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Embodied warm-ups in L2: Integrating classical ballet barre practice into English language teaching

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Abstract

This paper introduces the 4Ps model, a theoretically grounded four-phase lesson architecture for primary-level L2 instruction, and presents the design and rationale of its application within an ongoing research project examining how elements of ballet training can enhance foreign language acquisition in primary education. Grounded in embodied cognition theories and neurolinguistic evidence, the study investigates how integrating ballet-derived movement can support L2 learning.

The proposed language teaching model reconceptualizes the opening phase of the English lesson by introducing ballet barre exercises as a structured psycho-physical warm-up. Unlike conventional L2 warm-ups typically centered on lexical recall, affective engagement, or pair work (Krashen, 1982), this model introduces an embodied, non-verbal dimension based on the hypothesis that the ballet barre training, long recognized in dance pedagogy as a ritualized and functional entry into movement, provides an effective structure for embodied priming and cognitive focus.

A short sequence derived from foundational ballet technique (e.g., pliés, tendus, dégagés) engages posture, proprioception, and rhythmic coordination, functioning simultaneously as physical activation and cognitive priming. Interdisciplinary research indicates that warm-ups combining motor and cognitive components enhance attention, memory, and verbal fluency (Morales et al., 2023). The model is being tested in a quasi-experimental cluster-randomized pilot study involving 50 pupils (aged 7–9) in an Italian primary school. Baseline linguistic and motor competences have been assessed and will be re-evaluated post-intervention to empirically validate the embodied pedagogical framework. Preliminary qualitative observations suggest increased attentional engagement, smoother transitions into L2 tasks, and heightened learner readiness, indicating the potential of this model to offer a replicable framework for embodied L2 learning.

Keywords: ballet-barre; embodied cognition; L2 learning; primary education; warm-up

1. Introduction

Evidence from cognitive science, developmental psychology, and applied linguistics

has increasingly challenged the long-standing assumption that language learning is primarily a symbolic, mental, and fundamentally disembodied activity. Theories of embodied cognition posit that cognitive processes emerge from the continuous interplay between neural activity, bodily action, and engagement with the environment (Barsalou, 2008; Glenberg & Gallese, 2012). Embodied accounts locate perception, attention, executive functioning, and linguistic processing within sensorimotor systems, challenging approaches to L2 pedagogy that remain largely verbal, sedentary, and cognitively abstract (Gallese & Lakoff, 2005; Garello et al., 2024).

Converging evidence from developmental neuroscience, sport psychology, and exercise physiology demonstrates that even brief bouts of coordinated movement enhance attentional control, executive functioning, and verbal fluency, capacities central to L2 acquisition (Chang et al., 2012; Diamond, 2015; Pesce et al., 2009; Alvarez-Bueno et al., 2017; Morales et al., 2023). Across these fields, the evidence suggests that motor activation may act as a form of cognitive priming, preparing learners for subsequent linguistic and communicative tasks.

Despite this growing body of evidence, its implications have yet to be systematically incorporated into L2 pedagogy. Within the widely adopted PPP (Presentation–Practice–Production) framework, the warm-up or "lead-in" phase is typically conceived as an affective or communicative device aimed at activating prior knowledge, reducing learner anxiety, and promoting engagement (Krashen, 1982; Garton & Copland, 2019; Spada & Lightbown, 2019; Husnaini et al., 2023). While such activities contribute to motivation and classroom rapport, they remain predominantly linguistic or social in nature and do not engage the neurocognitive mechanisms that contemporary research identifies as critical for learning readiness. This creates a mismatch between the pedagogical importance assigned to the lesson opening and the processes it is expected to support. Sensorimotor activation and executive regulation remain largely overlooked in conventional warm-up practices despite their recognized role in cognitive preparedness.

The study therefore tests an extension of the traditional PPP lesson structure in which a Preparation phase precedes linguistic instruction. In the proposed model, foundational ballet barre exercises are integrated into the opening phase of the English lesson as a form of embodied priming. Ballet pedagogy has long conceptualized the barre as a ritualized psychophysical transition into focused work: a codified sequence that organizes posture, proprioception, balance, coordination, rhythmic entrainment, and attentional focus (Kimmerle & Côté-Laurence, 2003).

