INTEGRATING UDL AND 4E COGNITION IN SECOND LANGUAGE ACQUISITION: AN ENACTIVE PERSPECTIVE

INTEGRARE I PRINCIPI DELL'UDL E IL PARADIGMA DELLA 4E COGNITION NELL'ACQUISIZIONE DI UNA L2 IN UNA PROSPETTIVA ENATTIVA

Floriana Di Gesù
Università degli Studi di Palermo
floriana.digesu@unipa.it

Elisabetta Fiorello
Università degli Studi di Palermo
elisabetta.fiorello@unipa.it

Rosa Anna Prestigiacomo
Università degli Studi di Palermo
rosannaprestigiacomo10@gmail.com

Double Blind Peer Review

Citation
Di Gesù, F., Fiorello, E., & Prestigiacomo, R.A. (2025). Integrating UDL and 4E cognition in second language acquisition: an enactive perspective. *Giornale italiano di educazione alla salute, sport e didattica inclusiva*, 9(2).

Doi:
https://doi.org/10.32043/gsd.v9i2.1406

gsdjournal.it
ISSN: 2532-3296
ISBN: 978-88-6022-510-8

ABSTRACT

This paper examines second language acquisition from an enactive perspective, integrating the Universal Design for Learning framework with the 4E Cognition paradigm. Through the analysis of student translation outputs, the study aims to explore how bodily, cognitive, contextual, and emotional factors may contribute to shaping learners' linguistic choices in the early stages of learning.

Il presente contributo esamina l'acquisizione di una L2 in una prospettiva enattiva, attraverso l'integrazione del framework dell'Universal Design for Learning e del paradigma della 4E Cognition. Lo studio si propone di esplorare, attraverso un'analisi di produzioni traduttive, in che modo fattori corporei, cognitivi, contestuali ed emotivi possano concorrere a modellare le scelte linguistiche in fase iniziale di apprendimento.

KEYWORDS

Second language acquisition; enactive didactics; universal design for learning (UDL); 4E Cognition

Acquisizione di una seconda lingua; didattica enattiva; universal design for learning; 4e cognition

Received 30/04/2025
Accepted 28/05/2025
Published 20/06/2025

1. The principles of Universal Design for Learning as a framework for second language teaching and acquisition

The principles of Universal Design for Learning (UDL), which have been built on the need to incorporate within teaching practice multiple means of representation (the "what" of learning), action and expression (the "how"), and engagement (the "why") (CAST, 2024), laid in the possibility—substantiated by neuroscientific research—to trigger changes in neural plasticity across interconnected brain networks (recognition, strategic, and affective networks) responsible for modulating learning processes and, by extension, second language (L2) acquisition (Kasch, 2018). In particular, within the field of language teaching, the UDL framework efficiently aligns with to L2 acquisition processes, thus it enables the development of personalized learning paths that align with students' diverse cognitive and learning styles embedded in their unique cultural, emotional, and motivational profiles (Joseph & Toro Añazco, 2025). This approach, consistent with the neuroscientific principle of neurovariability, is based on the awareness of the complexity and uniqueness of individual cognitive processes and of the inner variability that characterize how the brain perceives, assimilates, and organizes linguistic knowledge. From this perspective, students do not possess a fixed or isolated learning style, but instead their learning processes rely on the synergic interaction of multiple brain regions within a specific context. The cognitive configurations through which each learner approaches to the acquisition of a new language are the result of a unique combination of neurological, affective, and environmental factors similarly to other higher-order cognitive functions.

In light of these premises, it is evident how the first principle outlined in the UDL 3.0 guidelines (CAST, 2024) about providing multiple means of representation – based on the need to offer varied options for the encoding of perceptions, language, expressions, and symbols - can be applied within L2 teaching and learning processes. Operationalizing Principle 1 of UDL ensures that educators integrate a heterogeneous range of modalities (written texts, audio, video) into their instructional practices in order to convey linguistic input that can support access and comprehension, even in the presence of perceptual or communicative barriers (1.1, 1.2). In achieving this goal, teachers are called to focus on the personalization of communicative experiences and the recognition of linguistic and cultural pluralism (2.3, 2.4) that may characterize each learning environment (Cruz Rondón & Velasco Vera, 2016). As highlighted by the neuroscientific literature, individual

variability in language learning structures in multiple levels, including differences in the quality of lexical representations and in the processing of syntactic components (Kidd et al., 2018; Lowie & Verspoor, 2015). In parallel, the second principle of UDL 3.0, focused on providing learners with multiple means of action and expression, invites educators to employ a variety of communicative channels and tools—including embodied and sensory experiences (5.1, 5.2)—and to diversify instructional strategies and modes of student response (4, 4.1). Implementing this principle involves focusing on the learning process rather than solely on outcomes or achieved objectives, taking into account learners' abilities, strengths, challenges, and individual contexts. In this context, Principle 4 of the CAST (2024) guidelines—aimed at offering options for physical action—assumes particular importance, as it stimulates, from an embodied cognition perspective, motor circuits that functionally interact with brain areas involved in verbal production and comprehension (Taylor & Zwaan, 2009; Fischer & Zwaan, 2008). Finally, the third UDL principle, which highlights the importance of fostering multiple forms of active engagement and motivation (7.1–9.3), can be implemented in language teaching only if educators strive to value learners' individual interests, promote collaboration within the classroom, and likewise provide tools and strategies that support metacognitive processes and the self-regulated management of cognitive and emotional resources (Strangman et *al*., 2005; Jiménez & Barrantes, 2024).

