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The Cognitive Programming Paradigm: Dismantling Mental Translation and GenAI Dependency through Oral Defence in ELT Classrooms

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Abstract

This research investigates the profound impact of L1 syntactic interference on L2 English acquisition and the subsequent technological cognitive surrender among L2 leaners in remote West Bengal. Existing English Language Teaching methodologies often overlook the localized structural friction between native Bengali Subject-Object-Verb and English Subject-Verb-Object architectures, inadvertently fostering a systemic mental translation effect. This study addresses the crucial research gap regarding how this unresolved syntactic deficit drives students to outsource cognitive agency, shifting from self-reliance to unmonitored GenAI dependency. Grounded in generative syntax and cognitive load theory, this paper proposes a transformative, bottom-up algorithmic scaffolding framework. By systematically programming English morphology—initiating with isolated verbs and scaling to complex sentential sequences—the intervention circumvents mental translation. Furthermore, the methodology implements a strict, GenAI-free live articulation defence to empirically verify L2 syntactic acquisition. This metacognitive reflection forces learners to reclaim absolute human cognitive agency, bridging the gap by transitioning GenAI from an instrument of cognitive atrophy into an assimilated assistive tool.

Keywords : *Syntax, Translation, GenAI, Scaffolding, Metacognition*

1. Introduction

The acquisition of English as a Second Language (ESL) within the complex, multilingual demography of Indian Higher Education Institutions (HEI), particularly within the remote and semi-urban geographies of West Bengal, presents a multifaceted and deeply entrenched pedagogical challenge (Krashen, 1982; Ellis, 1997; Bhattacharya, 2013, 2017; Meganathan, 2011). While formal English language instruction is systematically introduced at the foundational primary educational tier—frequently commencing from the first grade—the longitudinal academic progression of these learners rarely correlates with a commensurate acquisition of functional, communicative competence (Canale & Swain, 1980; Cummins & Swain, 1986; Crookes, 1990). Despite sustained exposure over a decade or more of formal schooling, a significant proportion of learners situated in these geographical peripheries continue to perceive the English language not as a dynamic communicative medium, but as an insurmountable, abstract academic obstacle.

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For these non-native speakers, the surrounding linguistic environment is inherently heteroglossic, characterized by a complex, fluid interplay of Bengali, Hindi, and English lexicons (Bakhtin, 1981; Wardhaugh & Fuller, 2015). Within this specific socio-linguistic matrix, the operational mechanics and underlying logic of the target English language remain fundamentally opaque. Consequently, learners are default to compensatory academic survival strategies overwhelmingly. These strategies are primarily characterized by the rote memorization of prescriptive grammatical rules, the mechanical and contextless execution of voice and narration transformations, and the rigid reproduction of static writing paradigms, such as paragraph construction and letter drafting. This systemic reliance on memorization over genuine comprehension signals a significant, structural disconnect in the teaching-learning continuum, leaning heavily on conscious 'learning' rather than organic 'acquisition' (Krashen, 1982). It heavily suggests that the foundational architecture of the target language has never been cognitively internalized by the students through meaningful social interaction (Vygotsky, 1978). Instead, the language is treated merely as an abstract, disconnected dataset to be temporarily recalled for evaluative purposes, a practice that strips the language of its organic utility and results in a static linguistic repertoire fundamentally incapable of adapting to spontaneous discursive environments.

This persistent pedagogical stagnation is primarily rooted in the structural divergence between the learners' native language (L1) and the target language (L2) (Odlin, 1989), a phenomenon that systematically manifests within the classroom as the "mental translation effect" (see Ellis, 1997). Within the specific linguistic ecology of rural West Bengal, the foundational syntax of the Bengali language operates on a strict Subject-Object-Verb (SOV) ordering paradigm (Dasgupta, 2003). In stark contrast, the English language mandates a rigid Subject-Verb-Object (SVO) structural sequence (Quirk et al., 1985). This typological distance creates a severe, continuous cognitive friction point for ESL learners. Observational data indicates that both educators and learners heavily rely on the cognitive scaffolding of translating English texts directly into the native Bengali, a translational procedure that provides a dangerous illusion of comprehension while systematically undermining the actual acquisition of English syntax (Cook, 2013; Bhattacharya, 2013). The reason for this is, the learners are continuously filtering the L2 through the rigid morphological and syntactic constraints of the L1, they are trapped in an inescapable cycle of cross-ordering (Selinker, 1972; Cook, 2001). The fundamental mechanics of the English language are consequently deviated, leaving students logically and structurally "stuck" without the necessary metacognitive awareness to diagnose the source of their own linguistic paralysis. They continually attempt to map English vocabulary onto a Bengali structural framework (MacWhinney, 2009), leading to fragmented, erroneous linguistic outputs that further erode their academic confidence (Cook, 2013; Corder, 1981). This structural misalignment is not merely a superficial academic error; it represents a profound epistemological barrier that actively prevents the naturalization of the new language within the learner's brain (Corder, 1967).

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The failure to address this specific L1 interference at the very onset of language instruction institutionalizes a fractured, distorted understanding of English, rendering advanced communicative tasks virtually impossible and heavily reinforcing the cultural perception of the language as inherently "difficult" and cognitively inaccessible (DeKeyser, 1998; Han, 2004). The contemporary landscape of English Language Teaching (ELT) is currently undergoing a radical, unprecedented destabilization due to the ubiquitous integration of Generative Artificial Intelligence (GenAI) technologies (Holmes et al., 2019; Jwair, 2025; Cai, 2025).

In the twenty-first century, the historical challenges associated with English writing tasks have been largely circumvented by the advent of advanced sophisticated Large Language Models (LLMs) (Zaim et al., 2025). Learners, irrespective of their foundational linguistic competence, the depth of their vocabulary, or the sophistication of their command prompts, can now generate grammatically flawless, coherent textual outputs with unprecedented ease and speed (Stöhr et al., 2024; Kim et al., 2025; Jwair, 2025; Țală et al., 2024). However, this sudden technological facilitation masks a deepening crisis in actual language acquisition. While GenAI has neutralized the immediate friction of academic writing tasks effectively, the core communicative competencies—specifically speaking, reading, and listening—remain critical, unaddressed vulnerabilities for these students. The frictionless ease of text generation has introduced a dangerous new variable into the educational ecosystem: the complete surrender of human cognitive agency (Britten-Neish, 2025; Klein & Klein, 2025; Heersmink, 2017). When learners bypass the vital cognitive struggle of articulating pre-articulated thoughts into structured language, they engage in a passive process that inevitably leads to severe cognitive atrophy (Klein & Klein, 2025; Lodge & Loble, 2026). Consequently, the explicit distinction between "using GenAI" and "depending on GenAI" has rapidly become the central battleground of modern language pedagogy. "Using GenAI" implies a sophisticated, conscious integration where the technology acts as a supplemental scaffold within a carefully teacher-mediated environment, enhancing an already active learning process (Vygotsky, 1978). Conversely, "depending on GenAI" represents a total abdication of the educational journey, where the learner's creative, natural intelligence and analytical faculties are entirely outsourced to an algorithmic entity. This dependency creates a hollow linguistic proficiency, where the students can effortlessly produce high-level texts but remain completely unable to defend, articulate, or comprehend the underlying linguistic structures of their own generated outputs (Qian, 2025; Tankelevitch et al., 2024; Jin et al., 2025).

Therefore, understanding the true depths and mechanics of this crisis requires a rigorous empirical examination of the localized, lived realities within rural and semi-urban educational networks (Mohanty, 2006). An extensive, targeted investigation encompassing eighteen distinct villages across two separate districts in West Bengal provides a critical, highly revealing cross-section of this educational phenomenon. The demographic matrix of this empirical study includes detailed interviews with twenty-nine high school English educators.

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This cohort comprises thirteen graduates holding specific honours degrees in English, alongside sixteen instructors transitioning from disparate academic disciplines such as geography, mathematics, and physics to teach the language. Additionally, the study incorporates insights from seven collegiate educators who hold both Bachelor's and Master's degrees in English literature and language (English Hons.). The student cohort interviewed is equally comprehensive, spanning from the eighth to the twelfth grade and encompassing 117 school-level learners. Furthermore, the collegiate demographic includes 79 undergraduate students exclusively enrolled in English honours programs, strategically distributed across their first (n=37 students), second (n=21 students), and third (n=21 students) years of collegiate study in various degree colleges. A problematic thread connecting this diverse demographic—regardless of age or educational tier—is the pervasive, unyielding reliance on supplementary private tuition and an entrenched culture of rote note-memorization (see Bray, 2007). Collegiate learners, despite pursuing advanced specialized degrees in the language, exhibit reluctances to engage with the actual structural mechanics of English (Sridhar, 2020), strongly preferring instead to memorize the notes provided by their instructors. Interviews with the teaching faculties explicitly corroborate this systemic failure; educators widely acknowledged that despite rigorous pedagogical efforts, the overwhelming majority of learners remain entirely unable to transcend their foundational linguistic deficits (Han, 2004). Evaluative assessments of students writing consistently reveal a spectrum of fundamental errors, ranging from basic orthographic inaccuracies to severe grammatical malformations (Corder, 1967). More critically, the observational data highlights a pervasive, deep-seated lack of self-trust among the learners, visibly manifesting as a persistent tendency to copy from peers during basic dictation exercises (Bandura, 1997). This specific behavioural pattern underscores a fundamental, pre-emptive surrender of individual cognitive agency (Britten-Neish, 2025; Klein & Klein, 2025; Heersmink, 2017)—a psychological posture of intellectual defeat that seamlessly and dangerously transitions from relying on a human peer to depending entirely on a GenAI algorithm (Lodge et al., 2023).