The present paper introduces and describes the 4Ps model, an embodied L2 lesson architecture in which systematic bodily activation at the start of the English lesson supports attentional regulation and facilitates the transition into linguistic tasks (Iverson, 2010; Mathias et al., 2021).

The model is being piloted through a quasi-experimental cluster-randomized study involving fifty primary school pupils (aged 7–9) in Italy, with assessments of both linguistic and motor competences administered at pre- and post-intervention stages. Initial qualitative observations point to smoother classroom transitions, more sustained attention, and greater preparedness for subsequent L2 activities.

The resulting four-phase architecture retains the familiar logic of Presentation, Practice, and Production while adding an initial Preparation phase grounded in embodied priming. The next section details the conceptual rationale and instructional organization of the model.Conceptual framework and instructional design.

The embodied L2 lesson model developed in this study represents the paper's primary

theoretical and pedagogical contribution. By integrating insights from embodied cognition, dance pedagogy, and established approaches to English language teaching, the model provides a coherent framework through which structured bodily activation can be systematically embedded within the internal architecture of the L2 lesson. Its purpose is not merely to redesign the lesson opening, but to articulate a principled account of how sensorimotor engagement can function as a preparatory condition for linguistic cognition.

At the core of the model lies a reconceptualization of the lesson opening as a structured, embodied warm-up grounded in ballet-derived movement. Rather than functioning as a peripheral kinesthetic supplement, this opening is positioned as a psychophysical gateway into L2 learning, shaping learners' cognitive readiness before explicit linguistic input is introduced (Barsalou, 2008; Glenberg & Gallese, 2012).

The embodied warm-up is designed to operate simultaneously at physiological and cognitive levels. Physiologically, it promotes blood circulation, joint mobility, postural alignment, and proprioceptive awareness. Cognitively, it engages executive functions by requiring learners to coordinate sequencing, inhibition, spatial orientation, and error monitoring while following a guided and synchronized movement sequence (Chang et al., 2012; Chaddock-Heyman et al., 2014; Pesce et al., 2009; Thaut et al., 2015). These functions are directly implicated in the management of linguistic input and output, particularly in young learners, for whom attentional control and self-regulation are still developing (Nicholas & Lightbown, 2008). This preparatory phase does not aim to introduce linguistic content directly. Unlike conventional lead-ins that activate prior vocabulary or elicit immediate speech production, its function is preparatory and foundational. It establishes the psychophysical conditions under which linguistic learning can unfold more effectively, fostering a state of regulated arousal and focused attention. Only once this embodied readiness has been established does the lesson proceed to phases in which lexical and grammatical forms are explicitly addressed. In this way, the preparatory phase shapes the quality of engagement with subsequent instructional activities.

The decision to draw on classical ballet barre practice as a template for the embodied warm-up is theoretically and pedagogically motivated, as the barre constitutes a ritualized transition to technically controlled activity through a codified sequence organizing posture, alignment, balance, proprioception, and attentional focus (Kimmerle & Côté-Laurence, 2003; Bläsing et al., 2012; Bläsing, 2022). When adapted to the L2 classroom, the embodied warm-up employs simplified versions of foundational barre movements such as pliés, tendus, and dégagés. These movements are stripped of aesthetic demands and reconfigured to ensure developmental appropriateness, safety, and accessibility. Emphasis is placed on controlled flexion and extension, clear spatial orientation, postural stability, and a slow, unhurried tempo.

The sequence, lasting approximately 30 minutes, is implemented consistently at the beginning of each English lesson, thereby establishing a predictable ritual that signals entry into a cognitively and corporeally distinct learning space.

The teacher's verbal counting, together with recorded music, serves a precise cognitive function: it synchronizes bodily movement with attentional focus (Thaut et al., 2015). This synchronization supports arousal regulation, reduces restlessness, and facilitates a state of alert calm conducive to sustained engagement with linguistic input (Diamond, 2015; Pesce et al., 2009).Through repetition, the routine evolves into a shared classroom ritual that scaffolds behavioral regulation and attentional alignment over time. The successful enactment of the model depends critically on teacher

mediation. Although the movements are derived from ballet, the intention is neither to transform the English lesson into a dance class nor to require technical proficiency. Rather, the teacher guides the sequence calmly and transparently, explicitly framing the warm-up as a means of "getting the brain ready to work in English." This pedagogical framing enables learners to understand the cognitive purpose of bodily activation without construing it as performance. Over time, the ritualized nature of this opening routine supports smoother transitions into focused L2 engagement, an effect well documented in primary education research.

