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Instructional Design as a Cognitive Scaffold.

Educating thinking through language in Early Years.

Diseño instruccional como andamiaje cognitivo.

**Educando el pensamiento a través del lenguaje en
Educación Infantil.**

TRABAJO FIN DE GRADO EN EDUCACIÓN INFANTIL

(MENCIÓN EN LENGUA INGLESA)

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I would like to express my deepest gratitude

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*To the students at the school,
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*To my family,
Thank you for believing in me, even in moments of uncertainty and vulnerability.*

This achievement is as much yours as it is mine.

*And finally, to myself,
for never giving up.*

RESUMEN

El presente TFG investiga el impacto del diseño instruccional como andamiaje cognitivo en la autorregulación y las funciones ejecutivas (FE) en la Educación Infantil. Tras establecer las bases cognitivas, el estudio aborda la brecha de rendimiento examinando cómo los mediadores pueden compensar a jóvenes estudiantes cuya corteza prefrontal está madurando, en particular aquellos con perfiles impulsivos o con Trastorno por Déficit de Atención e Hiperactividad (TDAH). A través de una situación de aprendizaje sobre una reserva natural implementada en Irlanda, se examina el impacto de los mediadores visuales y se propone una mejora posterior. Como conclusión, el entorno definitivamente se convierte en una herramienta neuro educativa esencial para educar el pensamiento a través del lenguaje, optimizando el aprendizaje globalizado y la competencia socioemocional a través del Diseño Universal para el Aprendizaje (DUA) y el Aprendizaje Basado en Proyectos (ABP).

PALABRAS CLAVE

Funciones ejecutivas, autorregulación, diseño instruccional, primera infancia, neuroeducación, situación de aprendizaje, Diseño Universal para el Aprendizaje (DUA), Aprendizaje Basado en Proyectos (ABP), Trastorno por Déficit de Atención e Hiperactividad (TDAH).

ABSTRACT

The present FDP investigates the impact of instructional design as cognitive scaffolding on self-regulation and executive functions (EFs) in early years education. After setting the cognitive bases, the study addresses the performance gap by examining how mediators can compensate for young learners whose prefrontal cortex is maturing, particularly those with impulsivity profiles or Attention Deficit/Hyperactivity Disorder (ADHD). Through a nature reserve learning situation implemented in Ireland, there is an examination of the impact of the visual mediators and a subsequent improvement proposal. As an insight, the environment definitely becomes an essential neuroeducational tool for educating thinking through language, optimising globalised learning and socio-emotional competence through Universal Design for Learning (UDL) and Project-Based Learning (PBL).

KEY WORDS

Executive functions, Self-Regulation, Instructional Design, Early Years, Neuroeducation, learning situation, Universal Design for Learning (UDL), Project-Based Learning (PBL), Attention-Deficit/Hyperactivity Disorder (ADHD).

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INTRODUCTION

The development of holistic learning in Early Years (EY) is a high-standard neurocognitive challenge, where language has an essential role. The design and implementation of the Foreign language learning/acquisition lessons, creating meaningful contexts as the EY (1-2 y.o. and 3-6 y.o.) Workshops included within the Educational Innovation Project coordinated from the Foreign Language area (DLyL) in the FEDP, have led to conclusions on the link between success in language acquisition and social participation and maturation of Executive Functions (EFs).

This document presents research on the development of a globalised, inclusive learning situation rooted in Socio-Emotional Learning (SEL). It comprises a set of interventions designed to use instructional design as a cognitive mediator, allowing students with diverse neurocognitive profiles to achieve communicative and scientific objectives through the systemic practice of self-regulation. By integrating instructional design with cognitive scaffolding, we foster language acquisition and behavioural autonomy simultaneously.

The present investigation aims at bridging the performance gap described by Barkley (1997), particularly in students with impulsivity or Attention Deficit/Hyperactivity Disorder (ADHD). Without accurate external scaffolding, the extraneous cognitive load can overwhelm students and push them out of their Window of Tolerance, resulting in emotional dysregulation or disconnection from learning.