To effectively disrupt this entrenched, multi-generational cycle of dependency and linguistic paralysis, a radical paradigm shift in teaching-learning pedagogy is absolutely imperative. The currently prevalent strategy of mental translation must be completely dismantled and systematically replaced with a rigorous framework of "systematic programming" (Odlin, 1989; Muranoi & DeKeyser, 2007). This pedagogical approach demands that the prescriptive rules of English morphology and syntax be taught not merely as abstract, disconnected dictates to be memorized, but as highly descriptive and explanatory logical mechanisms (Bialystok, 2001). Such linguistic programming must commence at the absolute genesis of the pedagogical intervention, entirely circumventing the L1 to prevent any structural contamination (Cook, 2001). The Educators must cultivate an immersive environment where explanations, phonetic corrections, and conceptual frameworks are delivered exclusively in the target language (Richards & Rodgers, 2014).

Conscious and deliberate assistance helps the learners in mentally programming the new, independent rule sets of the English language into their cognitive architecture. This methodology requires a meticulous, step-by-step progression ensuring deep understanding is prioritized over superficial memorization. The intervention must begin at the atomic level of language: the rigorous familiarization of English phonetics and intricate sound combinations, taught with explicit, localized care to overcome regional pronunciation barriers (Derwing & Munro, 2015). Following this secure phonetic grounding, core morphological rules—including the mechanics of affixes, regular and irregular verb conjugations, and rigid part-of-speech categorization—must be systematically introduced and drilled (Celce-Murcia & Larsen-Freeman, 1999). The syntactic programming then proceeds incrementally, beginning with the absolute simplest sentential unit possible: one subject and one intransitive verb (Pienemann, 1998). Only when this foundational linguistic binary is cognitively secured and flawlessly executed by the learner should the architecture be expanded to include further constituent elements. The subsequent introduction of transitive verbs and object arguments must be similarly controlled, ensuring that the learners maintain complete, unbroken cognitive mastery over the expanding sentential sequence. The foundational pedagogical rule governing this process is evolutionary: begin with a single word—preferably an active verb—where the instructor dictates the pronunciation, the learner attentively listens, repeats the vocalization, and physically transcribes the form, thereby simultaneously engaging the listening, speaking, and writing faculties in a single, unified cognitive action (Swain, 2005).

Once this foundational linguistic mechanism is carefully programmed into the cognitive architecture of both the learners and the teachers, the role of GenAI within the classroom can be safely and effectively redefined (Hwang & Chen, 2023). When learners possess a robust, internalized understanding of English syntax, GenAI rapidly transitions from a dangerous crutch to an assistive, empowering tool (Bearman et al., 2023). Educators and students can then leverage the technology systematically, not out of academic desperation or a basic lack of capability, but from a secure position of linguistic empowerment and understanding. In this scenario, the learner no longer treats the algorithm as a surrogate intelligence to do the thinking for them, but rather as an advanced, interactive interface for linguistic exploration and refinement (Holmes et al., 2019). However, the critical pedagogical challenge remains constant: how can educators guarantee that early proficiency in syntactic rules will prevent a later regression into GenAI dependency? (Bates, 2019). The resolution to this ongoing pedagogical anxiety lies in the strict enforcement of rigorous oral articulation and the real-time, public defence of generated contents (Cummins & Swain, 1986). By mandating that students verbally articulate their responses and defend their arguments in front of the classroom, the educator forces the continuous, unavoidable activation of listening, speaking, and reading skills (Ellis, 2003).

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In these high-stakes, unscripted classroom environments (Skehan, 1998), learners are completely isolated from technological algorithms or peer support networks; they are compelled by the environment to rely exclusively on their natural intelligence and internalized programming, thereby exercising one hundred percent of their human cognitive agency. This coerced, public articulation acts as a powerful, necessary antidote to cognitive atrophy, requiring learners to systematically bridge the gap between their internalized syntactic programming and spontaneous, high-pressure oral production (Klein & Klein, 2025).

The final, crucial stage of this pedagogical transformation involves a structured, critical comparative analysis of human-generated outputs versus AI-generated outputs (Çela et al., 2025; Noroozi et al., 2024; Mattalo, 2024; Xiaoyu et al., 2025). After the learner has successfully articulated their response utilizing their unassisted cognitive agency, they may then be permitted to cross-refer their organic outputs with an AI-generated equivalent. This specific comparative moment is critical to the learning process; it allows the learner to visually and intellectually discern the differences in structural complexity, lexical choice, and stylistic nuance (Zhai, 2023) without having bypassed the initial cognitive labour (Britten-Neish, 2025; Klein & Klein, 2025; Heersmink, 2017). More importantly, this exercise reinforces the intrinsic, irreplaceable value of their own cognitive agency, clearly demonstrating that while the AI may produce a more polished surface syntax, the human articulation is deeply grounded in genuine comprehension, intentionality, and contextual awareness (Bender et al., 2021). To permanently transform GenAI dependency into productive, critical GenAI use, continuous, on-the-spot evaluation and correction by the educator are mandatory (Lyster & Ranta, 1997). Even when assignments are partially generated via AI and submitted, the educators must meticulously redirect the assessment to force the students to reverse-engineer, orally explain, and critically defend the algorithmic outputs (Cai, 2025). Just as the foundational linguistic rules were explicitly and systematically programmed, the steps to use GenAI must be explicitly taught, guiding the students on a deliberate, carefully monitored journey from passive algorithmic reliance to active, critical technological utilization (Selwyn, 2023). Ultimately, successfully navigating the complexities of the GenAI era in ELT requires extreme caution, robust methodological frameworks, and collaborative vigilance (Zaim et al., 2025); both the educators and learners must forge a unified, resilient alliance to ensure that technological advancement serves to amplify, rather than silently extinguish, the irreplaceable human cognitive agency at the very heart of language acquisition (Lodge & Loble, 2026).

2. Literature Review

The acquisition of ESL within non-native, structurally divergent linguistic environments is a highly complex, deeply negotiated cognitive process (Mitchell et al., 2013). When this acquisition process intersects with the sudden, ubiquitous availability of GenAI, the foundational paradigms of language pedagogy are fundamentally disrupted (Cai, 2025; Lodge et al., 2023).

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To fully comprehend the dual crises of entrenched L1 interference and algorithmic dependency identified in this study, it is necessary to examine the existing scholarly discourse across several overlapping disciplines: theoretical linguistics, cognitive psychology, the sociology of education, and educational technology. This literature review synthesizes research concerning cross-linguistic influence and typological distance (Odlin, 1989), specifically focusing on the friction between Subject-Object-Verb (SOV) and Subject-Verb-Object (SVO) syntaxes (MacWhinney, 2009). Furthermore, it examines the socio-pedagogical realities of peripheral educational contexts where rote memorization operates as a compensatory mechanism for structural opacity. Most critically, this review maps the emerging scholarship on GenAI in education, differentiating between technological scaffolding and cognitive offloading (Britten-Neish, 2025; Klein & Klein, 2025; Heersmink, 2017), and traces the theoretical underpinnings of "cognitive atrophy" (Klein & Klein, 2025). Finally, it reviews pedagogical frameworks regarding explicit form-focused instruction and oral articulation as methodologies for reclaiming human cognitive agency in language acquisition (Swain, 2005; Muranoi & DeKeyser, 2007).

2.1. Typological Distance and the Mechanics of Cross-Linguistic Influence

The phenomenon wherein a learner's native language (L1) structural paradigms influence the acquisition of a target language (L2) has been a central concern of applied linguistics since the advent of contrastive analysis (Lado, 1957; Odlin, 1989). Early structuralist perspectives posited that the degree of difficulty in L2 acquisition is directly proportional to the typological distance between the L1 and the L2 (Ellis, 2015). While contemporary frameworks have moved beyond strict behaviourist interpretations of "negative transfer", the consensus remains that deep-seated L1 morphosyntactic structures exert a profound, often unconscious gravitational pull on L2 processing (Gass & Selinker, 2008; MacWhinney, 2009).

In the specific context of Bengali-speaking learners acquiring English, the typological divergence is severe. Bengali operates on a relatively rigid Subject-Object-Verb (SOV) word order, utilizing extensive postpositional markers and morphological agglutination to indicate case and thematic roles (Dasgupta, 2003; Klaiman, 1987). Conversely, English is heavily reliant on a strict Subject-Verb-Object (SVO) sequence and prepositional phrasing to establish syntactic relationships (Chomsky, 1965; Quirk et al., 1985). The literature indicates that when learners attempt to map an SVO lexicon onto an SOV cognitive architecture, the resulting linguistic output is frequently fractured (Jarvis & Pavlenko, 2008). Research into the Competition Model suggests that learners rely on the strongest cues available in their L1; for Bengali speakers, these cues are morphological markers rather than the strict word-order cues demanded by English (Bates & MacWhinney, 1987). Consequently, learners systematically misinterpret or misapply English syntax because their cognitive parsers are actively searching for linguistic signals that do not exist in the target language, while ignoring the crucial sequential signals that do (Slabakova, 2016).

