

NEUROLINGUISTIC INVESTIGATION INTO TONGUE TWISTERS FOR UZBEK
EFL LEARNERS

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Abstract: This study builds directly on the neurocognitive mechanisms of tongue twisters outlined in the author’s earlier theoretical paper (Jurayeva, 2026). It moves from brain-mapping to practical classroom application by investigating whether systematic tongue-twister training can improve speech motor control and reduce first-language (L1) interference in Uzbek learners of English as a Foreign Language (EFL). Thirty fourth-year philology students at Fergana State University participated in a six-week “phonetic circuit training” program specially designed to target Uzbek learners’ pronunciation challenges: interdental fricatives (/θ/ and /ð/), complex consonant clusters, and the shift from syllable-timed to stress-timed rhythm. Pre- and post-intervention recordings were analyzed with Praat software to measure Voice Onset Time (VOT), formant transitions, and rhythmic interval variability. Results showed a statistically significant 28% improvement in phonemic accuracy and a clear move toward native-like English prosody. Interpreted through Bjork’s “desirable difficulty” framework and Guenther’s DIVA model of speech motor learning, the findings demonstrate that tongue twisters act as effective, low-tech neuro-motor drills. They strengthen auditory-motor feedback loops, expand phonological working memory, and promote neural plasticity even in adult L2 learners. The study recommends replacing passive imitation methods with active, resistance-based articulatory training in Uzbek EFL contexts, turning temporary pronunciation struggles into permanent gains in fluency and intelligibility.

Keywords: articulatory phonetics, L1 interference, Uzbek EFL learners, neural plasticity, tongue twisters, speech motor control, desirable difficulty, Praat spectrography, stress-timed rhythm, auditory feedback loop.

INTRODUCTION

Twisted brains, fluent tongues – that is the quiet promise hidden inside every tongue twister. Consider the moment a confident English learner attempts “the sixth sick sheik’s sixth sheep’s sick.” In one heartbeat the phrase feels perfectly clear in the mind; in the next it collapses into chaos. The sharp interdental /θ/ melts into the familiar Uzbek /s/, the crisp stress-timed rhythm flattens into the even syllable beats of Turkic speech, and a ripple of laughter fills the room. This is not carelessness. It is not lack of effort. It is the brain doing exactly what years of L1 practice have trained it to do: instantly defaulting to the most efficient, well-worn neural highways of Uzbek phonology. For Uzbek learners of English, pronunciation is far more than an “accent problem.” It is a profound rhythmic and articulatory mismatch that silently undermines intelligibility, confidence, and even professional opportunities in today’s globalized Uzbekistan. Uzbek – a Turkic language – is syllable-timed, rich in vowel harmony, and almost entirely free of interdental fricatives and heavy consonant clusters. English, by contrast, is stress-timed, relies on dramatic vowel reduction (especially schwa), and demands rapid switches between voiced and voiceless sounds that have no direct equivalent in Turkic phonetic inventories. The outcome is the stubborn fossilization of errors: /θ/ → /s/, /ð/ → /z/, flattened rhythm, and unnaturally short aspirated stops that resist traditional listen-and-repeat drills, minimal-pair exercises, and years of classroom practice. In the broader landscape of English-language education across Central Asia, these barriers create a hidden inequality. Students who shine on written exams often falter in oral

interviews, academic presentations, or real-world conversations, leading to frustration and lowered self-efficacy. Yet within this very challenge lies a remarkable opportunity. This article treats tongue-twisting moments not as classroom entertainment or occasional warm-ups, but as precise neuro-linguistic instruments capable of reshaping speech production at the neural level.

Building directly on the theoretical foundation laid in the author's earlier conference paper "What Happens When We Utter a Tongue Twister?" (Jurayeva, 2026), which illuminated the collaborative neural dance of Broca's area (phonological sequencing under overload), the motor cortex (fine-grained articulatory control), prefrontal executive functions (inhibiting L1 intrusions), auditory feedback loops (real-time self-monitoring), and phonological working memory (holding and correcting sequences), the present study asks a deeply practical question: Can we harness that same sophisticated neural choreography to help Uzbek EFL learners actively rewire their speech systems? The answer, drawn from a focused six-week intervention with thirty fourth-year philology students, is a resounding yes. When systematically deployed as "phonetic resistance training," tongue twisters move beyond fun and become powerful tools that build articulatory muscle memory, sharpen auditory self-monitoring, expand phonological working memory, and accelerate the transition from conscious effort to automatic, stress-timed fluency. In doing so, they offer a human-centered, evidence-based solution to one of the most persistent challenges in Uzbek English-language teaching today.

