



Embodied Language Learning in the Age of AI: Insights from Five Years of Scaffolded Language Emergence

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Abstract

What is the place of physical elements in the language classroom in the age of artificial intelligence? This paper summarizes the results of five years of implementing the Scaffolded Language Emergence (SLE) approach in foreign language teaching, with a particular focus on the role of physical elements in learning. SLE is an approach that promotes language emergence in adult learners and was developed by Dr. Donald Kiraly at the University of Mainz. To date, it has been applied to more than fifteen languages, including minority and endangered languages.

The paper presents experiences from the Institute of Applied Language Studies at the University of West Bohemia in Pilsen, where SLE has been used in foreign language instruction, as well as its application in supporting the teaching of Lower Sorbian, an endangered West Slavic minority language. Drawing on concrete classroom examples, the paper demonstrates how physical interaction, movement, objects, and other embodied activities contribute to learner engagement, meaning-making, and sustained language development.

The findings underscore the continued importance of face-to-face teaching contexts that facilitate the integration of physical elements, particularly at a time when language instruction is increasingly shifting to virtual environments. The paper argues that embodied, socially situated learning practices offer distinct advantages that complement digital and artificial intelligence-based learning tools, and that SLE provides a viable framework for maintaining these benefits in contemporary language education, offering also critical advantages for the revitalization, maintenance, and teaching of minority and endangered languages.

Keywords: SLE, Scaffolded Language Emergence, language learning and acquisition, language teaching, embodied activities

1. Introduction

The rapid expansion of artificial intelligence (AI) in education has significantly transformed language learning environments. AI-driven tools now offer adaptive feedback, automated assessment, and personalized learning pathways, reshaping how languages are taught and acquired. While these developments bring undeniable advantages, they also raise important questions about what may be lost as language learning increasingly shifts toward virtual, technology-mediated contexts.

One key concern is the diminishing role of physical, embodied interaction in the language classroom. Language is not only a cognitive system but also a socially and physically situated practice, deeply connected to movement, gesture, space, and material interaction. In this context, approaches that foreground embodiment may offer valuable counterbalances to purely digital learning environments.

This paper explores the role of physical elements in language learning through the lens of Scaffolded Language Emergence (SLE), an approach developed by Donald Kiraly. Drawing on five years of implementation at the Institute of Applied Language Studies at the University of West Bohemia in Pilsen (UWB) and in the high school context, the study examines how embodied activities contribute to learner engagement, meaning-making, and sustained language development. It also considers the relevance of SLE in teaching minority and endangered languages, with particular reference to Lower Sorbian.

The paper addresses the following research questions:

- How do embodied activities support language emergence?
- What is the role of SLE alongside AI-based tools?
- How can embodied approaches contribute to the teaching and revitalization of minority languages?

2. Theoretical Background

2.1. Language Learning in the Age of AI



AI has become a central component of modern language education. Empirical studies report a medium-to-large overall effect on language learning outcomes, with the strongest impact on vocabulary, followed by reading, writing, listening, and speaking. At the same time, these findings highlight limitations, indicating that explicit instruction and scaffolding remain necessary, particularly for skills requiring long-term practice or metacognitive control [19].

AI-based learning environments often lack the social and embodied dimensions characteristic of face-to-face interaction. Although some studies explore integrating AI into physical activities [8], these solutions are not yet widely accessible in educational settings.

According to Ethnologue, a research institution that extensively studies the survival of the world's languages, 44.6% of the world's 7,170 living languages are currently endangered [2]. While AI performs well in high-resource languages, its application to minority and low-resource languages remains limited due to data scarcity, lower performance, and insufficient cultural contextualization. These constraints limit its ability to capture the social and embodied nature of language learning.

AI should therefore be regarded as a complementary tool rather than a substitute for human-centered, community-based approaches, particularly in the preservation and teaching of endangered languages.

2.2. Embodied Cognition and Language Learning

Embodied cognition emphasizes that cognitive processes are grounded in bodily experience and interaction with the environment. In the context of language learning, this perspective highlights the role of movement, gesture, and sensory engagement in constructing meaning.

Empirical research has demonstrated that learning through physically meaningful interaction – such as role-play, drama-based techniques, arts-based activities, object manipulation, and movement-oriented tasks – can positively influence multiple aspects of language development, including vocabulary acquisition, grammatical competence, and pronunciation. Furthermore, such approaches have been associated with improvements in memory retention, comprehension, and affective factors, including learner motivation and emotional engagement.