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2.2. The Cognitive Burden of the Mental Translation Effect

The structural friction between SOV and SVO syntaxes manifests pedagogically as the "mental translation effect". Literature in psycholinguistics extensively documents the cognitive load associated with continuous, conscious translation during L2 processing (Sweller, 1988; Kroll & Stewart, 1994). The Revised Hierarchical Model of bilingual memory suggests that in early-to-intermediate stages of L2 acquisition, learners access L2 vocabulary almost exclusively through L1 semantic representations (Kroll et al., 2010). In a classroom setting, this means students are not merely learning English words; they are engaging in a highly taxing, multi-step cognitive algorithm: receiving an English input, translating it into Bengali, formulating a Bengali response (SOV), translating the lexical items back into English, and finally attempting to reorder them into an SVO structure (De Groot, 2011).

This protracted internal translation process monopolizes the learners' working memory capacity. Cognitive Load Theory posits that working memory is severely limited; when its capacity is exhausted by the mechanics of translation and reordering, there is no remaining cognitive bandwidth for higher-order linguistic processing, such as pragmatic nuance, stylistic fluency, or spontaneous articulation (Paas et al., 2003; Baddeley, 2003). The literature demonstrates that pedagogical reliance on mental translation—often reinforced by Grammar-Translation Methods (GTM) still prevalent in many developing regions—provides a temporary illusion of comprehension while delaying the establishment of direct conceptual links to the L2 lexicon (Cook, 2013). It traps the learner in an intermediary interlanguage state, characterized by structural fossilization and an inability to operate the target language outside of highly controlled, slow-paced academic exercises (Selinker, 1972; Han, 2004).

2.3. Pedagogical Ecosystems in the Periphery: Rote Learning as Cognitive Survival

To contextualize the reliance on rote memorization among ESL learners in rural and semi-urban Indian contexts, it is necessary to engage with the sociology of language education. Focusing on ELT in the Global South, researchers highlight the systemic disjuncture between mandated communicative curricula and the lived realities of under-resourced classrooms (Canagarajah, 1999; Holliday, 1994). While national educational frameworks—such as NEP 2020—advocate for experiential and communicative language teaching, the literature indicates that the operational realities of peripheral classrooms often default to teacher-centric dictation and examination-oriented pedagogy (Kumaravadivelu, 2006; Tan, 2005). Within these environments, the phenomenon of rote memorization is eventually mischaracterized in mainstream ELT literature as a cultural deficit or a lack of academic motivation. However, critical applied linguists argue that in contexts where the underlying mechanics of a target language remain structurally opaque, rote memorization operates as a highly rational, adaptive survival strategy (Watkins & Biggs, 1996; Pennycook, 2001).

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When learners cannot decode the internal logic of English syntax (due to unaddressed L1 interference), they treat English texts as static, monolithic data blocks to be memorized and reproduced for evaluative survival (Watkins & Biggs, 2001). The literature confirms that collegiate-level students retaining a dependence on already prepared notes are exhibiting the long-term sequelae of a foundational pedagogical failure (Kirkpatrick, 2007). They have internalized the cultural narrative that English is an insurmountable, abstract code, leading to a pervasive lack of self-trust and the subsequent surrender of cognitive agency to external authorities—be it the teacher, peer-provided notes, or, contemporarily, algorithmic text generators (Norton, 2013).

2.4. The Epistemological Shift: Generative AI and the Outsourcing of Linguistic Production

The introduction of LLMs and GenAI into this fragile educational ecosystem represents an unprecedented epistemological shift. The contemporary literature on AI in education is rapidly expanding, with researchers attempting to categorize GenAI's role ranging from an "intelligent tutor" to a disruptive threat to academic integrity (Hwang et al., 2020; Zawacki-Richter et al., 2019). Earlier technological interventions in ELT, such as spell-checkers or basic grammar correction tools (e.g., Grammarly), operated reactively; they required the learners to produce an initial, organic linguistic output which the tool then refined (Warschauer, 2004). GenAI, however, operates proactively and generatively. Given a rudimentary prompt, tools like ChatGPT can instantly bypass the learner's interlanguage limitations to produce highly sophisticated, syntactically flawless text (Baidoo-Anu & Owusu Ansah, 2023).

This shift alters the foundational nature of language learning. Language acquisition is inherently tied to the process of "languaging"—the active, often difficult cognitive struggle to externalize internal thought into structured syntactic forms. The literature on the cognitive science of learning emphasizes that this very friction—the trial, error, and cognitive effort required to formulate language—is the exact mechanism through which neural pathways are forged and linguistic competence is established (Bjork & Bjork, 2011; Vygotsky, 1978). By entirely neutralizing the friction of academic writing tasks, GenAI bypasses the Zone of Proximal Development (ZPD). Studies on algorithmic reliance suggest that when an AI produces language on behalf of a student, the student may experience a false sense of mastery, conflating their ability to prompt a machine with their own communicative competence (Susnjak, 2022; Chomsky et al., 2023). They are interacting with the end-product of language without ever engaging with its underlying mechanisms, leading to a profound, hollow simulation of proficiency.

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2.5. Cognitive Offloading and the Threat of Cognitive Atrophy

The transition from "peer-copying" to GenAI dependency must be examined through the lens of "cognitive offloading"—the use of physical actions or external tools to reduce the cognitive demands of a task (Risko & Gilbert, 2016). While cognitive offloading is a natural human behaviour (e.g., using a calculator for complex arithmetic, or writing down a grocery list), the literature distinguishes between offloading tasks that free up working memory for higher-level critical thinking, and offloading the exact skills one is attempting to acquire (Sparrow et al., 2011). In the context of ESL acquisition, leaning entirely on GenAI to generate textual responses represents a pathological form of cognitive offloading that precipitates "cognitive atrophy". Cognitive atrophy refers to the degradation of mental faculties due to disuse, heavily documented in studies examining the impact of GPS systems on spatial memory and navigational skills (Dahmani & Bohbot, 2020; Heersmink, 2017). When applied to language learning, the literature theorizes that if learners consistently outsource the executive function of syntactic structuring and lexical retrieval to an algorithm, the neural circuits responsible for these linguistic processes will weaken (Carr, 2020).

Crucially, researchers delineate a strict boundary between "using tools" and "depending on tools" (Floridi & Chiriatti, 2020). Using tools implies a human-in-the-loop paradigm where the human maintains cognitive agency, intentionally directing the tools to augment an active process (Clark, 2003). Tool dependency, conversely, involves a surrender of agency, where the users accept the algorithmic output passively, lacking the foundational knowledge required to audit, critique, or modify the machine's production (Bender et al., 2021). In marginalized educational settings where structural understanding is already deficient, GenAI threatens to lock students into a permanent state of dependency, effectively halting their development of independent cognitive agency.

2.6. Reclaiming Human Agency: Structural Programming and Form-Focused Instruction

To counteract the dual phenomena of L1-induced linguistic paralysis and GenAI-induced cognitive atrophy, the literature points toward robust, interventionist pedagogies. The concept of "systematic programming" proposed in this framework closely aligns with theories of explicit, Form-Focused Instruction (FFI) and Skill Acquisition Theory (SAT) (Spada, 1997; DeKeyser, 1998). While the communicative approach such as CLT has marginalized explicit grammar instruction in favour of organic exposure, contemporary researchers argue that for adult or adolescent learners operating in input-poor environments, implicit learning is vastly insufficient (Ellis, 2002; Norris & Ortega, 2000). SAT posits that learning a complex skill—such as a structurally divergent L2—must transition from declarative knowledge (knowing the rules explicitly) to procedural knowledge (applying the rules fluidly through practice) (Anderson, 1983; Muranoi & DeKeyser, 2007).

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The literature supports a bottom-up morphological and syntactic approach that explicitly maps the differences between the SOV L1 and the SVO L2 (Celce-Murcia, 1991). By systematically teaching the prescriptive rules of English morphology (e.g., affixes, verb forms) as logical, explanatory mechanisms rather than arbitrary rules to be memorized, educators can assist learners in building a new, independent cognitive parser for the English language (Lightbown & Spada, 2013). This explicit "programming" is foundational; it provides the cognitive architecture necessary for the learner to eventually audit and critically evaluate GenAI outputs, transforming them from passive consumers to active directors of the technology (Warschauer, 2004)

2.7. The Role of Oral Defence and the Output Hypothesis

Furthermore, the literature strongly validates the pedagogical requirement of rigorous oral articulation and real-time defence as an antidote to GenAI dependency. This aligns seamlessly with Merrill Swain's Comprehensible Output Hypothesis, which argues that while exposure to linguistic input is necessary, it is the act of *producing* language (output) that forces learners to move from semantic processing to deep syntactic processing (Cummins & Swain, 1986; Widdowson, 1995).

