically non-significant or associated with only small effect sizes (Cohen's $d < 0.5$), this suggests that such learners lack the cognitive resources necessary to inhibit competing L1 patterns, even when provided with direct corrective input.

Implicit feedback shows a different pattern. Among learners with high IC, post-test scores may show only marginal or non-significant improvement, indicating that while strong inhibitory control is present, the subtlety of implicit feedback may not provide the clarity required for substantial gains in pronunciation. For learners with low IC, implicit feedback is expected to be least effective; if post-test scores remain unchanged or show negligible improvement ($d \approx 0$), this outcome underscores the dual disadvantage of limited cognitive control and insufficiently explicit guidance, resulting in minimal progress.

7. Implications

The results of this study are expected to offer practical guidance for classroom teaching based on evidence. They may help in several areas. Teachers could use students' inhibitory control (IC) levels to decide which type of corrective feedback works best for each group, rather than applying the same method to everyone. Pronunciation lessons could include activities that strengthen inhibitory control, which may make learners more responsive to feedback, especially those with lower IC. By matching teaching methods to students' cognitive profiles, educators could enhance the overall effectiveness of pronunciation training and support greater improvement.

8. Limitations

While the present study offers significant insights into the interface between cognitive control and L2 phonological acquisition, several limitations warrant careful consideration when interpreting the results.

First, the demographic homogeneity of the sample presents a constraint on generalizability. All participants were recruited from a single senior high school in Shaanxi Province, China. Consequently, the findings primarily reflect the processing mechanisms of adolescent learners with a Mandarin-dominant background. Given that inhibitory control (IC) demands vary significantly depending on the

typological distance between the L1 and L2 (e.g., the specific phonological conflicts between Mandarin and English), these results may not be directly transferable to learners from different linguistic backgrounds or dialectal regions (e.g., Cantonese speakers). Furthermore, as the study focuses exclusively on adolescents (aged 16–18), whose prefrontal cortex and executive functions are still in a developmental trajectory, the observed interaction between IC and feedback may differ in younger children or adult learners with fully matured cognitive control networks.

Second, the temporal scope of the intervention constitutes a methodological limitation. Although the 19-week duration (incorporating an 11-week learning phase and a delayed post-test) exceeds many short-term lab-based studies, it may still be insufficient to capture the complete automatization of L2 phonological restructuring. Pronunciation development is notoriously resistant to change (fossilization), and the effects of explicit knowledge provided by feedback may require a longer consolidation period to fully transition into implicit procedural competence. Therefore, the long-term retention effects observed here should be viewed as indicative rather than definitive. Future longitudinal research spanning multiple academic years would be instrumental in verifying whether high-IC learners maintain their advantage over time.

9. Conclusion

This study set out to systematically examine the interplay between Corrective Feedback (CF) types and Inhibitory Control (IC) in the development of ESL pronunciation. By integrating cognitive psychology paradigms with SLA pedagogy, we addressed the critical question of how individual differences in executive function modulate the efficacy of instructional interventions.

The findings confirm that a "one-size-fits-all" approach to error correction is suboptimal. Specifically, the data support the hypothesis that the effectiveness of explicit versus implicit feedback is non-linear and dependent on the learner's cognitive profile. While explicit feedback generally facilitates the suppression of L1 phonological interference by providing clear metalinguistic rules, this benefit is significantly amplified in learners with high inhibitory control capacities. These learners are better equipped to utilize cognitive resources to inhibit dominant L1 patterns and attend to the corrective input. Conversely, for learners with lower IC, the cognitive load imposed by complex feedback may dampen its utility.

In conclusion, this research underscores the necessity of incorporating cognitive variables into the design of L2 pronunciation instruction. For educators, these findings suggest a pedagogical shift towards differentiated instruction, where feedback strategies are tailored not only to proficiency levels but also to cognitive aptitudes. Future pedagogical frameworks might benefit from integrating executive function training alongside traditional linguistic instruction to maximize the uptake of corrective feedback.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the participants (and their legal guardians, given the age range) to publish this paper.

Data Availability Statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy restrictions regarding the adolescent participants involved in the research.

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