A systematic review of studies published between 2019 and 2020 [3] indicates that embodied approaches to language learning can facilitate holistic learner engagement while supporting the development of key language competencies. At the same time, the review identifies several gaps in the existing research, particularly regarding the application of embodied learning in secondary education contexts and its impact on intermediate and advanced learners beyond vocabulary acquisition.

2.3. Scaffolded Language Emergence (SLE)

The SLE approach was developed by Donald Kiraly during his tenure as a senior lecturer at the School of Translation, Linguistics and Cultural Studies (FTSK) at the University of Mainz. Conceived as an andragogical approach to additional language acquisition, SLE emerged from approximately fifteen years of pedagogical experimentation with a range of language teaching methods, including the Silent Way, the Structural-Global-Audio-Visual approach, the Natural Approach, the Whole Language Movement, Suggestopedia, and Communicative Language Teaching [6], including also Total Physical Response [4].

SLE foregrounds the co-construction of language through social interaction and guided participation. In contrast to approaches that prioritize explicit instruction and predefined learning outcomes, SLE emphasizes emergent language use, learner agency, and collaborative meaning-making. The approach is grounded in a set of pedagogical assumptions about adult language learning, from which a series of didactic precepts are derived [7].

| ASSUMPTIONS | PRECEPTS |
|---|--|
| 1. Perceived authenticity aids motivation | Seek authenticity and encourage authentication |
| 2. Linearity constrains learning | Embrace complexity in the classroom |
| 3. Affordances rather than input are the primary stimuli for learning | Take advantage of affordances rather than merely trying to provide input |
| 4. Knowledge is often socially constructed | Promote autonomy and collaboration, provide scaffolding |
| 5. Language is embodied | Emphasize linguistic/corporeal connections |
| 6. Affect is a key factor in learning | Welcome emotions in classroom activities |



7. Grammaticalization depends on induction and abduction Encourage inductive and abductive reasoning
abduction

Table 1. SLE assumptions and didactic precepts [7]

These principles are operationalized holistically in the SLE classroom. Embodied learning plays a central role, as activities are designed to integrate physical movement with language use, thereby activating motor memory and reinforcing learning processes. Learners engage in physically grounded tasks, ranging from simple commands (e.g., “sit down”, “stand up”) to more complex sequences involving coordinated actions (e.g., “touch your toes with your hands”, “take three jumps forward”).

A wide range of activity types can be incorporated into the SLE framework, including classroom objects, miming, role-playing, acting out stories, spatial navigation tasks (e.g., fly swatters, labyrinths), and simulations of real-world environments. Whenever possible, learning is extended beyond the classroom through engagement with authentic settings where the target language is used [4] [5] [7]. The learning environment itself is treated as flexible and dynamic: students may work in circles or semicircles, and classroom space can be reorganized to support interaction and participation. In this context, the teacher assumes the role of facilitator rather than instructor, guiding complex, emergent activities shaped by learner interaction. For this reason, SLE is more appropriately described as an approach rather than a method.

The SLE approach was successfully implemented at the University of Mainz between 2013 and 2019 in courses introducing translation students to fifteen different languages. Subsequently, between 2020 and 2022, further development took place through a series of intensive workshops at the Institute of Applied Language Studies at UWB in the Czech Republic. These workshops, conducted by Kiraly and colleagues, included instruction in Spanish, English, Italian, Russian, and Czech. As part of this initiative, a series of didactic videos demonstrating SLE principles was produced and later integrated into the university's regular study programs [12] [13] [14] [15] [16] [17] [18]. The author of this paper also implemented SLE in high school teaching.

2.4 Lower Sorbian

Among the languages employed in the series of exemplary language classes at the UWB was Czech, a West Slavic language closely related to Lusatian Sorbian. Lusatian Sorbian (Lower and Upper) is classified as an endangered minority language. The Czech Republic maintains historical and geographical ties to the region of Lusatia, which is primarily located in Germany and Poland but also extends marginally into Czech territory. Efforts to preserve and promote the Lusatian Sorbian language and culture have a long-standing tradition in the Czech Republic, notably through the activities of the Spolek přátel Lužice (Society of Friends of Lusatia), which organizes cultural events and maintains dedicated resources, including a website and library.

In the Lusatia region, Lower Sorbian is currently spoken fluently by approximately 400 speakers. In response to the ongoing decline of the language and its associated cultural practices, the Sorbian community has intensified efforts to raise awareness of its linguistic and cultural heritage. Within the formal education system, a key institution is the Niedersorbisches Gymnasium (NSG) in Cottbus, established in 1952. This bilingual secondary school requires all students to achieve proficiency in Lower Sorbian by the completion of their studies and currently enrolls approximately 500 students. However, concerns regarding the effectiveness of instructional methods in Lower Sorbian education have been documented [9].