2. The E-Cognition approach and the 4Es as models for foreign language acquisition

E-Cognition offers an integrated and dynamic view of language learning, placing the body, environment, and social interactions at the center of the learning experience. This perspective emphasizes that language is deeply connected to physical experience and social interaction within specific contexts. According to the theory of Embodied Cognition, language learning involves not only abstract brain processes but also the activation of neural circuits linked to body experience.

One of the earliest definitions of E-Cognition comes from Clark and Chalmers (1998), who argued that human cognition is not limited to brain activity alone but is extended to include the external environment. Another key figure in this field is Atkinson, who in 2010 laid the basis for two interconnected approaches to cognitive learning in his article *Extended, Embodied Cognition and Second Language Acquisition.* He stated: «*Extended cognition conceptualizes mind/brain as*

inextricably tied to the external environment, while embodied cognition views cognitive activity as grounded in bodily states and action. These two approaches are related because bodies link minds to the world-we experience, understand, and act on the world through our bodies» (Atkinson, 2010:599).

Atkinson also introduced the term sociocognition to highlight how the brain is influenced by external inputs from the environment. This perspective calls for bridging two major areas of knowledge: neuroscience and cognitive science. Understanding which neural mechanisms are activated during learning (López, 2014) is essential for improving teaching strategies. The focus thus shifts to the idea of the "body in action," based on a system where the mind, brain, and body work together to support successful language learning. This intersection forms the foundation of Embodied Cognition, which holds that: «*Organisms have not only a brain but also a body, and the mind is not separate; cognitive processes are grounded in sensorimotor experiences*» (Gómez Paloma, 2016:79)

This concept can be further expanded by considering the four dimensions of E-Cognition -Embodied, Embedded, Extended, and Enactive- to reflect the interconnected nature of cognition, presented in the models of Newen, De Bruin & Gallagher (2018), and Schiavio & van der Schyff (2018):

Embodied Cognition focuses on the physical body, where sensorimotor processes and body structures are essential components of cognitive activity. Actively involving the body during learning tasks allows the cognitive system to function more efficiently and effectively (Gallese & Lakoff, 2005).

Embedded Cognition refers to the role of the social and physical environment in shaping cognitive development. It is crucial to see the mind as part of an integrated system that includes both the body and its social context, enabling individuals to process information based on their lived experiences.

Extended Cognition involves the idea that cognitive processes go beyond the brain and are supported by external tools and elements. These non-biological factors-such as objects, technology, or written language-work together with biological processes to carry out complex tasks that the mind alone could not achieve.

Enactive Cognition is based on the work of Varela et al. (1991), who proposed that cognition emerges through an organism's active engagement with its environment. The somatosensory system is involved, and perception plays a key role in guiding

human behavior and adapting to external situations. This creates a dense network linking internal (emotional) and external (behavioral) responses.

While the first three dimensions clearly influence second language acquisition, how can enaction also be considered essential in language learning? An enactive approach to language learning involves conscious and meaningful interaction with the language, where the learner is actively engaged and gains knowledge through direct experience.

3. Translational neurolinguistics: beyond traditional language teaching

This contribution arises from the need to shift perspective by moving away from conventional knowledge and erode the boundaries of traditional language teaching. The two traditional key concepts - language and language learning- are revisited through a neuroscientific lens and positioned within the theoretical frameworks of Universal Design for Learning (UDL) and the 4E Cognition paradigm. As previously discussed, both approaches center on acknowledging learners' neurocognitive variability and emphasize the importance of designing inclusive, flexible, and neuro-compatible learning environments. To grasp the scope of this theoretical and practical integration, it is necessary to first explore the complexity of the human brain - often referred to as a *black box* - by clarifying several foundational concepts. First, following the work of Abagnale (2023), it is important to distinguish between "cognitive styles" and "learning styles." Cognitive styles represent the stable, internal mechanisms of individual mental functioning, whereas learning styles emerge from the interaction between these cognitive traits, external factors, and educational contexts. Another issue concerns two traditional core components of the language process in language education: syntax and vocabulary. From a neuroscientific perspective, syntax is mainly rooted in the unconscious area of the limbic system, while vocabulary is processed in the conscious cortical regions of the brain. However, as López (2014) points out, these two components do not operate independently; rather, they are integrated through the activation of the basal ganglia, which process cortical data and organize it into structured sequences.