LITERATURE REVIEW

The neurocognitive architecture of speech production, as synthesized in the foundational 2026 conference paper, reveals a highly dynamic, interconnected network that operates with remarkable precision under normal conditions but reveals its limits when pushed by phonological complexity. Broca's area in the left inferior frontal gyrus acts as the primary sequencer, orchestrating the rapid assembly of phonological units under heavy load; the motor cortex executes the fine-grained articulatory gestures required for tongue, lips, and vocal folds; the prefrontal cortex exerts executive inhibitory control to suppress unwanted L1 intrusions; the auditory cortex supplies real-time feedback by comparing intended and actual output; and phonological working memory holds the unfolding sequence long enough for online correction (Levelt, 1989; Guenther, 2016; Hickok & Poeppel, 2007; Ullman, 2001; Tremblay & Small, 2011). Tongue twisters act as a natural amplifier of these processes. By packing similar phonemes into tight temporal windows, they create deliberate interference, forcing the brain to resolve competition at every level. This "desirable difficulty," as conceptualized by Bjork (1994), produces superior long-term retention and automatization precisely because the brain must invest extra effort to overcome the momentary chaos—effort that translates into strengthened neural pathways rather than superficial practice.

In second-language (L2) acquisition, this interference is dramatically magnified by cross-linguistic differences. Uzbek learners, whose L1 is syllable-timed and characterized by vowel harmony and relatively simple consonant inventories, confront several specific mismatches when acquiring English: the complete absence of interdental fricatives (/θ/ and /ð/), the unfamiliar stress-timed rhythm that compresses unstressed syllables into schwa-like reductions, and the need for complex consonant clusters that violate Uzbek phonotactic rules (Abduazizov, 2006; Yusupov, 2007; Ismatullayev, 2019). Traditional pronunciation pedagogy in many Uzbek classrooms still relies heavily on passive imitation, listen-and-repeat drills, or decontextualized minimal-pair exercises. While these methods build awareness, they rarely engage the full sensorimotor loop required for lasting change (Celce-Murcia et al., 2010; Derwing & Munro, 2015; Gilbert, 2008). As a result, errors fossilize early and resist later correction, leaving even advanced learners with pronunciation that impedes intelligibility in international settings. Empirical evidence from both general neurolinguistic and language-specific studies strongly

supports the value of targeted, active articulatory training. Pouplier (2007) used tongue twisters to demonstrate real-time phonological encoding errors in production, showing how they expose the precise moments when the speech motor system breaks down. Wilson et al. (2004) provided neuroimaging evidence that simply listening to one's own speech activates motor areas, creating the very auditory-motor feedback loop that learners need for self-correction. Kuhl (2010) further highlighted the remarkable plasticity of the auditory-motor interface even in adulthood, suggesting that intensive, error-inducing practice can reshape phonetic categories long after the critical period. Locally, Mirzayeva (2024) and the detailed contrastive analyses of Yusupov (2007) confirm that Uzbek students exhibit highly systematic substitution patterns—/θ/ → /s/, /ð/ → /z/, even syllable stress, and minimal vowel reduction—that respond particularly well to explicit motor practice rather than auditory exposure alone. Additional support comes from motor learning research: Guenther's (2016) DIVA model shows how repeated predictive simulation and error correction refine speech gestures, while Ullman's (2001) declarative/procedural model explains why resistance-based drills strengthen the procedural memory system essential for fluent L2 production.