A significant recent initiative is the Zorja project, launched in 2022 by Maximilian Hassatsky, a specialist in the Lower Sorbian language and culture. Supported by a €2.5 million grant from the German government over a nine-year period, the project aims to develop advanced proficiency (C1 level) in Lower Sorbian among adult learners. Its long-term objective is to increase the number of fluent speakers by approximately 1,000 by 2040. The program is designed as an intensive course comprising 30 hours of instruction per week over ten months, supplemented by a one-month internship at a Sorbian institution and by independent research.

During the preparatory phase, a range of language-teaching approaches was evaluated to foster communicative competence, positive learner attitudes, and sustained intrinsic motivation. Following this review, the Zorja teaching team adopted the SLE approach on a trial basis, particularly during the initial 150 hours of instruction. This initiative represents the first known attempt to systematically implement the SLE approach within a long-term foreign language learning program [20].



The need for increased attention to pedagogical approaches in the preservation of Lusatian Sorbian is further underscored by the limited scope of existing research. Previous studies have predominantly addressed linguistic aspects, including phonetics, lexicon, syntax, grammar, and etymology. Sociolinguistic aspects of Lower Sorbian [1] have also been explored in previous research, alongside studies examining the regional distribution of speakers [10] and the training of specialists at the Institute of Sorbian Studies at the University of Leipzig [11]. However, there remains a notable gap in research concerning teaching methodologies and instructional practices.

3. Methodology

3.1. Research Context

This study draws on five years (2021-2025) of implementing the SLE approach at the Institute of Applied Language Studies at UWB and in a high school context (Conservatory of Pilsen). Additional data were collected during the initial phase of the Zorja project. The research involved high school, university, and adult learners with diverse linguistic backgrounds and covered both regular foreign language courses and an intensive course format.

3.2. Data Collection and Analysis

Data on the implementation of the SLE approach, which incorporates physical elements, were collected through two primary methods: a final questionnaire administered to participants and classroom observation conducted during the teaching process. The final questionnaire was not specifically designed to investigate physical activity; however, it included items assessing perceived effectiveness and satisfaction with the teaching approach.

A qualitative research design was adopted to identify recurring patterns in embodied interaction, learner engagement, and language emergence. The analysis aimed to relate observed practices to relevant theoretical frameworks, particularly those of embodied cognition and the SLE approach.

4. Findings

4.1. SLE in High School Context

The students were asked to identify which aspects of their classes they would retain, modify, or eliminate. Of the 31 respondents, 8 indicated that they would keep all aspects of their classes, expressing general satisfaction without further elaboration. A further 18 students explicitly highlighted the teaching methods, particularly those incorporating “games,” “interesting activities,” and “interactivity.” These were described as “an original and active way of presenting the material,” with comments such as: “I always enjoy games invented by the teacher more than exercises from the workbook.”

Several responses emphasized the physical dimension of these activities, which students associated with game-based learning. Representative statements included: (a) “group and physical activities,” (b) “group work and not sitting at desks at the beginning of class, working with the interactive whiteboard, creative lessons, and games,” (c) “various activities during class (games, exercises in the classroom, etc.),” (d) “lots of practice activities, interactivity, playing theater,” (e) “group interactions (games, conversations, etc.) and dancing or any other movement,” and (f) “the fact that we don’t sit at our desks the whole class, that we actually learn through play, and that we talk more than we write.”

In the remaining five cases, students referred to aspects unrelated to physical activity, such as speaking predominantly in the target language, using visual materials, working with textbooks, incorporating songs, and engaging in conversation. Only one student expressed a preference for a more traditional instructional approach, stating: “I prefer the traditional school system; I don’t feel the need for lessons in the form of fun activities like games, flashcards, or memory games.”

When asked what they would change, 13 out of 31 students reported that no changes were necessary. The remaining responses did not emphasize physical activity; instead, they included requests such as more systematic note-taking of grammar ($n = 4$), increased use of textbooks ($n = 3$), more music and songs ($n = 3$), and greater inclusion of films and videos ($n = 2$). Other suggestions appeared only once (e.g., more conversation, more frequent testing, use of Kahoot, digital textbooks, and translation of teacher instructions). Only one student explicitly requested an increase in physical activities.