Moreover, studies such as Atkinson's (2010) which highlight the critical role of mirror neurons, activated both during the execution and observation of motor

actions, emphasize the close interplay between perception, action, and language. Understanding how the body functions is essential: language learning is not solely a cognitive process but an embodied and contextual (*enacted*) experience in which language-related areas are activated simultaneously with motor and sensory systems during language production. Furthermore, the acknowledgment that both biological and environmental factors shape second language acquisition supports the idea that vocabulary is not merely a mental storage of words, but an interconnected network. López (2014) distinguishes between regular lexical networks—governed by fixed rules—and random networks—based on free connections between lexical elements. As representations of the external world become embodied in the individual, these networks are structured within the brain, forming increasingly complex lexical maps. Based on these premises, it becomes clear that UDL and the 4E Cognition paradigm can work in synergy to offer a forward-thinking theoretical model for reimagining language teaching practices. The integration of neuroscientific evidence calls for a re-evaluation of traditional instructional models and encourages approaches that view language learning as a distributed, situated, enactive, and extended phenomenon.

4. Linguistic and translational analysis of *Sinrazón* according to Di Gesù's (2023) textual linguistics analysis model: methodological premises and research hypotheses

The applied analysis presented here, aimed at integrating the principles of UDL with the 4E Cognition framework in the processes of language production and comprehension-including translation – is based on the linguistic text analysis method developed by Di Gesù (2023). This approach is grounded in the idea that learners should engage in an active and progressive interaction with linguistic material, considering both contextual and embodied dimensions of the learning experience. Specifically, the method involves an initial global reading of the text, followed by a second reading during which learners identify and underline unfamiliar terms. As Di Gesù (2023:85–86) explains: «*This neurodidactic strategy activates long-term memory stores, opening access to the mental lexicon, where a semantic chain of meanings and utterances is stored and organized*». This procedure represents an enactive and embodied didactic practice, as it stimulates the interaction between memory, body, and the learner's lived experience.

The translation sample used for the analysis-structured according to Di Gesù's model is divided into three sections, each designed to develop specific competencies:

- The first extract focuses on syntax: students are asked to translate two idiomatic expressions, focusing not only their literal meaning but also the situational context.
- The second extract explores textual aspects: learners translate a full paragraph that features a mix of formal and informal registers, with the aim of highlighting the role of lexical repertoire and individual pragmatic skills.
- The third extract centers on vocabulary: students must choose the most appropriate translation for a single term based on the communicative situation, thus promoting semantic flexibility and decision-making skills.

4.1. Research questions and hypothesis

It becomes clear that even within evaluative and assessment contexts aimed at identifying linguistic and translational competencies, adopting an enactive perspective means that the teacher prioritizes not the outcome, but the process through which each learner arrives at producing a translation. This aligns with the principles promoted by Universal Design for Learning (UDL) and the 4E Cognition framework.

From this perspective, the aim of the present study is to investigate to what extent the external environment (*entorno*) and students' levels of perceived anxiety influence their performance during the translation process. It also explores how assessment practices targeting language competence—and more specifically, translational skills—can be rethought and implemented through an enactive lens.

To this end, it was hypothesized that a linguistic-translational analysis of a set of 16 exam tasks—each involving the translation into Italian of a passage from the play *Sinrazón* by Ignacio Sánchez Mejías, based on the textual analysis model developed by Di Gesù (2023)—would make it possible to observe how learners' morphosyntactic and lexical choices reflect different modes of interaction with the text. These modes are shaped by embodied, cognitive, and enactive processes, in accordance with the principles of UDL (CAST, 2025) and the 4E Cognition model (Gola, 2024).