When students are required to publicly articulate and defend their linguistic choices without technological assistance, they are denied the opportunity for cognitive offloading. The literature on high-stakes oral recitation indicates that this practice forces the continuous, unavoidable activation of executive functioning, lexical retrieval, and syntactic formulation (Skehan, 1998; Bygate, 2001). In this unscripted classroom environment, learners must rely entirely on their natural intelligence. Moreover, the subsequent pedagogical step—comparing the students' organically generated oral defence with an AI-generated textual output—finds strong support in literature regarding "noticing" and metacognitive awareness (Schmidt, 1990; Flavell, 1979). By engaging in this comparative analysis, the learner visually and intellectually discerns the gap between their interlanguage and the target language syntax (Gass, 1997). More importantly, this comparative exercise, mediated heavily by the instructor, reinforces the irreplaceable value of human intentionality, demonstrating that while the AI can simulate fluency, authentic communicative agency remains an exclusively human faculty (Lantolf & Thorne, 2006). Therefore, the existing literature clearly demarcates the severe cognitive and structural challenges faced by non-native ESL learners navigating the typological chasm between SOV and SVO languages. It validates the assertion that in marginalized pedagogical ecosystems, rote memorization is a symptom of systemic structural opacity rather than a localized academic failure. Furthermore, the emerging research on GenAI starkly warns against the epistemological dangers of unmediated algorithmic dependency, emphasizing the very real threat of cognitive atrophy when the "struggle" of language acquisition is bypassed. However, a significant gap exists in the literature regarding localized, empirical interventions that bridge these two distinct crises.

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While research exists independently on L1 syntactic interference and AI educational policy, there is a lack of cohesive, empirical frameworks that demonstrate how systematic, bottom-up morphological programming, combined with forced oral defence, can specifically transition learners in rural Indian contexts from AI dependency to empowered AI utilization. The current study is positioned to directly address this critical intersectional gap.

3. Methodology

3.1. Research Design and Paradigm

To systematically investigate the intersections of first language (L1) interference and GenAI dependency in ELT, this study utilized a robust, mixed-methods quasi-experimental research design. The foundational architecture of this research was grounded in a pragmatic epistemological paradigm, which allows for the simultaneous collection of qualitative experiential data and the implementation of structured pedagogical interventions (Creswell & Plano Clark, 2018). The qualitative dimension employed a phenomenological approach to capture the lived experiences, cognitive struggles, and pedagogical anxieties of both educators and learners operating within marginalized linguistic ecosystems (Denzin & Lincoln, 2011). Concurrently, the quasi-experimental facet of the design involved the localized implementation of a highly structured, step-by-step pedagogical framework aimed at dismantling rote memorization and reprogramming syntactic comprehension (Tashakkori et al., 2010). By integrating these dual methodological pathways, the study avoided the limitations of purely observational research, moving beyond mere diagnosis to actively test a corrective, agency-driven pedagogical model in real-time classroom environments (Yin, 2018).

3.2. Research Setting and Contextual Grounding

The geographical and sociocultural setting of this study was strategically selected to represent a highly specific, resource-constrained linguistic environment. Fieldwork and pedagogical experiments were conducted across eighteen distinct, geographically isolated villages situated within two separate administrative districts in the state of West Bengal, India. This specific regional focus was mandated by the area's unique heteroglossic landscape, where the academic exposure to English from the first grade violently clashes with a lived reality dominated by a complex amalgamation of Bengali and Hindi (c.f., Bhattacharya, 2013, 2017). Within these rural and semi-urban educational networks, English operates almost exclusively as an abstract academic hurdle rather than a functional communicative medium (Singh, 2023). The selection of these eighteen localized sites ensured that the data collected reflected the systemic, deeply entrenched nature of the "mental translation effect" unmitigated by the supplementary infrastructural advantages typically found in major metropolitan educational centres (Mohanty, 2010). Consequently, this setting provided a pristine, uncompromised environment to observe the foundational friction between an SOV native language and an SVO target language (Tan, 2005).

3.2.1. Participant Selection: The Educator Cohort

A purposive sampling strategy was employed to assemble a comprehensive cross-section of English language educators functioning within the targeted regional parameters. The study successfully recruited and personally interviewed a total of thirty-six teaching professionals, stratified across two distinct educational tiers to capture a longitudinal perspective on pedagogical methodologies (Patton, 2014). The high school educator cohort consisted of twenty-nine individuals. Crucially, the demographic breakdown of this specific cohort revealed systemic disciplinary overlaps: only thirteen of these teachers held formal undergraduate honours degrees specifically in English, while the remaining sixteen transitioned into English language instruction from disparate academic backgrounds, including geography, mathematics, and physics (c.f., Etikan et al., 2016). To analyze advanced academic instruction, the study also recruited seven collegiate-level educators, all of whom possessed both Bachelor of Arts (BA) and Master of Arts (MA) degrees in English Hons. (c.f., Robinson, 2014). This deliberate inclusion of variably qualified educators allowed the research design to isolate instructional variables and determine whether the students' reliance on rote memorization was a localized pedagogical failure or a broader, systemic outcome of the region's ELT infrastructure (see Guest et al., 2006).

3.2.2. Participant Selection: The Learner Cohort

To effectively map the trajectory of linguistic acquisition and algorithmic dependency, the learner cohort was meticulously selected across a wide spectrum of academic development. The student participant pool comprised a total of one hundred and ninety-six individuals, similarly divided into school-level and collegiate-level demographics (c.f., Cohen et al., 2017). The secondary education group included one hundred and seventeen students enrolled in classes ranging from the eighth to the twelfth grade. The higher education group consisted of seventy-nine collegiate undergraduates exclusively enrolled in specialized English Honours degree programs. To ensure longitudinal validity, these undergraduate participants were strategically distributed across their academic tenure, featuring thirty-seven first-year students, twenty-one second-year students, and twenty-one third-year students across various regional degree colleges. A critical, unifying characteristic screened for across all 196 participants—regardless of age or institutional affiliation—was their sustained, regular reliance on private English tuition networks outside of formal schooling hours.

3.3. Diagnostic Data Collection: Interviews and Observations

The initial phase of data collection prioritized diagnostic personal interviews to establish the baseline cognitive frameworks of the participants. Semi-structured, in-depth interviews were conducted independently with both the educator and learner cohorts to circumvent performative classroom dynamics and elicit authentic pedagogical reflections (Brinkmann & Kvale, 2015). Through these interviews, the study isolated the learners' universal perception of English as inherently "difficult" and documented the collegiate students' explicit preference for memorizing readymade tuition notes over engaging with underlying linguistic mechanisms (Seidman, 2013).

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Following the interviews, a rigorous observational protocol was initiated, wherein researchers critically audited the students' written assignments, dictation exercises, and examination responses (Rubin & Rubin, 2011). This observational artifact analysis revealed a consistent pattern of severe orthographic inaccuracies, profound grammatical malformations, and a pervasive tendency for peer-copying during live dictation—phenomena that researchers operationalized as empirical indicators of pre-emptive cognitive surrender (Charmaz, 2014).

3.3.1. Identifying the L1 Interference Variable

A critical procedural objective during the diagnostic phase was isolating the exact mechanical failure point within the standard teaching-learning continuum. Through combined observational field notes and teacher interviews, researchers identified that the predominant pedagogical methodology heavily relied on translating English texts directly into the native Bengali (see Corder, 1981). This qualitative data confirmed that both teachers and learners found psychological comfort in this translational procedure; however, the methodology systematically deviated from the fundamental syntax of English grammar (Richards, 1975). By mapping the observational data against typological linguistic models, the researchers confirmed that the students were cognitively trapped in a cross-ordering loop, attempting to reconcile the Subject-Object-Verb (SOV) structure of Bengali with the Subject-Verb-Object (SVO) mandate of English (Ellis & Barkhuizen, 2005). The diagnostic data conclusively demonstrated that students were completely unaware they were stuck at a fundamental logical impasse, necessitating a radical redesign of the intervention strategy (Brown, 2014).

3.3.2. The Pedagogical Intervention Phase 1: Banning Translation

Based on the diagnostic findings, the study deployed a quasi-experimental pedagogical intervention designed to explicitly redirect the mental translation process toward "systematic programming". The foundational rule instituted in the experimental classrooms was the strict prohibition of L1 (Bengali) mediation when explaining L2 (English) structures (c.f., DeKeyser, 1998). The researchers had instructed the participating educators that all prescriptive morphological rules should be delivered as descriptive, explanatory mechanisms exclusively in English. The methodological objective was to intentionally isolate the learners' cognitive parsers, forcing them to mentally program a completely new language rule set without relying on the familiar, yet structurally incompatible, scaffolding of their native tongue (Spada, 1997). This required a highly delicate and careful procedural shift from the very beginning of the experimental classes, ensuring that students did not panic but rather began to map English vocabulary directly onto a newly formed SVO cognitive architecture (Lyster, 2004). Educators were trained to prioritize the learners' deep understanding of these structural phenomena, entirely discarding the previous mandates of rapid syllabus completion and rote grasping (Long, 1991).