Classical ballet provides a particularly coherent and well-documented template for structured activation; the model is intentionally scalable and advances a broader educational principle: the body can function as a deliberate epistemic instrument for preparing the mind to learn a foreign language. This conceptual reframing of the PPP model into a four-phase (4Ps) architecture constitutes the core pedagogical variable operationalized in the experimental study described in the following section.

Within the present model, the term *embodied priming* is used to designate the theoretical construct underlying the proposed lesson architecture. It refers to the pedagogically designed process through which structured bodily experience prepares learners for subsequent language learning. The *embodied warm-up* represents the instructional procedure through which this construct is operationalized in classroom practice. In the present study, this procedure takes the form of a ballet-derived movement sequence, although the construct itself is not intrinsically linked to ballet. At the behavioral level, the construct is enacted through purposeful *bodily activation*, while its hypothesized effects are interpreted in terms of *sensorimotor activation*, referring to the neurocognitive processes involved in attentional regulation and the preparation for subsequent linguistic activity. This distinction is adopted throughout the present paper in order to differentiate the theoretical construct from its pedagogical implementation, the observable learner behavior, and the underlying neurocognitive mechanisms.

1.1 Reframing the PPP framework: The 4Ps architecture

Within traditional PPP (Presentation, Practice and Production) pedagogy, the warm-up or lead-in is typically conceived as a brief affective or communicative phase designed to activate prior knowledge, introduce the lesson topic, and ease learners into the target language environment (Spada & Lightbown, 2019; Anderson, 2017). While such activities fulfil important motivational and social functions, they remain predominantly linguistic and cognitive in orientation, leaving the body largely absent as an active agent in the learning process.

The embodied L2 lesson model proposed in this study advances a stronger epistemological stance by reframing the warm-up as a Preparation phase grounded in embodied priming.

Priming is not conceptualized as vocabulary pre-teaching or as a communicative lead-in, but rather as a non-verbal, structured form of neurocognitive preparation that conditions the effectiveness of subsequent linguistic instruction. Drawing on research in embodied cognition, the model assumes that readiness for language learning emerges from bodily activation, particularly through posture, proprioceptive engagement, rhythmic alignment, and attentional modulation (Barsalou, 2008; Iverson, 2010). On this basis, the traditional PPP structure is expanded into a four-phase (4Ps) framework comprising Preparation, Presentation, Practice, and Production. The first phase is termed Preparation because it represents the pedagogical stage through which the

process of embodied priming is intentionally implemented. The model thus preserves the pedagogical logic of PPP while extending it through an embodied preparatory layer aligned with contemporary accounts of cognition.

Within this reframed architecture, Preparation functions as a foundational phase that conditions the effectiveness of all subsequent instructional stages.

The Preparation phase supports attentional regulation, executive control, and sensorimotor integration, thereby enhancing receptivity to linguistic input and supporting more stable form–meaning mapping during practice and production.

Table 1 summarizes the pedagogical organization of the 4Ps model as implemented in the present study. This framework constitutes the instructional intervention.

Table 1. 4PS Model: Phases and pedagogical functions

PHASE	**CORE FEATURES**	**COGNITIVE–PEDAGOGICAL FUNCTION**
PREPARATION	Structured ballet-derived movements (posture, balance, rhythm, spatial orientation); slow, synchronized execution under teacher guidance	*Embodied priming: regulation of arousal; activation of executive and sensorimotor networks; establishment of attentional readiness for L2 input*
PRESENTATION	Introduction of lexical and grammatical content through multimodal input (speech, gesture, visual support)	Grounding of linguistic forms in sensorimotor experience; facilitation of form–meaning mapping
PRACTICE	Controlled and semi-controlled activities integrating gesture, movement, and language use	Consolidation of linguistic structures; scaffolding of retrieval through embodied cues
PRODUCTION	Communicative tasks with optional gesture support and reflective closure	Integration of linguistic, cognitive, and embodied processes; reinforcement of communicative confidence and fluency

This framework constitutes the instructional intervention that was subsequently operationalized and examined within the quasi-experimental cluster-randomized design described in the following section.