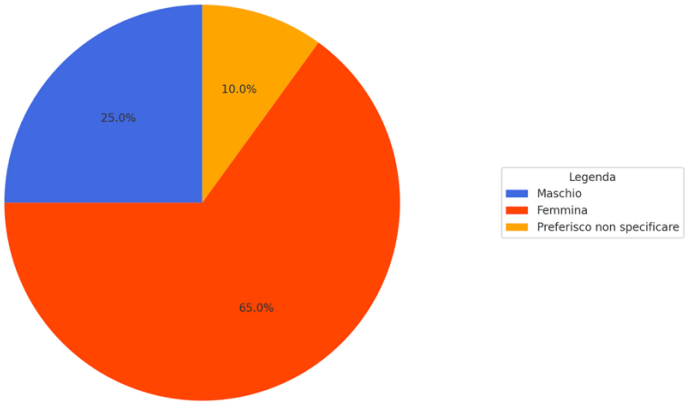
4.2 Methodological phases of the study

The methodology adopted in this study is structured into two distinct phases, carried out during the second semester of the 2024/2025 A.Y.
The study involved a group of 16 beginner students enrolled in the course *Lingua e traduzione spagnola I* at the University of Palermo, within the B.Sc degree program in *Lingue e letterature-Studi interculturali* (L11 and L12).
In the first phase of the research, an exploratory questionnaire was administered to participants in October. The questionnaire aimed to collect socio-demographic data (age, gender, employment status), to explore the motivations behind choosing Spanish as a major subject, and to assess the levels of anxiety experienced during evaluation contexts.
In the second phase, during the first examination session of the first semester (January–February), students were asked to complete a translation task consisting of rendering into Italian a passage from the play *Sinrazón* by Ignacio Sánchez Mejías. The translation activity followed the textual linguistic analysis method proposed by Di Gesù (2023) and required students to identify and translate the morphosyntactic and lexical structures of the source text, with particular attention to interlinguistic mediation phenomena and situated comprehension processes. The integration of quantitative data collection with the linguistic-translational analysis based on Di Gesù's model (2023) offered a nuanced picture of the cognitive, emotional, and environmental dynamics underlying second language acquisition. Given the use of a pre-experimental single-group design and the small sample size, the results should not be considered generalizable. Rather, they represent preliminary reflections that can guide future studies involving larger samples and more robust experimental designs.

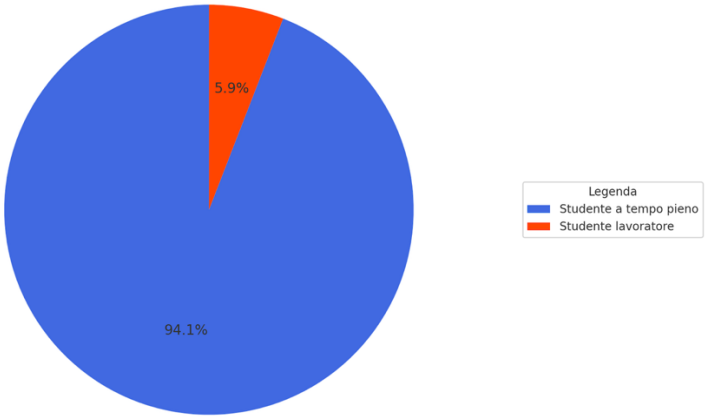
4.3. The participants of the study

The participants involved in the study were sixteen students enrolled in the course of *Lingua e traduzione spagnola I* within the B.Sc degree program in Lingue e letterature - Studi interculturali (L11 and L12) at the University of Palermo during the I semester of the 2024/2025 A.Y. Descriptive statistical analysis conducted on this convenience sample revealed (Graph 1) that 82.40% of the students identified as female, while 17.65% identified as male. Regarding employment status, 94.12% of participants reported being full-time students, while 5.88% indicated they were working students (Graph.2). The average age among participants was 19.00 years

(SD = 0.35), indicating a high degree of homogeneity in terms of age within the student group involved in the study.



Graph 1. Gender distribution of the participants



Graph 2. Employment status of the partecipants

5. Results of the exploratory questionnaire

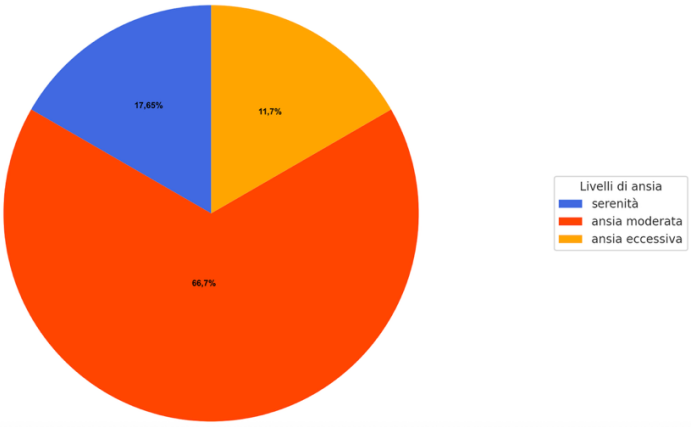
The descriptive statistical analysis of student responses to the exploratory questionnaire administered during the initial phase of the study enabled to outline the participants' motivational profiles and levels of perceived anxiety during assessment contexts. The purpose of this data collection is to provide a foundation for in-depth analysis aligned with the theoretical premises of UDL and the 4E Cognition framework.From this perspective, the aim of data collection is to gain a

more nuanced understanding of the personal learning context of the students involved in the study. As shown in Graph 3, the results reveal that, with regard to students' motivations for choosing Spanish as their major language of study, 88.90% indicated personal reasons (such as curiosity or a passion for languages) as their primary motivation. A further 5.88% cited professional reasons, while another 5.88% referred to academic or practical reasons—viewing Spanish as the most accessible foreign language within their university program. None of the students indicated family-related reasons, such as having a parent who speaks Spanish as a first (L1) or second language (L2).