To achieve this, self-regulation is revised as a broad construct under the premise of integral education. This study aims at enabling students to transition from impulsive reactions to reflective, goal-directed actions via inhibitory control. Co-regulation environments are further specified, exploring the creation of positive relationships, supportive environments, and skill coaching. Inspired by Vygotskian sociocultural theory, the instructional design is studied for transforming the evanescence of verbal instructions into permanent, multimodal instructional texts.

Based on the conclusions drawn, I have designed and analysed a learning situation during my internship in a school in the North West of Ireland. This has led to an improvement proposal for Senior Infants (6 years-old), where students design and construct a nature reserve habitat. Following a Project-Based Learning (PBL) methodology and the Universal Design for Learning (UDL) framework, students engage in hands-on investigation at learning stations. This unit is analysed by highlighting the intended goals and the effectiveness of instructional mediators in fostering self-regulation, with a prospective study.

JUSTIFICATION

The chosen topic has prompted reflection on the competencies expected of a teacher. These competences were acquired through the compulsory and optional training modules of the Bachelor's degree and were then put into practice during this research project. I have delved deeper into the curricular areas of Early Years Education, particularly focusing on their interdisciplinary relationship.

Within the general competencies in a transversal manner, this work is based on innovation and creativity for teacher improvement. Through systematic observation, the aim is to link theory with classroom reality, demonstrating that applied neuroeducation is the most effective way to improve the climate and success in acquiring foreign languages in early childhood.

Regarding the basic module, I have identified learning and attention difficulties. This proposal stems from the need to address the performance gap observed in the Senior Infants classroom. At this age, students possess knowledge of the rules but still lack the maturity to implement them autonomously. Therefore, this work is justified not only as an instructional design, but also as an intervention based on developmental psychology, which assumes that self-regulation is a socially mediated process.

The ethical justification for this work lies in its commitment to universal accessibility. By integrating Universal Design for Learning (UDL), the creation of multimodal instructional materials and texts becomes a right for students with impulsivity or ADHD profiles. A teacher profile is proposed that is capable of planning and implementing best practices, where the physical and visual environment reduces the load on working memory.

The proposal articulates the Disciplinary Didactic Module through a holistic approach. Through the project, scientific thinking and experimentation are fostered, promoting respect for the environment and sustainability. The unit ensures the development of oral and written communication through instructional texts. All of this is facilitated through Project-Based Learning, making guided research the natural strategy for young learners to build their knowledge in a motivating and autonomous way.

From a Vygotskian perspective, this proposal justifies the use of language and spatial structure as co-regulatory tools. The professionalising objective is to equip teachers with skills to regulate interaction and communication processes, facilitating the child's transition from impulsive reaction to guided reflection. In this way, the teacher designs learning situations where autonomy is the result of a carefully structured external framework.

OBJECTIVES

MAIN OBJECTIVE

As a Nursery and Early Years Teacher, we are supposed to demonstrate our competence designing learning situations, as well as creating the necessary mediators to implement them. The complexity of the contexts full of diversity where we work requires a challenging response from the teacher. Therefore, the main objective of this work is to design a pedagogical resource to foster students' self-regulation based on Socio-Emotional Learning and Universal Design for Learning techniques.

SPECIFIC OBJECTIVES

These are the specific objectives that derive from the main one:

Neuroeducation

3. To categorise the primary neurobiological barriers in 6-year-old learners by analysing how the maturation of the prefrontal cortex conditions the development of EF and behaviour.
4. To identify the neurocognitive profile of young learners by analysing the role of the EFs in the management of impulsivity and ADHD, justifying the need for external scaffolding to bridge the performance gap.

Pedagogy

1. To define and develop co-regulation and Socio-emotional Learning (SEL) strategies to establish a secure classroom climate that fosters progressive autonomy.
2. To integrate the Universal Design for Learning (UDL) framework to ensure an inclusive pedagogical proposal that addresses the diversity of profiles in the classroom.