2. Methods

The empirical component of the study was conceived as a pilot evaluation of the embodied L2 lesson model described in Section 2. Its primary aim was to determine whether this theoretically grounded model, centered on a structured, ballet-derived warm-up, could produce measurable effects on learners' attentional readiness, motor performance, and early English L2 development.

A key feature of the experimental design is the transition from a traditional PPP lesson structure to a four-phase (4Ps) framework. Specifically, the Preparation phase systematically replaces the conventional linguistic warm-up, thereby allowing its

effects to be examined within a controlled comparison between naturally occurring classroom groups.

To achieve this aim, the model was operationalized within a quasi-experimental cluster-randomized design, combining implementation in a natural classroom context with class-level random allocation while preserving the ecological characteristics of the educational setting.

2.1 Study design

The study employed a quasi-experimental design with cluster-level random assignment. Two intact classes from the same Italian primary school were randomly assigned to either the experimental or control condition. Randomization was therefore performed at the class rather than the individual level, preserving the naturally occurring classroom structure while reducing the potential for selection bias in condition assignment (Shadish et al., 2002). Both groups were taught by the same teacher and followed identical curricular content; consequently, the warm-up phase constituted the only systematically manipulated component of the lessons.

The participant cohort comprised 50 children aged between seven and nine years, all monolingual Italian speakers with comparable exposure to English as a foreign language. Informed consent was obtained from parents, and the study procedures were explained to the pupils using developmentally appropriate language. The decision to focus on this age range was grounded in developmental research highlighting the co-emergence of motor, executive, and linguistic systems in early and middle childhood, rendering this population particularly suitable for examining the cognitive consequences of bodily activation (Iverson, 2010; Gonzalez et al., 2019).

2.2 Intervention procedures

In the experimental classes, the 4Ps model is being implemented through a short ballet-derived warm-up lasting approximately 30 minutes at the beginning of each two-hour English lesson. The sequence draws on classical barre pedagogy (Kimmerle & Côté-Laurence, 2003; Bläsing et al., 2012; Bläsing, 2022) and incorporates foundational movements such as pliés, tendus, and dégagés. Although the movement sequence draws on movement principles derived from classical ballet, the incorporation of these elements does not serve any aesthetic or performative purpose. Rather, the model retains technical rigor of execution, such as precision of alignment, controlled range of motion, and attentional focus, while fully respecting the structural, developmental, and physiological constraints of primary school children.

Movements are evaluated solely in terms of their functional contribution to bodily organization and cognitive readiness, rather than stylistic or artistic quality. The routine emphasizes controlled flexion and extension, clear spatial orientation, postural organization, and slow rhythmic execution. The 30-minute duration was selected in light of evidence indicating that moderate bouts of structured, cognitively engaging physical activity within the 20–45-minute range are associated with measurable improvements in executive functioning and attentional control in children (Chang et al., 2012; Tomporowski et al., 2015; Xu et al., 2025). This timeframe was therefore considered sufficient to stabilize psychophysiological activation prior to L2 instruction while remaining compatible with standard lesson structures.

In the present pilot phase, the embodied warm-up was implemented in collaboration with a trained classical ballet specialist. The protocol itself was developed at the intersection of motor science research on coordinated, cognitively engaging movement and established principles of ballet pedagogy, drawing on both empirical literature in

exercise–cognition studies and systematic observations conducted within professional dance academy settings. The involvement of a specialist was intended to ensure biomechanical precision, rhythmic integrity, and fidelity to the codified structure of the barre-derived sequence during this initial validation stage. This expert-led implementation was conceived not as a permanent dependency, but as a design-verification phase aimed at refining sequencing, temporal pacing, and instructional framing prior to teacher-led delivery. Observational field notes, procedural logs, and implementation feedback collected during the pilot are currently informing the development of structured training materials and guidelines for classroom teachers, thereby supporting the model's pedagogical transferability and long-term scalability beyond specialist facilitation. Particular attention was paid to feasibility and safety. All movements were developmentally adapted, excluding extreme ranges of motion or load-bearing demands, and were implemented under continuous teacher supervision. Fidelity of implementation was monitored through classroom observation protocols and teacher logs documenting adherence to sequence, tempo, and instructional framing. No adverse events or physical discomfort were reported during the intervention period.