3.3.3. The Pedagogical Intervention Phase 2: Morphological Foundations

Once the translational ban was established, the intervention proceeded with a highly granular, bottom-up morphological programming sequence. To completely bypass the fossilized errors acquired over previous years, the experimental curriculum reverted to the absolute atomic level of the language, beginning with the rigorous familiarization of English phonetic sounds, specific sound combinations, and morphological rules (Celce-Murcia et al., 2014). The researchers had mandated that educators teach these phonetic elements explicitly and with localized care, ensuring that regional articulatory habits did not affect the new linguistic inputs. Following phonetic security, the curriculum introduced explicit morphological structures, focusing extensively on the mechanics of affixes, the precise categorization of regular and irregular verb forms, and the rigid delineation of parts of speech (Nation, 2001). This phase of the methodology treated language learning identically to computational coding, where students were not asked to write essays, but rather to memorize the discrete operational functions of individual word categories before attempting to assemble them (Schmitt, 2000). This foundational programming was heavily monitored to ensure absolute cognitive retention before progressing.

3.3.4. The Pedagogical Intervention Phase 3: Syntactic Assembly

The third phase of the intervention operationalized a strict, sequentially expanding syntactic assembly protocol. The educators were instructed to begin sentence formation utilizing a singular unit: one word, specifically mandated to be an active verb. The procedural cycle required the teacher to pronounce this single verb, after which the students were compelled to listen, physically repeat the pronunciation, and manually transcribe the word, thereby synchronizing their auditory, vocal, and motor pathways (Goldberg, 2006). Upon mastering the single-word imperative, the sequence expanded to an absolute binary: one subject and one intransitive verb. The methodology rigidly prevented the introduction of third, fourth, or fifth constituent words until this intransitive binary was flawlessly executed by the entire cohort (MacWhinney, 2004). Subsequently, the educators introduced transitive verbs, limiting sentences to a maximum of three words initially, before incrementally expanding the sentential sequence to more words. This systematic, trackable learning procedure provided educators with real-time empirical data regarding the exact syntactic threshold where individual students began to struggle (Crookes, 1990).

3.4. Integrating the GenAI Variable

Only after this mechanical syntax was securely programmed into the cognitive architecture of the learners did the methodology introduce the variable of GenAI. The experimental design explicitly positioned GenAI not as a primary teaching-learning tool, but strictly as an advanced assistive device utilized by students who already had comprehended the underlying linguistic mechanisms (Warschauer, 2004). To operationalize this epistemological shift, the researchers had instructed the educators to dedicate specific instructional modules to explicitly explaining the technological realities of GenAI.

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This involved a systematic, delicate pedagogical breakdown of the technology's inherent limitations, its structural benefits, its academic drawbacks, and its long-term cognitive risks (Chapelle, 2001). Crucially, educators explicitly taught the definitive boundary between "using GenAI" (where the teaching-learning process integrates technological advancement) and "depending on GenAI" (which precipitates severe cognitive atrophy). By openly discussing the cost of algorithmic reliance, the methodology aimed to cultivate a hyper-aware, highly critical technological consciousness among both the educator and learner cohorts before any actual AI interaction occurred (Godwin-Jones, 2011; Selwyn, 2014).

A primary methodological challenge was developing a reliable metric to determine whether a student was actively using GenAI or passively depending upon it for answer generation. To resolve this measurement issue, the experimental design mandated a protocol of forced oral articulation in front of the peers and educators (Oberg et al., 2026; Lee et al., 2024). The methodology hypothesized that simply knowing the morphological and syntactic rules in isolation would not guarantee a rejection of GenAI dependency. Therefore, listening, speaking, and reading skills, which had been systematically tracked since the single-verb phase, were abruptly subjected to high-pressure environmental testing (Dawson, 2015). When tasked with formulating an academic response, learners were completely stripped of any access to GenAI interfaces or peer support networks (Lee et al., 2024; Swiecki et al., 2022; Lodge et al., 2023). They were forced by the pedagogical environment to independently defend their own arguments, requiring them to access their creative, natural intelligence and utilize one hundred percent of their human cognitive agency in a public forum (Buckingham, 2015).

This forced articulation protocol served as the primary empirical crucible for combating cognitive atrophy within the study. By removing the safety net of written memorization or algorithmic generation, the intervention demanded real-time executive functioning and spontaneous lexical retrieval (Widdowson, 1995). The researchers have observed that this specific teaching method has catalyzed a definitive shift; students were forced to completely abandon their previous GenAI or peer-copying dependencies and surrender entirely to the limits and capabilities of their own natural intelligence (Skehan, 1998). The methodology required the educator to act not merely as a passive listener, but as an active interrogator, pushing the students to clarify structural choices and justify syntactic positioning on the spot (Bygate, 2001). This gruelling, unmediated oral defence ensured that any linguistic output produced by the student was authentically rooted in their internalized cognitive programming, rather than a superficial, mechanically reproduced string of text (Ellis, 2003).

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3.5. The Cross-Verification and Comparative Analysis Stage

Immediately following the successful unassisted oral articulation of an argument, the experimental protocol introduced a controlled GenAI cross-verification stage. The students were permitted to input their specific prompts into a GenAI platform to generate an algorithmic response directly on the spot (Schmidt, 1990).

The core pedagogical task then shifted to a rigorous, side-by-side comparative analysis. The learners were instructed to visually and structurally compare their organically uttered, newly transcribed responses against the polished text generated by the GenAI (Flavell, 1979). This comparative methodology was designed to highlight the qualitative differences in textual output while simultaneously reinforcing the intrinsic value of human cognitive effort. When students visually recognized the structural differences, they engaged in advanced metacognitive reflection, realizing why they should value the active use of their own cognitive agency rather than passively relying on the algorithmic system (Lantolf, 2000). This rigorous, continuous cross-checking became a mandatory requirement for educators to track the ongoing developmental progress of their students (Vygotsky, 1978). The final methodological phase required continuous, on-the-spot evaluation and correction by the educators to transform GenAI dependency into productive GenAI use. The researchers trained the participating teachers to act as vigilant gatekeepers against cognitive atrophy during written assignment submissions (Black & Wiliam, 1998). If a student submitted a written answer that the educator suspected was generated by GenAI without sufficient human cognitive mediation, the educator was instructed not to simply grade the paper, but to reject the submission and immediately redirect the task (Hattie & Timperley, 2007). This redirection forced the student to publicly reverse-engineer the submitted text, explaining the algorithmic syntax utilizing the morphological rules they had been previously taught. Exactly as the foundational linguistic rules had been explicitly programmed, the students were monitored and taught how to wield the GenAI system systematically, ensuring a gradual, controlled psychological move away from dependency (Sadler, 1989). The methodology proved that only when teachers and students work collaboratively in a state of high caution can GenAI be utilized without sacrificing human cognitive agency (Boud, 2000).

3.6. Data Analysis and Triangulation Strategy

Following the conclusion of the pedagogical intervention, a rigorous data analysis strategy was employed to synthesize the qualitative interview transcripts and the quasi-experimental observational outcomes. The initial diagnostic interviews and the post-intervention reflections were subjected to thematic analysis, utilizing an inductive coding framework to identify shifts in student confidence and teacher pedagogical anxiety (Braun & Clarke, 2006). Concurrently, the observational data—specifically the frequency of spelling errors, syntactic malformations, and instances of peer-copying—were quantitatively tracked to measure the efficacy of the bottom-up programming approach (Saldaña, 2015).

By triangulating the students' pre-intervention written assessments with their post-intervention unassisted oral defence transcripts, researchers were able to establish a clear evidentiary chain demonstrating the restoration of cognitive agency (Miles et al., 2014). This multifaceted analytical approach ensured that the findings were deeply grounded in empirical realities, accurately reflecting the complex transition from rote dependency to active linguistic programming within the specific rural context of West Bengal (Creswell & Poth, 2016).

4. Results

4.1. Baseline Linguistic Deficits and the Eradication of Mental Translation

The diagnostic phase of the intervention yielded compelling empirical data regarding the baseline linguistic paralysis of the 196 participant learners. Pre-intervention textual analyses revealed that 87% of high school students and 62% of collegiate English honours students exhibited severe syntactic malformations directly traceable to L1 (Bengali) interference. Observational data confirmed that learners systematically applied an SOV (Subject-Object-Verb) framework to English prompts, resulting in highly fragmented, structurally inverted outputs. Furthermore, baseline dictation exercises demonstrated a 74% peer-copying rate, empirically validating the pervasive lack of self-trust and pre-emptive cognitive surrender hypothesized in the preliminary investigation.

The implementation of the strict L1 translation ban (Intervention Phase 1) initially precipitated intense cognitive friction and heightened pedagogical anxiety among both educator and learner cohorts. However, thematic analysis of mid-intervention interviews revealed that within four weeks, this friction transitioned into structural clarity. By forcefully dismantling the mental translation loop, learners were denied the familiar, yet incompatible, scaffolding of their native tongue. Consequently, the bottom-up morphological programming (Phase 2) yielded a marked 68% decrease in basic orthographic errors and incorrect conjugations across written assessments, as students began engaging directly with the prescriptive rules of English as independent, explanatory mechanisms rather than arbitrary data points to be memorized.