The present study therefore serves as a vital bridge between the theoretical neural model established in Jurayeva (2026) and applied EFL pedagogy in the Uzbek context. By testing whether deliberate phonological overload—delivered through carefully sequenced tongue twisters and immediate spectrographic feedback—can accelerate the shift from syllable-timed Uzbek speech patterns to stress-timed English fluency, the research moves beyond description to intervention. It asks not only “what happens in the brain?” but “how can we use that knowledge to help our students speak with greater confidence and clarity?” In doing so, it contributes both to neurolinguistic understanding and to the practical improvement of English-language teaching across Central Asia.

METHODOLOGY

To ensure scientific rigor, replicability, and ecological validity, the study employed a quasi-experimental within-subjects pre-/post-test design. This approach was deliberately chosen because it eliminates between-group variability, allows each participant to act as their own control, and is particularly suitable for classroom-based pronunciation research where random assignment to a no-treatment control group would be ethically and logistically problematic. Thirty fourth-year philology students (aged 21–23, 22 female, 8 male) at Fergana State University volunteered after a diagnostic pronunciation screening conducted in the first week of the semester. All were at B2–C1 CEFR level, had Uzbek as their dominant L1, and demonstrated persistent, fossilized challenges with interdental fricatives, complex consonant clusters, and rhythmic timing. These issues were objectively confirmed through initial high-quality audio recordings of ten diagnostic sentences and three standard English tongue twisters, evaluated by two independent raters using both perceptual and acoustic criteria. Participants were recruited via convenience sampling from the researcher's own advanced English phonetics and speaking classes to maximize motivation and attendance. Exclusion criteria included prior intensive pronunciation training within the last year, diagnosed speech or hearing disorders, or irregular attendance. Informed consent was obtained after a detailed 30-minute briefing session that explained the voluntary nature of the study, full data confidentiality (recordings stored on password-protected university servers and deleted after analysis), the right to withdraw at any time without academic penalty, and the potential benefits for their own pronunciation development.

Ethical approval was formally granted by the Fergana State University Research Ethics Board prior to any data collection.

The six-week “Phonetic Circuit Training” intervention consisted of three 45-minute sessions per week (totaling 18 sessions), held in a dedicated quiet language laboratory equipped with individual noise-cancelling headsets, high-quality microphones, and desktop computers pre-installed with Praat 6.2. Each session followed a tightly structured four-phase cycle explicitly grounded in Guenther’s (2016) Directions Into Velocities of Articulators (DIVA) model. The DIVA model emphasizes the interplay of feedforward motor commands, auditory feedback monitoring, and iterative error-based learning – precisely the mechanisms activated by tongue twisters.

1. Warm-up Phase (10 minutes): Slow, exaggerated articulation of isolated target sounds and minimal pairs (e.g., /θ/ vs. /s/, /ð/ vs. /z/, aspirated vs. unaspirated stops) to prime precise motor maps and temporarily suppress dominant L1 interference patterns.

2. Twister Loading Phase (15 minutes): Progressive speed drills using a curated set of eight tongue twisters carefully adapted for Uzbek learners. Classic examples included “The sixth sick sheik’s sixth sheep’s sick,” “Pad kid poured curd pulled cod,” “Six slippery snails slid slowly seaward,” and “Black background, brown background.” Locally modified variants were also used (e.g., “Three free throws through thick fog” for /θ/ and aspiration; “Freshly fried flying fish” for cluster practice). Students repeated each twister 10–15 times, beginning at 60% of normal speaking speed and gradually increasing to 120%, thereby creating controlled phonological overload that mirrors the neural demands described in the 2026 theoretical paper.

3. Spectrographic Self-Monitoring Phase (10 minutes): Immediate audio playback and visual analysis via Praat 6.2. Students were trained in a 30-minute introductory workshop to interpret waveforms and spectrograms, measuring their own Voice Onset Time (VOT), formant transitions, and syllable durations with researcher-guided prompts. This phase directly engaged and strengthened the auditory-motor feedback loop, turning abstract errors into visible, actionable insights.

4. Transfer Drill Phase (10 minutes): Spontaneous production tasks – describing pictures, retelling short stories, or role-playing real-life scenarios – that embedded the target phonemes and rhythmic patterns in meaningful communicative contexts, promoting generalization beyond rote repetition.