Concerning perceived anxiety during assessment situations, student responses (Graph4) were gathered using a closed-ended question ("I approach assessment situations with...") and a 3-point Likert scale: 1 = calmness, 2 = moderate anxiety, and 3 = high anxiety. The average score recorded was 2.06 (SD = 0.56), indicating a moderate level of anxiety. In percentage terms, 70.59% of students reported experiencing moderate anxiety, 17.65% reported high anxiety, and 11.76% indicated approaching evaluations with calmness.

Overall, the analysis shows that most students experience a moderate level of anxiety, with the mean score above the lowest point on the scale. This finding is consistent with previous research on language learning in university contexts (Yamashiro & McLaughlin, 2001; Luo et al., 2020), and underscores the importance of considering motivational and enactive dimensions as key factors in second language acquisition, as emphasized by UDL principles and the neuroeducational 4E Cognition approach.

Graph 3. Percentage distribution of students' motivations for studying spanish



Graph 4. Percentage distribution of students' perceived anxiety levels during assessments

5.1 Results of the linguistics text analysis of *Sinrazón* according to Di Gesù's Model (2023)

The data collected stem from a detailed lexico-semantic analysis that involves, on one hand, the examination of excerpts from *Sinrazón* by Ignacio Sánchez Mejías translated by 16 beginner-level Spanish students enrolled in the course of *Lingua e traduzione spagnola I*, and on the other hand, a lexical analysis conducted from an enactive perspective, following the textual linguistic analysis model proposed by Di Gesù (2023).

JEFE. – En realidad no ha ocurrido nada; pero pudo ocurrir una catástrofe. Ya recordará usted que cuando a Collerón se le metió en la cabeza que era el comerciante más grande del mundo, dio usted orden que se le instalara un gran almacén por donde pasara todo lo que se consume en el establecimiento. Que se simulara la compra-venta con dinero falso que se había de mandar a hacer ex profeso. Todo se hizo como usted lo mandó, y tan metido estaba en su papel, que la mejor contabilidad del establecimiento era la que él llevaba. Tenía en cuenta lo que costaban las cosas, y les cargaba el trescientos por cientos a todos los artículos. Tan a maravilla llevaba su comercio, que empezamos a creer que estaba cuerdo. Ya hace algún tiempo se empezó a quejar de su negocio, diciendo que no ganaba bastante, y le dio por achacarlo a la tiendecilla que, fuera del manicomio, tiene un buen nombre que se llama Perico, el Extraño. Todos **le llevamos la corriente**, y la idea fue tomando cuerpo en su cerebro. Anoche se presentó en el patio y empezó a decir que debían salir nuestros soldados a quitar las tropas del Rey, con las que siempre estamos amenazando, como usted sabe, a nuestros enfermos. Les dijo también que Perico, el Extraño, tenía la culpa de todo lo que pasaba aquí dentro, y que el día que le quemáramos la tienda serían todos libres y no faltaría de nada. Las tropas se alborotaron; y como les dijera que eran unos cobardes si no salían, se empezaron a formar, y ya estaban dispuestos a salir, cuando nos enteramos los cabos; nos opusimos, se enfadaron, quisieron atropellarnos, y **hubo que repartir una poca de leña**. Se le avisó al médico, y don Luis dio orden que encerráramos a Collerón y a dos o tres locos de los más resueltos.