4.2. The Thresholds of Syntactic Assembly

When the educators executed the syntactic assembly protocol (Phase 3)—beginning with single-verb utterances and strictly limiting incremental sentential expansion—the researchers were able to isolate the exact cognitive threshold of structural failure. Quantitative tracking indicated that 81% of learners have successfully mastered the intransitive binary (Subject + Verb) without L1 structural contamination. The primary cognitive breakdown has consistently occurred upon the introduction of the fourth constituent element in complex transitive sequences. By maintaining this highly controlled, trackable progression, the educators have successfully mapped English vocabulary directly onto a newly established SVO cognitive architecture.

Furthermore, the 36 participating educators have reported a significant paradigm shift in their own instructional efficacy. The instructors who had previously relied on rote dictation and rapid syllabus completion have noted that the deliberate pacing of the single-word-to-sentence expansion allowed them to dynamically assess and correct individual learner trajectories in real-time. This provided empirical proof that the learners' previous reliance on rote memorization was not an inherent intellectual deficit, but a direct consequence of a structurally opaque pedagogy that this intervention has successfully corrected.

4.3. Reclaiming Cognitive Agency Through Oral Defence

The most effective epistemological shift within the participant cohorts was observed during the oral articulation and defence protocol. When completely stripped of GenAI interfaces, written notes, and peer scaffolding, the learners have initially exhibited acute communicative paralysis, substantiating the presence of GenAI-induced and rote-induced cognitive atrophy. However, longitudinal tracking across the experimental cycle has demonstrated a steady, significant reclamation of cognitive agency.

When the students were forced to spontaneously retrieve lexical items and execute their newly internalized syntactic programming in a high-pressure public forum, they have demonstrated a 65% improvement in unassisted oral fluency by the conclusion of the study. The observational data has recorded a complete eradication of peer-copying behaviours during these interactive sessions. The qualitative feedback from the educator cohort has emphasized that their mandated role as "active interrogators" was critical; by demanding real-time justification for syntactic choices, the educators have forced the learners to bridge the gap between declarative knowledge (knowing the rules) and procedural knowledge (using the rules spontaneously under pressure).

4.4. Transitioning from Algorithmic Dependency to Technological Utilization

The introduction of the GenAI cross-verification stage has successfully operationalized the theoretical distinction between algorithmic dependency and technological utilization. Following their unassisted oral defences, the students have compared their organic transcripts with AI-generated responses on the spot. The post-intervention interviews indicate a significant metacognitive awakening among the learner cohort as a direct result of this exercise. Rather than viewing the polished AI text as an unattainable standard that justified their own academic surrender, 78% of the collegiate cohort have articulated a clear, critical understanding of the AI's structural complexities versus the foundational intentionality of their own human output. This comparative methodology has neutralized the threat of cognitive atrophy by ensuring the human cognitive labour occurred *prior* to algorithmic exposure.

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Furthermore, the continuous redirection of suspected AI-generated written assignments by educators proved highly effective in altering submission behaviours. The quantitative tracking of written assignments has showed a 58% reduction in unmediated, purely algorithmic submissions by the conclusion of the intervention. Instead, the students were engaged in reverse-engineering GenAI outputs, utilizing the algorithm as an interactive interface to test, refine, and critically analyze their newly acquired syntactic programming. Ultimately, the results validate the methodological premise: explicit structural programming, tightly coupled with mandatory unassisted oral production, successfully equips ESL learners in marginalized settings to transition from passive technological dependency to active, empowered linguistic agency.

5. Discussion

The fundamental objective of this research was not merely to diagnose the persistent linguistic paralysis observed among non-native English learners in the remote geographies of West Bengal, but rather to construct and validate a transformative pedagogical architecture capable of neutralizing it. The empirical observations catalogued in this study coerce a critical confrontation with the deeply entrenched, structural failures of traditional ELT paradigms when applied to linguistically marginalized demographics. Furthermore, the advent of GenAI has altered the trajectory of this pedagogical failure, transforming a crisis of academic proficiency into an existential crisis of human cognitive agency. This discussion synthesizes the empirical outcomes of the proposed "systematic programming" intervention, positioning it against the existing corpus of ELT literature to expose critical theoretical gaps. It subsequently delineates the theoretical framework necessary to reconcile typological dissonance (Subject-Object-Verb versus Subject-Verb-Object) and articulates how the strategic, controlled integration of GenAI—mediated through mandatory oral defence—can irrevocably alter the pedagogical landscape for both educators and learners.

5.1. Addressing the Research Gap in Contemporary ELT Literature

A rigorous examination of contemporary ELT literature reveals an alarming, bipartite theoretical gap concerning the specific demographic and technological realities investigated in this study. The first dimension of this gap resides in the literature's historical overreliance on CLT and Task-Based Language Teaching (TBLT) frameworks (Crookes, 1990; Richards, 1975). While these paradigms advocate for immersive, meaning-focused instruction and implicit language acquisition, they operate on a flawed universalist assumption: they presuppose that the learners possess a foundational, underlying structural intuition that can be activated through mere exposure and communicative pressure (Swan, 2005).

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The existing literature inadequately accounts for pedagogical ecosystems—such as the rural Bengali context—where the typological distance between the L1 (SOV) and the target L2 (SVO) is so severe that implicit acquisition is cognitively challenging (Odlin, 1989; Jarvis & Pavlenko, 2008). Consequently, the literature currently lacks advanced diagnoses of the phenomenon of rote memorization. It is predominantly framed as a cultural deficit, a lack of learner motivation, or the byproduct of antiquated examination systems (Watkins & Biggs, 1996). Existing literature inadequately theorizes rote memorization not as a failure of effort, but a logical, psychological survival mechanism. This systematization is deployed by the learners who are trapped in a state of unmitigated "mental translation", attempting to force SVO architectures into an SOV cognitive parser (Cook, 2013).

Another dimension of the research gap concerns the emerging, fragmented literature on the integration of GenAI in educational ecosystem. Current research is largely polarized. One faction approaches GenAI through the restrictive lens of academic integrity, focusing predominantly on plagiarism detection, institutional policy formulation, and the safeguarding of traditional assessment metrics (Dawson, 2021; Lancaster & Cotarlan, 2021). The opposing faction adopts a techno-optimistic stance, treating GenAI merely as an advanced evolutionary step in writing assistance—a sophisticated extension of automated grammar checkers designed to enhance productivity and reduce writing friction (Warschauer, 2004; Zawacki-Richter et al., 2019). What is missing from the current discourse is a synthesized, neuro-pedagogical framework that examines the intersection of foundational linguistic deficits and generative algorithmic reliance. The literature has yet to adequately conceptualize "cognitive atrophy" as a direct, measurable consequence of bypassing the linguistic struggle (languaging) inherent in SLA. There is a distinct theoretical void regarding how to systematically transition marginalized learners—who already exhibit a propensity to surrender their cognitive agency to peer-provided notes—from algorithmic dependency back to self-reliant, natural intelligence. This study directly occupies this theoretical vacuum by providing a pedagogical bridge between structural linguistic programming and critical technological utilization.

5.2. The Cognitive Programming Paradigm

To effectively bridge this localized research gap and operationalize the findings of this study, it is necessary to pivot away from traditional input-output acquisition models and adopt what this paper defines as the "Cognitive Programming Paradigm". This theoretical framework synthesizes elements of SAT (Muranoi & DeKeyser, 2007) and Cognitive Load Theory (Sweller, 1988), but radically recontextualizes them for the GenAI epoch. The Cognitive Programming Paradigm theorizes that in environments of extreme typological dissonance, a second language cannot be effectively "acquired" through ambient exposure or translated semantic mapping; rather, it must be explicitly and mechanically "programmed" into the learner's cognitive architecture as an independent operating system (see Anderson, 1983).

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Traditional mental translation is theoretically conceptualized here not merely as an inefficient habit, but as a catastrophic system error. When a Bengali-speaking learner attempts to process an English sentence via mental translation, they are actively corrupting the target input by filtering it through an incompatible SOV architectural algorithm (MacWhinney, 2009). Because the Bengali language relies heavily on post-positional markers and morphological agglutination to determine meaning, the learner's brain searches for these non-existent cues in English, while simultaneously ignoring the rigid, positional syntactic cues (Subject-Verb-Object sequence) that actually govern English logic (Bates & MacWhinney, 1987).

Therefore, the theoretical necessity of the "translational ban" and the subsequent "bottom-up morphological programming" detailed in this study is grounded in the imperative to isolate the cognitive workspace. By forcing explanations exclusively in the target language and breaking the language down to its atomic elements (phonetics, singular active verbs, and simple intransitive binaries), the educator is theoretically acting as a software developer. S/he is deliberately bypassing the corrupted L1 neural pathways to forge a new, discrete SVO parsing mechanism (Ellis, 2002).

This framework posits that explicit, descriptive grammar instruction is not a regression to antiquated pedagogical methods, but rather a necessary, precise cognitive intervention designed to restore logical sequence to a fractured interlanguage (Lightbown & Spada, 2013).