Movement guidance is provided through verbal counting and recorded classical music, consistent with the model's emphasis on attentional synchronization and deliberate bodily awareness.

The warm-up is conceptualized as a psychophysical entry into the lesson and is designed to activate motor and proprioceptive systems, regulate arousal, and stimulate executive functions such as inhibition, sequencing, and selective attention, processes that are central to L2 comprehension and production. In this respect, the Preparation phase provides the pedagogical context through which embodied priming is translated into classroom practice. The control class follows a traditional PPP-style warm-up typical of primary-level L2 instruction (Anderson, 2017; Spada & Lightbown, 2019). These activities focus on lexical recall, affective engagement, or brief communicative exchanges and are therefore predominantly verbal and social rather than physical. Although pedagogically valid, they do not involve any structured motor component, making them appropriate as a comparison condition for isolating the effects of embodied activation.

The intervention is being conducted over the course of one school year, with one two-hour English lesson per week. Throughout the study, classroom observations are being conducted to document behavioral transitions, attentional readiness, and fidelity to the warm-up protocols. To ensure consistent implementation of the embodied warm-up, the teacher has received preparatory training focused on movement modelling, pacing, and verbal cueing. This training is essential to ensure that the experimental condition represents a faithful enactment of the theoretical model.

2.3 Assessment instruments

A set of complementary assessment instruments is being employed to capture changes across linguistic, motor, and attentional domains. Linguistic competence is being assessed using the Cambridge English Pre-A1 Starters test, which provides an age-appropriate measure of early receptive and productive English language skills within the Pre-A1 proficiency range (Alexiou & Stathopoulou, 2021). Motor competence is being measured using the *Test of Gross Motor Development–Third Edition* (TGMD-3), a standardized instrument widely used to assess gross motor abilities in children.

Attentional and executive functioning are being assessed using multiple measures.

Sustained attention and inhibitory control are being evaluated through selected subtests of the BVN battery (*Batteria di Valutazione Neuropsicologica per l'Età Evolutiva*; Bisiacchi et al., 2005). In addition, a teacher-completed observational checklist is being used to document classroom-based indicators of attentional focus, distractibility, and the smoothness of transitions from the embodied warm-up into the core lesson.

Collectively, these measures have been selected to reflect the cognitive domains most directly implicated in embodied cognition and motor–cognitive priming research.

All assessments are being administered at two time points: baseline (T0), and post-intervention (T1). This repeated-measures design is intended to examine change over the intervention period and to explore whether changes in motor or attentional functioning are associated with gains in linguistic performance.

2.4 Data analysis

Quantitative analysis will focus on changes over time and differences between the experimental and control groups across baseline and post-intervention. Given the pilot nature of the study and the use of only two intact classes, inferential results will be treated as exploratory. Changes over time will be examined, where appropriate, through mixed-effects models in which repeated observations are nested within participants, allowing changes over time and their interaction with condition to be estimated. Since randomization occurred at class level, with one class assigned to each condition, classroom variance cannot be estimated independently from the intervention condition and will therefore not be modelled as a random effect. This constraint will be taken into account when interpreting between-group differences. Effect sizes and confidence intervals will accompany inferential statistics to indicate the magnitude and uncertainty of the observed effects. Associations between changes in motor competence, attentional functioning, and linguistic performance will also be explored through correlational analyses, consistent with the proposed relationship among these domains within the embodied learning framework.

Classroom observations and teacher journals will undergo inductive thematic analysis, focusing on recurrent patterns of behavioral regulation, attentional alignment, learner engagement, and embodied participation. The qualitative material will provide a contextual account of how the warm-up operates in everyday classroom practice and of learners' responses to its implementation.

2.5 Ethical considerations

The study has received ethical approval from the university's ethics committee. All data are being anonymized in accordance with the Italian data protection law, and pupils are reminded that participation is voluntary and that they may withdraw at any point without penalty. These ethical procedures ensure that the empirical investigation of the model is conducted with full respect for the rights, safety, and dignity of the participating children.