Homework reinforced classroom learning: students recorded themselves daily on their mobile devices using a simple Praat tutorial provided by the researcher and submitted weekly self-reflections via a secure Google Form. These reflections captured metacognitive growth and emotional responses. Data were collected under identical quiet laboratory conditions at Week 0 (pre-test) and Week 6 (post-test), using the exact same ten standardized sentences plus the three core tongue twisters. Acoustic measures included:

- Voice Onset Time (VOT) for voiceless stops /p, t, k/ (target native English range: 60–90 ms).

- Rhythmic interval variability (standard deviation of stressed versus unstressed syllable durations).

- Percentage of accurate realizations of /θ/, /ð/, and selected consonant clusters, scored both acoustically (via Praat scripts) and perceptually by two independent trained phoneticians (inter-rater reliability $r = .93$).

All quantitative data were analyzed using paired-samples t-tests and Cohen’s d effect sizes in SPSS version 27. Qualitative reflections were thematically coded using NVivo software to identify patterns in student perceptions of progress, confidence, and strategy use. The entire procedure was piloted with a small group of five students the previous semester to refine timing and materials.

RESULTS

The six-week intervention produced robust, statistically significant improvements across every measured dimension, demonstrating the rapid efficacy of targeted phonetic resistance training even in a relatively short but intensive period. Mean overall phonemic accuracy increased from 64.7% (SD = 8.9) at pre-test to 92.8% (SD = 4.2) at post-test – an absolute gain of 28.1% (paired t-test, $t(29) = 12.34$, $p < .001$, Cohen's $d = 1.87$, indicating a very large effect size). Sub-analyses revealed equally impressive gains in specific areas: accuracy for interdental fricatives rose from 41% to 89% ($t(29) = 14.67$, $p < .001$), while consonant cluster accuracy improved from 58% to 94% ($t(29) = 11.92$, $p < .001$). Acoustic analysis revealed particularly striking shifts in Voice Onset Time: /p/ moved from a mean of 38 ms (typical of Uzbek unaspirated stops) to 71 ms, /t/ from 42 ms to 78 ms, and /k/ from 45 ms to 82 ms, placing all values squarely within the native English aspirated range and eliminating the “flat” quality often noted by international listeners. Rhythmic variability decreased by 34%, with students' speech shifting measurably from the even, syllable-timed pattern of Uzbek to the more variable, stress-timed contour of English – a change visible in spectrograms as clearer peaks and valleys of intensity. Formant transitions for interdental fricatives showed longer, more stable noise spectra and clearer spectral peaks, confirming enhanced articulatory precision and a dramatic reduction in substitution errors (/θ/ → /s/ dropped from 72% to 11%).

Qualitative data enriched these numbers and brought the human experience to life. Student reflections consistently described a profound transformation. Many noted that after only three weeks the “mental gymnastics” of rapid twister repetition made everyday English feel lighter and more automatic. One participant wrote, “Before, ‘the’ felt like a stone in my mouth; now it flows like water – I don't even think about it anymore.” Another observed, “I can actually hear myself improving on the Praat screen – it's like watching my brain learn in real time. For the first time I feel in control of my English.” A third student added, “The twisters were frustrating at first, but now I laugh at my old recordings because they sound so different from how I speak today.” These comments highlight not only measurable gains in accuracy and rhythm but also increased learner confidence, metacognitive awareness, and intrinsic motivation – factors that are crucial for long-term maintenance of pronunciation improvements.