Figure 1. First extract from *Sinrazón* presented to students for translation

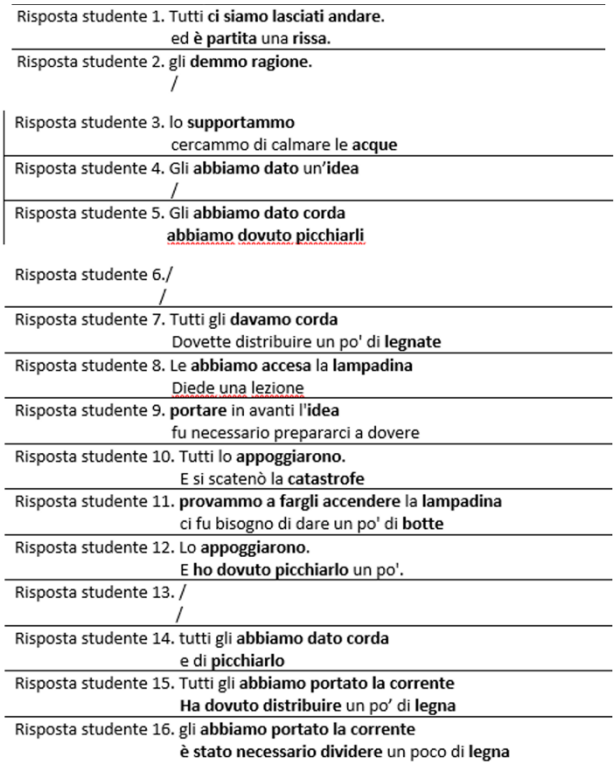


Figure 2. Student translations of the first extract from *Sinrazón*

The analysis of the translation sample (Fig. 1 and Fig. 2) reveals an interplay between UDL and the 4E Framework in students' cognitive processes during translation. From a syntactic standpoint, the examination of the first estract highlights the essential role of context in helping students understand sentence meaning. As a result, the majority of responses aligned with the intended sense of the original text—through strategies of literal transposition or adaptation—relying on the students' existing lexical knowledge. As beginners, the students were unable to accurately translate the *pretérito indefinido* (Spanish past simple tense) and instead used the *passato prossimo* (present perfect in Italian). Overall, although terms like *corriente* and *leña* were translated in various ways (*corrente, acqua, corda, idea, legna, botte, legnate*), their original meanings were preserved. Therefore, while UDL provides a cerebral mapping that allows for the personalization of cognitive styles, the 4E Cognition model acts to "regulate" or guide these cognitive profiles as they develop through the learning process.

MARCHENA. - ¿El loco de los papelitos? ¡Osú! Ese está más loco que una cabra. Tiene unos papelitos blancos donde ha escrito su nombre, y se pasa la vida dándole papelitos doblaos a todo el mundo. A ese tío hay que darle leña. ¡La diferencia que hay del hijo al padre! ¡Parece mentira! Usted me deja a mí, que yo los conozco muy pronto; leña, leña y castigo. Yo he estado en muchos manicomios, y sé cómo se trata a los locos. El loco con la pena es cuerdo.

Figure 3. Second extract from *Sinrazón* presented to students for translation

Risposta studente 1. Il pazzo dei **pezzetti di carta**? Ma no! Questo è più pazzo di una capra. Ha dei **pezzetti di carta** bianchi dove ha scritto il suo nome, e si passa le giornate dandoli a tutti.
Bisognerebbe dare una lezione a quest'uomo. C'è molta differenza tra il figlio e il padre! Non sembra vero! Lasciate fare a me che lo conosco da molto tempo, **schiaffi, schiaffi e punizione**. Sono stato in molti manicomi e so come si trattano i pazzi. **Il pazzo con una pena è un sano di mente.**

Risposta studente 2. Il pazzo dei **bigliettini**? Quello è più pazzo di una capra. Ha dei **bigliettini** bianchi in cui ha scritto il suo nome, e passa la sua vita a darli a tutti. A questo tizio bisogna **...**
La differenza che c'è dal figlio al padre! Sembra una menzogna! Lasci a me, che li conosco in poco tempo. Legna, legna e castigo. Sono stato in molti manicomi, e so come si trattano i pazzi. **Il pazzo con il dolore è sano di mente.**

Risposta studente 3. Il pazzo dei **bigliettini**? Lui é più pazzo di una capra. Ha dei **bigliettini** bianchi dove c'è scritto il suo nome, e passa la sua vita dando bigliettini piegati a tutto il mondo. A quel tizio c'è da darle legna. Che differenza che c'è dal figlio al padre! Sembra una menzogna! Lasciatemi, che io lo conosco da molto; **legna, legna e castigo**. Sono stato in molto manicomi, e so come si trattano i pazzi. **Il pazzo con la pena è sano.**

Risposta studente 4. Il pazzo dei **bigliettini**? Questo è più pazzo di una capra. Ha dei **bigliettini** bianchi dove ha scritto il suo nome, e passa la vita dando bigliettini a tutti. A questo zio bisogna dargli legna. La differenza che c'è dal figlio al padre! Sembra falso! Lui lo lascia a me, che già lo conosco molto bene; **legna, legna e castigo**. Io sono stato in molti manicomi, e so come si trattano i pazzi. **Il pazzo con dolore è sano di mente.**

Risposta studente 5. Il pazzo dei **copioni**? Eddai! È più pazzo di una capra. Ha dei **fogliettini** bianchi dove ha scritto il suo nome, e passa la vita dando fogliettini doppi a tutto il mondo. A questo uomo bisogna picchiarlo. La differenza che c'è dal padre al figlio! Sembra una bugia! Lei li lasci a me, che io li conosco subito; **picchiare, picchiare e castigo**. Sono stato in molti manicomi, e so come si trattano i pazzi. **Il pazzo con la pena è sano.**

Risposta studente 6. Il pazzo con i **bigliettini**? Quello è più pazzo di una capra. Ha dei **bigliettini** bianchi in cui ha scritto il suo nome, e passa la vita a dare a tutti i bigliettini. Quel tizio deve essere picchiato. La differenza che c'è tra padre e figlio! Sembra una bugia! Lasci fare a me, che lo conosco molto bene; **picchiarlo, picchiarlo e punirlo**. Sono stato in molti manicomi, so come si trattano i pazzi. **Il pazzo con il dolore è sano di mente.**