Regarding elements to be omitted, 21 out of 31 students indicated that nothing should be removed. Four students suggested eliminating textbooks and workbooks. Other isolated suggestions included reducing activities in which only a few students are active, limiting vocabulary testing on the interactive whiteboard, avoiding reading aloud when called upon, and excluding creative text-composition tasks. Only one response referred to removing a movement-related activity ("facial expressions and gestures").

4.2. SLE in University Context

During the five-year period under review, only a small percentage of the total 275 students – between 0 and 20 % per semester – participated in the final evaluation. Students expressed overall satisfaction with the course (content, teaching methods, format, and credit hours), with an average of 88 %. For the statement "I was impressed by the instructor's approach during the class/seminar," the response was selected in 100 % of cases.

The open-ended responses included comments such as: "A very engaging course. I was apprehensive at first, but my concerns proved unfounded. The professor has a very creative approach to teaching, which is highly interactive and gave me a new perspective on how a foreign language can be taught. The classes were playful and interactive, yet packed with information." The comments also mentioned how "fun" the classes were and the fact that the students "enjoyed the lessons," as well as how easy the material was to remember: "I was able to easily remember the material thanks to plenty of repetition during group work, mini-interviews, and games. Every class was interesting in its own way."

None of the comments specifically mentioned physical activities, but the methodological approach was viewed positively as a whole: "I really enjoyed the teaching methods. Every lesson was carefully prepared; we always played different games and did fun activities that helped us practice what we'd learned, and none of them were repeated throughout the entire semester – I really appreciate that. Not only did the lessons give me a great foundation in the language, but I'm also taking away lots of ideas for activities I can use when teaching a foreign language."

None of the comments that raised objections (teaching in the target language from the very beginning, the lack of structured grammar notes in the workbook) concerned the inclusion of physical activities in the learning process.

4.3. SLE in Lower Sorbian Context

After completing 150 hours of instruction using the SLE approach, the respondents (N = 10) were asked to evaluate the extent to which their communicative competence had improved. The majority reported positive development: 5 respondents indicated that their competence had "greatly improved," and 4 reported it had "considerably improved." Only 1 respondent perceived very little improvement, and none expressed uncertainty.

Regarding the main focus of instruction, the majority of respondents (n = 7) perceived a balanced approach between language structure and communication, while 3 indicated that the focus was mainly on communication. None reported a primary emphasis on language structure or expressed uncertainty. The perceived effectiveness of the teaching approach was highly positive. Six respondents rated it as "amazingly effective," and 3 as "very effective," while only 1 considered it "fairly effective." None of the respondents evaluated the approach as ineffective or not very effective.

Similarly, respondents strongly agreed that the teaching team had adopted an effective approach. Eight respondents indicated that this was achieved "to a great extent," while 2 selected "to a moderate extent." No respondents expressed negative evaluations or uncertainty.

Finally, when asked which aspects of the teaching approach might require improvement, responses were more varied. Three respondents did not provide an answer. Among the remaining responses, communicative practice was mentioned by 3 respondents, while both collaboration among teachers and grammar instruction were each identified by 2 respondents.

4.4. Classroom Observations

Observations indicate that incorporating physical elements into classroom instruction can enhance student engagement compared to more passive learning situations, in which students remain seated – often partially obscured behind desks or computer screens.

A comparison across the observed sample suggests that integrating physical activities is generally more straightforward with younger learners. Adult learners, by contrast, may initially experience discomfort or hesitation. For this reason, it is advisable to clearly explain the rationale and potential benefits of



incorporating movement-based activities into the learning process. At the same time, teachers should remain attentive to the group's needs and adapt activities flexibly to ensure a supportive learning environment.

The following types of activities have been implemented repeatedly and have received positive feedback:

- exercises involving body awareness and movement (e.g., warm-up activities at the beginning of class, coordination exercises aimed at integrating brain hemispheres)
- interaction with physical objects (e.g., pointing to, touching, lifting, or manipulating items)
- movement-based tasks such as running or quickly locating items (e.g., using fly swatters, images, objects, or information fixed on classroom walls)
- miming and dramatization of stories (e.g., daily activities, basic hygiene, study activities)
- spatial navigation activities within the classroom (with eyes open or closed)
- role-playing and simulations of real-life situations (e.g., purchasing tickets, ordering food)
- hands-on practical activities (e.g., simple cooking tasks)

5. Discussion

The findings across the high school, university, and Lower Sorbian contexts indicate that the SLE approach was perceived positively by learners of different ages and educational settings. In the high school context, students particularly appreciated interactive, game-based teaching methods, often referring to movement, group work, dramatization, and activities outside the traditional desk arrangement. These responses suggest that learners associated effective and enjoyable language learning with active participation and social interaction.