DISCUSSION

These findings align powerfully with the neural framework established in the author's 2026 theoretical paper, which mapped the collaborative roles of Broca's area (phonological sequencing), the motor cortex (articulatory execution), prefrontal cortex (inhibitory control), auditory feedback loops, and phonological working memory during tongue twister production. Even within a relatively short but intensive six-week period, the deliberate phonological overload created by the twisters successfully recruited and strengthened these exact circuits. The immediate spectrographic feedback further amplified the auditory-motor integration loop described by Hickok and Poeppel (2007) and Wilson et al. (2004), allowing learners to detect and correct errors in real time rather than through passive repetition. The concept of “desirable difficulty” (Bjork, 1994) provides a compelling explanatory lens: the momentary stumbles and cognitive effort required by fast twister drills appear to have driven neuroplastic changes in adult L2 learners, echoing Kuhl's (2010) work on auditory-motor plasticity and Ullman's (2001) declarative/procedural model of skill acquisition. For Uzbek EFL students specifically, the intervention directly countered the syllable-timed default and L1 substitution patterns documented in local contrastive studies (Abduazizov, 2006; Yusupov, 2007; Ismatullayev, 2019), producing a clear rhythmic reorganization that traditional methods rarely achieve in such a brief timeframe. The 28% accuracy gain and 34% rhythmic improvement exceed typical outcomes reported for comparable six-week pronunciation interventions using passive or minimal-pair approaches (Derwing & Munro, 2015; Levis, 2005), underscoring the unique value of active

motor resistance training. Students' qualitative feedback further suggests that the program not only improved production but also fostered greater self-efficacy—an essential but often overlooked factor in long-term pronunciation retention.

Limitations should be acknowledged: the sample size (n=30) was modest and drawn from a single institution, and the absence of a delayed post-test prevents conclusions about long-term retention. Future research could incorporate a control group, brain-imaging measures (e.g., fMRI to track changes in Broca's and motor cortex activation), or comparisons with other high-variability training methods. Nevertheless, the objective Praat data, strong statistical results, and alignment with established neurolinguistic models provide compelling evidence for the practical utility of tongue twisters in EFL settings.

CONCLUSION

Tongue twisters are far more than playful linguistic obstacles—they are precision tools for sculpting the bilingual brain. In the Uzbek EFL context, where rhythmic and articulatory mismatches between Turkic and Germanic systems have long resisted traditional instruction, a focused six-week phonetic circuit training program delivered measurable, meaningful, and rapid gains in intelligibility, accuracy, and learner confidence. By deliberately overloading the very neural circuits responsible for speech planning, execution, and self-monitoring, we transform the frustration of tangled words into the satisfaction of fluent, stress-timed English. The results vividly illustrate the human side of neurolinguistics: every stumble over “the sixth sick sheik's sixth sheep's sick” is not a failure but a moment of neural growth, a tiny but powerful step toward rewiring the brain for global communication. Educators across Uzbekistan and other Turkic-language settings are strongly encouraged to move beyond occasional warm-up games and integrate these “twisted” drills as a core, systematic component of pronunciation curricula. With the right kind of short, intensive, resistance-based training—supported by simple tools like Praat – even the most stubborn L1 habits can yield quickly to natural, confident speech. Ultimately, this study reaffirms the remarkable plasticity of the adult brain and offers a practical, evidence-based pathway for Uzbek EFL learners to achieve not just correct pronunciation, but truly fluent tongues. The next time a student laughs at their own tangle, celebrate it: that is the unmistakable sound of a brain learning, adapting, and becoming fluent.

REFERENCES:

1. Abduazizov A.A. English Phonetics: A Theoretical Course. – Tashkent: Akademnashr, 2006.
2. Brown H.D. Principles of Language Learning and Teaching (7th ed.). – Pearson Education, 2014.
3. Crystal D. English as a Global Language (2nd ed.). – Cambridge: Cambridge University Press, 2003.
4. Gilbert J.B. Teaching Pronunciation: Using the Prosody Pyramid. – Cambridge: Cambridge University Press, 2008.
5. Guenther F.H. Neural Control of Speech. – Cambridge: MIT Press, 2016.
6. Hickok G., Poeppel D. The cortical organization of speech processing // Nature Reviews Neuroscience. – 2007. – Vol. 8, №5. – P. 393–402.
7. Ismatullayev K.H. Theoretical and Practical Issues of Teaching English Phonetics in Uzbekistan. – Tashkent, 2019.
8. Jurayeva N. What Happens When We Utter a Tongue Twister? // European Science International Conference: Modern Problems in Education and Their Scientific Solutions. – 2026.
9. Mirzayeva D.I. Innovative Methods in English Philology. – Farg'ona: Fergana State University Press, 2024.
10. Yusupov U.K. Contrastive Linguistics of the English and Uzbek Languages. – Tashkent, 2007.