Risposta studente 7. Il pazzo dei **pezzetti di carta**? Orsù! Questo è proprio fuori di testa. Ha dei **pezzi di carta** che dove c'è scritto il suo nome e passa la vita a dare carte doppie a tutto il mondo. A questo zio bisogna dargli legnate. La differenza che c'è tra il figlio e il padre! Sembra una bugia! Lei mi lasci a me stesso, che io li conosco subito: **botte, botte e castigo**. Io sono stato in molti manicomi, e so come si trattano i pazzi. **Il pazzo con la pena è tranquillo.**

Figure 4. Student translations of the second extract from *Sinrazón*[1]

[1] It should be noted that, for the sake of conciseness, only a selection of the most significant translations among the 16 analyzed has been included in this section.

From a textual perspective, the second extract featured many idiomatic expressions and vocabulary typical of informal language—elements that could mislead any beginner in a foreign language. Once again, the term *papelitos* (translated as *bigliettini*, *pezzetti di carta* , *cartoline*, *copioni*, *fogli di carta* and *pezzi di carta*) (Fig. 4) preserved the meaning of the source text. However, the idiomatic expression *el loco con la pena es cuerdo* cannot be translated literally, as this would strip it of its full cultural value. According to the 4E model, this sample shows a stronger involvement of the embedded and extended dimensions rather then embodied and enactive ones: although learners had access to the context and communicative situation of the play, their limited abilities of the foreign language prevented them from fully diving into the text.

MARQUESA. - ¡Ah! ¿Tú no sabes? ¡La pobre! ¡Tan joven! **Bailoteo**, hija, bailoteo. Una fiesta, ¿sabes? Una fiesta en la que todas las señoras nos prestamos los maridos, unas a las otras, nada más que para la fiesta, naturalmente, para la fiesta, para la fiesta. ¡Ah! Sí, sí, sí, sí. Y abrazas al que quieres. Al que te dé la gana. Ellos también se prestan las señoras, como es natural, unos a los otros, para la fiesta, también para la fiesta. ¡Divertidísimo, divertidísimo! Aquí hace falta bailoteo.

Figure 5. Third extract from *Sinrazón* presented to students for translation

Risposta studente 1. **Divertimento**
Risposta studente 2. Ballare
Risposta studente 3. si balla
Risposta studente 4. Balletto
Risposta studente 5. balletto
Risposta studente 6. **Ballo scatenato**
Risposta studente 7. **Gran gala**
Risposta studente 8. Male, male
Risposta studente 9. Ballare
Risposta studente 10. Danza
Risposta studente 11. **Galateo/Buone maniere**
Risposta studente 12. Grande ballo
Risposta studente 13. Balliamo
Risposta studente 14. balletto
Risposta studente 15. Ballo
Risposta studente 16. ballo

Figure 6. Student translations of the third extract from Sinrazón

Ultimately, from a lexical perspective, it is particularly interesting to note how the term *bailoteo* allows students (Fig.5)—in the absence of a direct equivalent—to

activate their cognitive areas and generate a creative terminology (e.g., *ballo scatenato ,gran gala*, *galateo*). This indicates deeper involvement of the embodied and enactive components: although the students were provided with contextual information (the setting of the play is a palace-mental asylum) and although they knew that the speaking character is a marchioness, it is only through the mental simulation of the action conveyed by the word *bailoteo* that they are able to deep into their own experiences and expand their lexical repertoire. In fact, most of the characters in the play are patients in the mental asylum, and the high social status of the marchioness represents a source of distraction, therefore students often feel compelled to use formal language. The absence of a direct Italian equivalent for *bailoteo* therefore encourages students to move beyond familiar mental categories and create new ones (Fig. 6).

This hypothesis supports neuroscientific theories linking language—both in comprehension and production—to the motor system, particularly through the mechanism of internal simulation of mental actions. According to an embodied view of language, understanding words, concepts, or linguistic expressions activates cortical areas that overlap with those involved in performing or observing actions.

6. Conclusions

This study aimed to explore the integration of UDL principles and the 4E Cognition paradigm within the context of Spanish as a second language acquisition, from an enactive perspective. The primary goal was to demonstrate how language and translation learning processes are strongly influenced by the dynamic interaction between body, mind, and context. Although aware of the methodological limitations related to the adoption of a quasi-experimental single-group design and the small sample size, the findings nonetheless provide meaningful preliminary insights. On one hand, the analysis of the exploratory questionnaire confirmed the relevance of emotional and motivational dimensions in the language acquisition process, highlighting a predominance of personal motivations and a moderate level of perceived anxiety during assessment situation. On the other side, the linguistic-translational analysis of student work shows that morphosyntactic and lexical choices can be interpreted from an enactive perspective, as concrete expressions of the relationship between bodily experience, cognitive processes, and the

external environment. From this standpoint, the data collected suggest the need to rethink instructional and assessment practices through an enactive lens—placing emphasis not only on final outcomes, but also on the experiential processes that shape language learning.