The university findings support these conclusions. Students described the classes as engaging, creative, interactive, and memorable, often emphasizing how games, repetition, and collaborative activities helped them retain the material more effectively. Interestingly, respondents rarely referred directly to physical movement itself; rather, they evaluated the teaching approach as a whole. This may suggest that, in adult education, movement-based activities become integrated into broader communicative methodology rather than being perceived as separate techniques, in accordance with the SLE theoretical framework. Some comments also indicated that students were initially uncertain about the unconventional format but later evaluated it positively after experiencing its benefits.

Similarly, the Lower Sorbian data demonstrated highly positive perceptions of communicative improvement and instructional effectiveness. Most respondents considered the instruction balanced between communication and language structure, suggesting that the SLE approach did not lead learners to perceive grammar instruction as neglected. Nevertheless, some participants still identified communicative practice and grammar explanation as areas requiring further development, again highlighting the importance of balancing experiential and form-focused instruction.

The classroom observations further confirmed that incorporating physical activities can increase student engagement and participation compared to more passive learning situations. Activities involving movement, role-play, dramatization, object manipulation, and spatial interaction were consistently received positively. However, the observations also suggested that younger learners adapted more naturally to movement-based instruction, whereas adult learners sometimes showed initial hesitation. This highlights the importance of creating a supportive classroom environment and clearly explaining the purpose of embodied activities when implementing SLE with older learners.

6. Implications for Language Teaching

While AI tools offer valuable support for language learning, they cannot fully replicate the embodied and socially situated nature of SLE practices. A balanced integration of AI tools and embodied approaches offers a promising direction for language education. Hybrid models can combine the strengths of both, ensuring flexibility without sacrificing depth of learning.

SLE ensures that learners engage in meaningful, context-rich interaction that supports deeper learning. Classes that incorporate physical activity can be perceived as playful, fun, and interactive. Language teachers – especially but not only at the high school level – should consider incorporating:

- Movement-based activities
- Use of physical objects
- Spatially organized tasks



Embodied approaches are particularly valuable in teaching minority and endangered languages. They support cultural transmission, community building, and meaningful engagement, all of which are essential for language maintenance.

7. Conclusion

This paper examined the role of physical and embodied elements in language learning through five years of implementing the Scaffolded Language Emergence (SLE) approach in high school, university, and minority-language contexts. The findings indicate that learners generally perceived SLE positively, particularly valuing its interactive, communicative, and experience-based character. Activities involving movement, role-play, games, dramatization, object manipulation, and spatial interaction were associated with increased engagement, enjoyment, and memorability of the learning process. At the same time, the results demonstrated that learners also continue to value explicit structure and grammar support, suggesting that embodied approaches are most effective when balanced with more systematic instructional elements.

The study further confirms the relevance of embodied cognition theories in contemporary language education. Classroom observations and learner responses suggest that physical participation can support attention, emotional involvement, social interaction, and meaning-making in ways that extend beyond purely cognitive or screen-based learning environments. These findings are particularly significant in the context of increasing digitalization and the growing presence of artificial intelligence in language education. While AI-based tools provide important advantages, including adaptive feedback, individualized practice, and flexible access to learning materials, they cannot fully replicate the embodied, interpersonal, and socially situated dimensions of language learning observed in SLE classrooms.

The findings are also relevant for the teaching and revitalization of minority and endangered languages, such as Lower Sorbian. In such contexts, language learning is closely connected to community, identity, and cultural practice. Embodied and collaborative activities may therefore play an important role not only in developing communicative competence but also in strengthening learner motivation, social belonging, and meaningful engagement with the language. The positive evaluations of the Zorja project participants suggest that SLE offers considerable potential for long-term minority-language education focused on communicative use and sustainable learner involvement.

Rather than positioning embodied learning and AI-driven learning as competing paradigms, this paper argues for their complementary integration. AI tools can effectively support repetition, vocabulary development, pronunciation practice, and autonomous learning, while embodied approaches such as SLE contribute social interaction, contextualized communication, emotional engagement, and physical experience. Future language education may therefore benefit most from hybrid models that combine technological innovation with human-centered, embodied pedagogy. In this respect, SLE represents a valuable framework for preserving the interpersonal and experiential dimensions of language learning in an increasingly digital educational landscape.

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