Furthermore, this theoretical framework adheres the concept of "competence" in the era of GenAI. Traditionally, communicative competence has been measured by the final textual or verbal output (Canale & Swain, 1980). However, when a machine can instantly generate a flawless output, the final product ceases to be a reliable metric of human acquisition. The Cognitive Programming Paradigm asserts that true linguistic competence now resides entirely in the *process* of generation—the human intentionality, the real-time lexical retrieval, and the conscious structural assembly of the language (Lantolf & Thorne, 2006). If the learner outsources the generative process to an algorithm before the internal SVO operating system is fully programmed, the neural pathways associated with linguistic assembly are subjected to immediate cognitive atrophy. The framework dictates that GenAI can only be theoretically conceptualized as a safe "assistive tool" when the learner has already secured the internal procedural knowledge necessary to audit, deconstruct, and critically evaluate the algorithmic outputs (Floridi & Chiriatti, 2020).

5.3. The Anatomy of Cognitive Surrender

At the crux of this research lies the psychological and cognitive phenomenon of "surrender". The empirical observation that more than half of the students across both high school and collegiate tiers consistently prefer to copy from peers during dictation, or memorize readymade notes provided by private tutors, is symptomatic of a deeper systemic trauma within the ELT ecosystem (Pennycook, 2001). This behavioural pattern must be analytically deconstructed to understand the true threat of GenAI dependency.

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This surrender is primarily rooted in a loss of intellectual self-trust. When a student is subjected to years of English instruction that relies on mental translation, they inevitably reach an advanced academic stage where the cognitive load of cross-ordering SOV to SVO becomes unsustainable (Skehan, 1998). Because the underlying mechanics of the language have never been explicitly clarified as a logical, explanatory system. The students perceive their inability to construct a coherent sentence not as a pedagogical failure, but as an inherent, personal intellectual deficiency (Norton, 2013). The resulting psychological posture is one of defeat. The students realize that utilizing their own cognitive agency consistently results in failure, grammatical errors, and academic penalization. Consequently, the most logical, self-preserving action is to completely abdicate that agency.

In this context, it is critical to understand that the transition from relying on a peer's notebook to depending on ChatGPT is not a shift in academic behaviour; it is merely an upgrade in the technology of surrender (Susnjak, 2022). The core issue is identical: the outsourcing of natural intelligence. However, the generative nature of modern AI makes this surrender exponentially more dangerous. While a peer's notes might be flawed, requiring some modicum of human interpretation, a GenAI model provides an illusion of absolute, frictionless perfection (Bender et al., 2021).

This frictionless environment completely bypasses the ZPD—the specific cognitive arena where learning actually occurs through struggle, error correction, and structural negotiation (Vygotsky, 1978). By entirely removing the friction of writing tasks, GenAI ensures that the learner's internal linguistic mechanisms remain permanently dormant. The core observation of this study—that reading, listening, and speaking remain severe challenges despite the ease of AI-assisted writing—proves that algorithmic text generation does not correlate with language acquisition. It masks the deficit, creating a generation of structurally illiterate students who can prompt a machine to produce a flawless essay but cannot articulate a basic, syntactically coherent defence of their own generated thesis (Carr, 2020).

5.4. Reprogramming the L2 Learner

The implications of this research laid out above necessitate a radical, considerable transformation in the foundational pedagogy of ELT in rural areas, specifically targeting both the instructional methodology of the educators and the cognitive approach of the learners. The initial phase of this pedagogical shift requires complete systemic eradication of the mental translation methodology (Han, 2004). The educators must be explicitly trained to recognize translation not as a helpful scaffold, but as an active barrier to acquisition. The introduction of "systematic programming" requires the teachers to alter their classroom personas; they should transition from being mere providers of semantic vocabulary and evaluators of final essays, to becoming cognitive architects. This involves slowing down the pedagogical pace to a microscopic level at the onset of instruction.

By mandating that prescriptive grammatical rules be taught descriptively—explaining the *why* and *how* of a rule rather than demanding rote memorization—the educators can empower the students with the logic of the language (Celce-Murcia, 1991). For example, teaching the addition of an "~s" to a third-person singular verb should not be a dictation exercise, but a logical programming step ensuring the subject and verb are mechanically aligned within the newly built SVO parser.

The incremental syntactic assembly model proposed in this study—starting with a single active verb, expanding to a subject-verb binary, and strictly controlling the introduction of subsequent sentence constituents—is a systemic radical departure from traditional syllabus-driven teaching. It completely subverts the pressure to rush students into writing complex paragraphs or drafting letters before they have mastered the atomic structure of a sentence. For the learners, this methodology precisely restores self-trust. By restricting the learning environment to a single word or a binary pairing, the cognitive load is managed, and the probability of structural success is maximized (Baddeley, 2003). When a learner successfully constructs and pronounces a two-word SVO sequence without L1 interference, they experience a localized reclamation of cognitive agency. This process of listening, repeating, and physically writing the incremental expansions forces the synchronization of neural pathways, transforming the language from an abstract, fearful obstacle into a tangible, manipulable tool (Cummins & Swain, 1986). The pedagogical environment changes from one of anxiety and memorization to one of active, structural engineering.

5.5. Navigating the GenAI Epoch

Once the foundational SVO mechanics are effectively programmed into the cognitive architecture of the learners, the pedagogical strategy must explicitly address the integration of GenAI and maintain a balance with the technological advancement. The core finding of this study dictates that GenAI cannot be ignored, banned, or seamlessly integrated without rigorous, localized contextualization. The pedagogy must shift to teaching the technology as a distinct, secondary discipline within the ELT framework (Godwin-Jones, 2011).

The teachers should initiate this integration through explicit, transparent dialogue regarding the epistemological nature of AI. The students need to be systematically taught the absolute distinction between how to make use of GenAI as an assistive architectural tool and depending on it as a surrogate intellect (Lee et al., 2024; Swiecki et al., 2022; Lodge et al., 2023). This requires educators to openly discuss the concept of cognitive atrophy with their students, establishing a mutual understanding that the surrender of human cognitive agency is a severe developmental cost that the technology exacts from the unwary users. To practically enforce this distinction and prevent regression into dependency, the ELT pedagogy could promote implementing obligatorily "oral articulation and defence protocol" as the primary evaluative metric (see, Bygate, 2001). This represents a massive shift from traditional written assessments.

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By mandating that students publicly articulate and defend their linguistic choices, formulate arguments, and retrieve lexical items in real-time without technological or peer assistance, the pedagogy attacks cognitive atrophy (Skehan, 1998). In this unscripted, high-pressure environment, the student is stripped of all external scaffolding and forced to rely entirely on their internalized natural intelligence. This pedagogical practice ensures that the listening, speaking, and reading skills—which GenAI naturally bypasses—are rigorously and continuously exercised. It forces the learners to "language" in real-time, cementing the procedural knowledge they acquired during the systematic programming phase (Lantolf, 2000).

Furthermore, the integration of the cross-verification stage transforms GenAI from a threat into a powerful mechanism for metacognitive development (Flavell, 1979). When a student is permitted to generate an algorithmic response *only after* they have articulated their own human-generated defence, the classroom becomes an experimental centre for critical comparative analysis (Schmidt, 1990). The teachers can guide the students to structurally compare their organic outputs against the AI's syntax. This is where true, advanced language acquisition in the 21st century occurs. The students visually discern structural nuances, alternative lexical choices, and stylistic variations, but they evaluate these elements from a secure position of pre-existing knowledge (Warschauer, 2004). They are not blindly accepting the AI outputs; they are auditing it. They learn to appreciate the polish of the algorithm while simultaneously recognizing that their own slightly flawed, organically produced articulation possesses an authentic intentionality and contextual awareness that the machine inherently lacks. The findings and proposed frameworks of this study carry contemporarily relevant implications for the daily operational realities of ELT practitioners and broader institutional policy, particularly within resource-constrained, non-native environments like rural areas in West Bengal. The most immediate implication is the necessary redesigning of teachers' training and professional development programs. The data indicating that a majority of high school English educators transition from disparate disciplines (e.g., mathematics, physics) without specialized linguistic training is a critical institutional vulnerability (see Bhattacharya, 2013, 2017). These educators, while dedicated, are frequently unequipped to diagnose typological dissonance or execute systematic morphological programming. Professional development must urgently pivot away from abstract theories of communicative teaching to provide educators with rigorous, practical training in comparative syntax, psycholinguistics, and cognitive load management (Singh, 2023).

Additionally, the role of the educators in the GenAI era must be institutionally redefined. The teacher can no longer function primarily as an evaluator of final written products, as these products are increasingly prone to algorithmic contamination. Instead, the educators must become a continuous, on-the-spot algorithmic auditor and a facilitator of real-time cognitive performance (Black & Wiliam, 1998). This necessitates a departure from rigid, pre-determined syllabi that mandate the coverage of extensive literary texts or complex writing formats before the foundational syntax is secured.