Author contributions

This work is the result of a joint effort by the three authors; however, Floriana Di Gesù is the author of paragraph 2; Elisabetta Fiorello is the author of paragraphs 1, 4.1, 4.2,4.3 and 5; and Rosa Anna Prestigiacomo is the author of paragraphs 3,4, 5.1, and the conclusions.

References

Abagnale, L., (2023). Estilos cognitivos y estilos de aprendizaje en el campo de la adcquisición de segundas lenguas (ASL). Lynx. Panorámica de Estudios Lingüísticos, n°22, Universitat de València-Estudi General; 51-81.Atkinson, D., (2010). Extended, Embodied Cognition and Second Language Acquisition. Applied Linguistics, Oxford University Press; 599-622.Casas Gómez, M., (2020). Perspectivas actuales en el estudio del léxico. Lynx. Panorámica de Estudios Lingüísticos, n°19, Universidad de Cádiz; 5-72.

CAST (2024). *Universal Design for Learning Guidelines version 3.0.* Retrieved from https://udlguidelines.cast.org

Cruz Rondón, J. & Velasco Vera, l. F. (2016). Understanding the role of teaching materials in a beginners' level English as a foreign language course: A case study [Online]. PROFILE Issues in Teachers 'Professional Development, 18(2), pp. 125-137. http://dx.doi.org/10.15446/profile.v18n2.52813.

Di Gesù, F., (2023). El papel del análisis lingüístico del texto como trabajo propedéutico en la traducción del lenguaje específico: una perspectiva neurodidáctica. Lynx. Panorámica de Estudios Lingüísticos, n°22, Universidad de Palermo; 82-94.

Fischer, M. H., & Zwaan, R. A. (2008). Embodied language: A review of the role of the motor system in language comprehension. *Quarterly journal of experimental psychology*, 61(6), 825-850.

Gomez Paloma, F., (2016). Embodied Cognition: il ruolo del corpo nella didattica. Università degli Studi di Salerno; 75-87.

Jiménez, K. B., & Barrantes, K. S. (2024). The Relevance of UDL in English Language Beginners. *Investigación y Ciencia Aplicada a la Ingeniería*, 7(45).

Joseph , F., & Toro Añazco, J. E. (2025). The Effectiveness of Project-Based Learning and the (UDL) Framework in Acquiring English as a Second Language. *Ciencia Latina Revista Científica Multidisciplinar*, 9(1), 12685-12707. https://doi.org/10.37811/cl_rcm.v9i1.16848

Kasch, H. (2018). New Multimodal Designs for Foreign Language Learning. *Learning Tech* – Tidsskrift for læremidler, didaktik ogteknologi, (5), 28-59.

Kidd, E., Donnelly, S., & Christiansen, M. H. (2018). Individual Differences in Language Acquisition and Processing. *Trends in cognitive sciences*, 22(2), 154–169. https://doi.org/10.1016/j.tics.2017.11.006

López García, Á., (2014). Los mecanismos neuronales del lenguaje. (1era ed.), Prosopopeya Manuales, Tirant Humanidades; 9-149.

López García, Á., (2022). Gramática cognitiva para profesores de español L2. Lynx. Panorámica de Estudios Lingüísticos, n°22 (2023), Universitat de València-Estudi General; 237-243

López García, Á., Montaner, A., Morant, R., Pruñonosa, M., (2011). Redes léxicas como redes neuronales. Revista de Investigación lingüística, n°14, Universidad de Murcia; 61-86.

Lowie, W., & Verspoor, M. (2015). Variability and variation in second language acquisition orders: A dynamic reevaluation. *Language Learning*, 65(1), 63-88.

Luo, Z., Subramaniam, G., & O'STEEN, B. I. L. L. Y. (2020). Will anxiety boost motivation? The relationship between anxiety and motivation in foreign language learning. *Malaysian Journal of ELT Research*, 17(1).

Strangman, N., Meyer, A., Hall, T., & Proctor, P. (2005). Improving foreign language instruction with new technologies and universal design for learning. IALLT Journal of Language Learning Technologies, 37(2), 33-48.

Taylor, L. J., & Zwaan, R. A. (2009). Action in cognition: The case of language. Language and cognition, 1(1), 45-58.

Yamashiro, A., & McLaughlin, J. (2001). Relationships among attitudes, motivation, anxiety, and English language proficiency in Japanese college students. *Second language acquisition research in Japan*, 113-127.