3. Results and discussion

Given the ongoing nature of the quantitative analyses, this section focuses on qualitative findings and their theoretically informed interpretation. While statistical analyses of the quasi-experimental study are still in progress, the qualitative corpus derived from classroom observations, teacher journals, and informal learner feedback already delineates a coherent and theoretically consequential pattern of effects. These findings provide a valuable lens through which to examine how the embodied warm-

up model operates *in situ* and how its pedagogical mechanisms align with predictions derived from embodied cognition and motor–cognitive priming theories, as outlined in Section 2.

From the earliest weeks of the intervention, pupils in the experimental condition have demonstrated a noticeably smoother and more rapid transition into English lessons, requiring fewer teacher prompts and displaying a more stable attentional posture during initial instructional phases. These behavioral patterns are consistent with existing research indicating that structured movement sequences modulate arousal, enhance inhibitory control, and prime attentional networks (Diamond, 2015; Tomporowski et al., 2015). Within the classroom ecology, the ballet-derived routine appears to function as a form of psychophysical entrainment, establishing a shared behavioral rhythm that extends organically into subsequent vocabulary and grammar tasks. Teacher journals frequently describe the post–warm-up classroom climate as "calmer but more alert," capturing an optimal balance between physiological regulation and cognitive activation.

These gains in attentional regulation appear to coincide with early qualitative indications of linguistic benefits. During vocabulary elicitation activities, learners who have completed the embodied warm-up tend to produce target items with greater fluency, spontaneity, and confidence. Their oral responses are often supported by self-generated gestures, which appear to function as internal mnemonic anchors facilitating more efficient lexical retrieval. Learners in the experimental group also volunteer responses more readily and assume communicative risks earlier in the lesson, suggesting that the routine supports not only cognitive readiness but also willingness to communicate, an affective dimension closely intertwined with L2 development. These observations accord with research indicating that motor activation enriches lexical encoding and retrieval, particularly when multimodal linguistic input follows immediately after bodily movement (Macedonia, 2019; Glenberg & Gallese, 2012).

Although learners remain at an early stage of morphosyntactic mastery, the experimental group demonstrates a more stable and confident use of the target structure, frequently deploying self-referential gestures (e.g. pointing to body parts) to scaffold production.This form of embodied mediation appears to reduce hesitation and sustain communicative flow, suggesting that embodied priming may support executive functions and sensorimotor grounding processes essential for morphosyntactic mapping and controlled production.

The opening routine appears to function as a ritualized threshold activity that signals the transition from pre-lesson states to cognitively demanding English work, thereby reducing the attentional negotiation typically required at the beginning of lessons. Learners themselves articulate positive affective evaluations, describing the routine as "fun," "helpful for starting English," and something that "wakes the brain," reinforcing the model's potential to shape motivation and emotional readiness alongside cognitive preparedness.

Taken together, these qualitative findings provide preliminary, context-bound indications consistent with the study's central theoretical proposition: that replacing traditional, predominantly verbal warm-ups with an embodied warm-up can meaningfully enhance the neurocognitive preconditions for L2 learning. While quantitative analyses are still ongoing, the qualitative patterns observed thus far suggest potential improvements in attentional regulation, lexical retrieval, behavioral organization, and learner engagement. These preliminary indications position the embodied warm-up not as an ancillary or decorative addition to the lesson structure,

but as a foundational pedagogical phase that optimizes the conditions for subsequent linguistic work. The consistency and coherence of these emerging qualitative patterns point to the model's practical feasibility, low implementation cost, and strong pedagogical alignment with contemporary cognitive science. While further statistical analyses and longitudinal follow-up will be necessary to determine the durability and generalizability of these effects, the evidence currently accruing suggests that the embodied warm-up model constitutes a promising, theoretically grounded, and developmentally sensitive innovation in primary-level L2 pedagogy.

4. Limitations

This pilot study was conducted within a single institutional context and involved one classroom teacher during the instructional phase, which may introduce teacher-specific influences and limit the generalizability of the findings. Although this design ensured consistency across conditions, broader replication across multiple sites and instructors will be necessary to assess transferability.

While participants were not explicitly informed of being observed for research purposes, the introduction of a novel and highly structured embodied priming routine—along with the presence of a specialist facilitator during the pilot phase—may have influenced levels of engagement independently of the neurocognitive mechanisms hypothesized. Future longitudinal designs will be needed to disentangle sustained cognitive effects from possible novelty-related influences.