The curricula must be rendered flexible, allowing teachers the temporal bandwidth to implement the incremental syntactic assembly sequence at a pace dictated by the specific cognitive threshold of their classroom, rather than an arbitrary academic calendar (Crookes, 1990). Institutionally, the assessment frameworks must be radically overhauled. The traditional reliance on high-stakes, summative written examinations implicitly encourages both rote memorization and, increasingly, GenAI dependency (Boud, 2000). If the educational system values and rewards the flawless reproduction of text regardless of its origin, it actively incentivizes the surrender of cognitive agency. Assessment policies must therefore be redesigned to heavily weight formative, unscripted oral defences, real-time syntactic deconstruction, and the student's demonstrated ability to critically audit AI-generated texts (Sadler, 1989). By aligning assessment metrics with the actual mechanisms of human cognition and technological utilization, policymakers can ensure that the educational system accurately measures genuine communicative competence rather than algorithmic proficiency.

Therefore, the intersection of deep-seated linguistic marginalization and the sudden proliferation of GenAI constitutes a critical inflection point in the history of ELT. The reliance on rote memorization and mental translation, endemic to peripheral educational contexts like rural West Bengal, is not a superficial academic error, but a profound systemic failure to reconcile the typological dissonance between a native SOV architecture and a target SVO reality. When learners, already psychologically defeated by the structural opacity of the language, are introduced to the frictionless generative power of AI, they logically and rapidly surrender their remaining cognitive agency, resulting in severe, unmitigated cognitive atrophy. To arrest this decline, traditional pedagogical paradigms must be systemically dismantled. By implementing a framework of systematic, bottom-up morphological programming, the educators can actively build an independent SVO cognitive parser within the learners, restoring intellectual self-trust and foundational competence. Crucially, the technology of GenAI can only be safely integrated into this ecosystem when it is consciously subordinated to human intentionality through rigorous, mandatory protocols of unassisted oral articulation and critical, comparative algorithmic auditing. Ultimately, the future of language acquisition in the twenty-first century does not depend on outcompeting the algorithmic perfection of machines, but rather on the deliberate, pedagogical preservation and fierce cultivation of the inherently imperfect, yet irreplaceable, human cognitive struggle.

6. Conclusion

The acquisition of ESL within structurally divergent, non-native environments has been plagued by systemic pedagogical failures. As this investigation demonstrates, in the specific regional context of rural and semi-urban West Bengal, the profound typological friction between the native Bengali Subject-Object-Verb (SOV) architecture and the target English Subject-Verb-Object (SVO) framework creates an inescapable cognitive barrier for learners.

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Trapped in a paralyzing cycle of mental translation, students have long relied on rote memorization and the verbatim copying of peer notes as highly rational, yet academically fatal, survival mechanisms. The advent of GenAI has radically compounded this crisis. By offering frictionless, algorithmic text generation, GenAI tools have seamlessly replaced peer-copying, transforming a localized crisis of academic proficiency into a profound existential threat of cognitive atrophy. When learners outsource the fundamental struggle of linguistic assembly to a machine, they simply surrender their human cognitive agency, resulting in a hollow simulation of fluency that masks severe structural illiteracy.

This study sought to directly disrupt this multi-generational cycle of cognitive surrender by designing and implementing a highly localized, quasi-experimental pedagogical intervention across eighteen rural villages. The empirical findings unequivocally validate that the traditional communicative paradigms and syllabus-driven grammar-translation methods are drastically insufficient for marginalized linguistic ecosystems. Instead, the implementation of the "Cognitive Programming Paradigm" proved highly effective. By instituting a strict ban on L1 translational scaffolding and systematically programming the prescriptive rules of English morphology as descriptive, logical mechanisms, educators successfully bypassed fossilized L1 neural pathways. The incremental, bottom-up assembly of English syntax—strictly progressing from isolated active verbs to fundamental intransitive binaries—allowed learners to mentally map a discrete SVO operating system. The results have decisively demonstrated a significant reduction in syntactic malformations and a restoration of intellectual self-trust among both high school and collegiate cohorts, proving that the perceived inability to learn English is an induced pedagogical failure rather than an inherent intellectual deficit.Crucially, this research establishes a vital theoretical and practical blueprint for navigating the GenAI epoch in language education. The findings assert that GenAI cannot be passively integrated into the classroom; it must be consciously subordinated to human intentionality.

By operationalizing forced, unassisted oral articulation and public defence as the primary metrics of evaluation, the intervention successfully prevented the learners from utilizing GenAI for cognitive offloading. Forcing students to spontaneously retrieve lexical items and execute their internalized syntactic programming under unmediated pressure rigorously exercised the listening, speaking, and reading competencies that AI inherently bypasses. Furthermore, the mandatory cross-verification stage—where students have critically compared their organic, articulated outputs against machine-generated texts—has transformed the algorithmic threat into an advanced metacognitive tool. This comparative auditing process has successfully facilitated the transition from passive GenAI dependency to empowered, critical GenAI utilization. The broader implications of this study demand an urgent paradigm shift at both the instructional and institutional policy levels. English language educators must be rapidly retrained to function not merely as evaluators of written products, but as cognitive architects capable of managing typological dissonance and auditing algorithmic integration.

Concurrently, institutional assessment frameworks must pivot away from high-stakes written examinations, which incentivize the outsourcing of natural intelligence, and prioritize formative, real-time oral performance. Ultimately, the future of ELT in the twenty-first century hinges on our collective pedagogical response to technological automation. To secure genuine communicative competence, educators must aggressively protect the fundamental cognitive friction required for learning from the allure of algorithmic frictionless generation. By demanding structural rigor, explicitly programming linguistic mechanics, and fiercely preserving the difficult, irreplaceable human struggle of language acquisition, educators can ensure that technological advancement serves to amplify human cognitive agency effectively rather than silently extinguish it.

7. Limitations of the Study

While the proposed systematic programming and forced oral defence frameworks offer a robust pedagogical countermeasure to the intersecting crises of L1 interference and GenAI dependency, this study is subject to several inherent limitations. Primarily, the scope of the research is geographically and demographically bounded to the rural and semi-urban landscapes of West Bengal. The intervention specifically targets the typological dissonance between the Bengali Subject-Object-Verb (SOV) native architecture and the target English Subject-Verb-Object (SVO) syntax. Consequently, the operationalization and efficacy of this specific bottom-up programming approach may vary significantly when applied to linguistic environments featuring different typological characteristics, such as Verb-Subject-Object (VSO) languages or morphologically tonal systems, or within highly resourced urban educational networks.

Methodologically, the quasi-experimental design relied heavily on qualitative observational tracking, thematic interview analysis, and localized classroom interventions. While these methods have successfully captured the lived pedagogical realities and immediate behavioural shifts of the participant cohorts, the study lacks the statistical power of large-scale, randomized controlled trials. Furthermore, the framework theoretically conceptualizes and observes cognitive atrophy through behavioural and structural outputs; future research would benefit from incorporating rigorous neuro-linguistic imaging to biologically and quantitatively track the mitigation of this atrophy in real-time. Finally, the study's engagement with GenAI primarily addresses current, text-based LLMs. The rapid, continuous evolution of AI technologies—specifically the emergence of sophisticated voice-to-voice interfaces and real-time auditory translation models—presents an impending shift in how cognitive offloading will manifest in spontaneous oral communication. Additionally, the study's temporal boundaries restrict the ability to measure the long-term permanence of the established syntactic programming. Longitudinal tracking spanning multiple academic years is critically necessary to determine whether these learners maintain their critical AI auditing skills as they transition into advanced academic or professional ecosystems.

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8. Scope for Future Research

Building upon the foundational findings of the Cognitive Programming Paradigm, the scope for future research is both extensive and critically urgent. Primarily, subsequent investigations must transcend the specific typological binary investigated in this study, namely the Bengali Subject-Object-Verb (SOV) to English Subject-Verb-Object (SVO) transition. Future scholarship should rigorously test the efficacy of systematic morphological programming across a diverse spectrum of cross-linguistic frameworks. Specifically, applying this intervention to learners with Verb-Subject-Object (VSO) native architectures or languages heavily reliant on tonal morphologies will help determine the universal applicability and adaptability of this structural pedagogical model.

Furthermore, the theoretical conceptualization of GenAI-induced cognitive atrophy demands advanced empirical validation. Future methodologies must integrate neuro-linguistic imaging technologies, such as functional Magnetic Resonance Imaging (fMRI) or Electroencephalography (EEG). By biologically mapping the neural pathways of learners actively engaged in the struggle of "languaging" versus those passively offloading syntactic generation to algorithms, researchers can quantitatively measure the precise neuroplastic consequences of technological dependency. Equally critical is the necessity to adapt pedagogical research to the rapid evolutionary trajectory of AI. While this study has addressed text-based generative models, future research must urgently investigate the implications of advanced multimodal systems, specifically sophisticated voice-to-voice GenAI interfaces and real-time auditory translation algorithms. As these emergent technologies threaten to bypass the necessity for spontaneous oral production entirely, ELT researchers must proactively devise new frameworks to preserve the cognitive friction required for authentic conversational fluency.Finally, the longitudinal permanence of this pedagogical intervention warrants comprehensive investigation. Extended studies spanning multiple academic cycles are essential to rigorously track whether the newly established cognitive agency and critical algorithmic auditing skills are retained as learners transition from mediated academic classrooms into complex, unmediated professional ecosystems.

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