Although no observable gender-related resistance or discomfort emerged in response to the ballet-derived movement sequence, dance-based forms may carry sociocultural associations that vary across educational contexts. While the routine was framed functionally rather than aesthetically, further research in more diverse settings will be important to examine how cultural and gendered perceptions may shape participation.

Moreover, as quantitative outcome analyses are still in progress, the present interpretations remain preliminary and should be considered exploratory. Continued empirical investigation will be essential to determine the durability, scalability, and broader applicability of the 4Ps model.

5. Conclusion

This study advances a reconceptualization of early foreign language instruction by foregrounding the body as a constitutive element of cognition rather than a mere accessory to linguistic activity. Drawing on insights from embodied cognition, developmental psychology, and neuroscience, it argues that a structured, ballet-derived warm-up can function as an effective form of psychophysical preparation for L2 learning, priming the attentional, emotional, and executive systems that underlie linguistic processing (Barsalou, 2008; Glenberg & Gallese, 2012; Varela et al., 1991). This perspective challenges dualistic pedagogical traditions that separate mind and body and instead aligns language instruction with contemporary accounts of cognition as situated, sensorimotor, and dynamically enacted.

Qualitative evidence emerging from the pilot implementation provides initial support for this theoretical stance. Classroom observations and teacher journals consistently point to smoother behavioral transitions, enhanced attentional regulation, and more immediate readiness for linguistic engagement following the embodied warm-up. These classroom-level effects resonate with neuroscientific research indicating that structured motor activation modulates executive functioning, stabilizes arousal, and enhances the cognitive substrates of memory and verbal performance (Diamond, 2015;

Hillman et al., 2008). From this perspective, the embodied warm-up may function as a targeted cognitive intervention that shapes the conditions under which L2 learning can unfold. More broadly, the study contributes to ongoing debates in applied linguistics and educational neuroscience by illustrating how embodied pedagogies can be operationalized through concrete, developmentally appropriate classroom routines (Zhang et al., 2021). The ballet-derived sequence exemplifies how rhythmic, proprioceptively rich movement may be ritualized to bridge unregulated pre-lesson states and the focused engagement required for L2 tasks, aligning with embodied language research on gesture, enactment, and multimodal learning (Tellier, 2008; Macedonia, 2019; Oppici et al., 2023).

Integrating the embodied warm-up within the established PPP framework, the study further demonstrates that traditional language teaching models can be meaningfully extended without abandoning their core pedagogical logic. Movement at the outset of the lesson may therefore enable learners to enter the Presentation phase in a more cognitively prepared state, offering an evolutionary, rather than disruptive, pathway for innovation in L2 pedagogy. While the findings remain preliminary and context-specific, the convergence between qualitative classroom evidence, theoretical grounding, and existing empirical literature offers convergent indications of the pedagogical potential of embodied warm-ups. Such practices acknowledge the interdependence of motor, cognitive, and linguistic development in childhood (Iverson, 2010; Adolph & Hoch, 2019), providing young learners with a holistic entry into language learning that is attuned to their physiological and attentional needs. By foregrounding structured movement as an epistemically grounded pedagogical resource, the embodied warm-up model proposes a potentially scalable, theoretically informed, and developmentally sensitive approach with the potential to enrich the ecology of the early L2 classroom.

Author contributions

The contribution presented in this manuscript is the result of joint work by the three authors. Claudia Capaci conceptualized the study, developed the theoretical framework, and designed the didactic model for embodied L2 learning, and authored Sections 1 (Introduction), 2 (Conceptual framework and instructional design), 2.1 (Reframing the PPP framework: The 4Ps architecture), which constitute the theoretical core of the work, as well as Sections 3 (Methods), 3.1 (Study design), 3.2 (Intervention procedures), and 3.3 (Assessment instruments). Gabriella Ferrara contributed to data collection and classroom implementation and is responsible for Sections 3.4 (Data analysis) and 4 (Results and discussion). Janet Wolf provided academic support during the research and implementation phases, contributed specifically to Sections 3.5 (Ethical considerations) and 5 (Limitations), and participated in writing the final conclusions.

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