Instructional design

5. To structure the classroom's spatial and temporal dimensions to facilitate a transition of the students between activities and learning stations.
6. To measure the effectiveness of multimodal instructional texts and visual resources that function as cognitive mediators to reduce cognitive overload in the working memory.

DESIGN

- **Theoretical investigation**

To reach the objectives, a first approach on neurocognitive foundations of self-regulation will be closely analysed. It is done in order to discover the links between the development of the prefrontal cortex with the challenges faced by young learners regarding the EFs, and those with impulsivity profiles and ADHD. This first part will be followed by a deep study and exploration of external scaffolding techniques, emphasising on the design of instructional processes, as well as the visual mediators necessary to implement the learning process to reduce cognitive load and close the performance gap.

- **Design of a learning situation**

The next part will consist of the design of a learning situation to be implemented with 6-year-olds, considering their need of acquiring autonomy in the classroom by using strategies that provide pupils with tools to facilitate the transition from co-regulation to self-regulation.

- **Data collection**

There will be a data collection through observations, as well as the reflections of the students and the assessment of the content learned. That will serve to determine the effectiveness of the use of specific techniques to foster executive functions in achieving learning objectives and promoting engagement with the lesson. Specifically, we will focus on the influence of the instructional design as a cognitive mediator to improve self-regulation in early years students, and also in the specific case of students with impulsivity or ADHD.

Observations are made with a structured protocol to ensure both constancy and impartiality. This practice will be designed with criteria such as student engagement, interaction, participation and commitment to the rules. The educator will take notes during the lessons and particularly focus on the behaviour of the students, as well as group dynamics.

Regarding assessment, this strategy will be used to check the progress constantly and provide feedback while the activities are being done (formative). When the learning situation finishes, there will be an evaluation of the overall achievement of the students (summative). For both assessments, there will be detailed rubrics.

- **Data analysis and conclusions**

According to the previous topics, this data will be analysed and conclusions reached.

THEORETICAL FRAMEWORK

This section explores the neurocognitive mechanisms that govern learning and behaviour. This theoretical framework is grounded in the principles established by Alario, Guillén & Vez Jeremías (2002). Their integrated approach to language acquisition provides a pedagogical basis for this study by setting importance for creating a meaningful and globalised context in which language is a tool for social participation and cognitive growth.

Building upon this didactic foundation, this framework explores self-regulation as a broad construct. Based on the EFs, this section analyses that the ability to inhibit impulses and manage working memory is still developing, especially in neurodiverse profiles such as ADHD.

This framework justifies the use of external scaffolding to foster the shift from adult-led regulation to student-led autonomy. An instructional design of the classroom environment will be analysed as a cognitive mediator that reduces cognitive load. Particularly, the instructional text will be proposed as a visual anchor to foster reflective actions.

PART I: COGNITIVE BASIS OF SELF-REGULATION

SELF REGULATION AS A BROAD CONSTRUCT

Regulatory Skills

According to the Education Endowment Foundation (2023), self-regulatory skills manage behaviour and learning aspects. Bronson (2000) considers that behaviour is an interplay between innate and environmental factors, nature and nurture. On the one hand, it is influenced by neurological development, particularly the prefrontal cortex as well as biological maturation. In educational practice, it allows the students to go from impulsive and emotional processes to logic and controlled ones.

When considering young learners' development, including the promotion and development of these skills in our daily planning can highly improve their levels of self-control and reduce impulsivity. When we focus on EY work, those skills require co-regulation. It is at these ages when teaching design assumes a major role in its development. The objective, therefore, is to make a soft transition from adult monitoring to an internalisation of those external supports.

Therefore, the students rely on the teacher to calm down and focus, following their instructions (Vygostky, 1978). That external scaffolding is supported with the Zone of Proximal

Development, that is what the student is able to do with help. To do so, “the More Knowledgeable Other” provides support that is removed as the learner gains independence.

Definitely, it is a broad construct with important dimensions such as the executive function (EF) capabilities (Ernst, Sobel & Neil, 2022). Particularly the EF is a set of cognitive processes that are crucial for regulating behaviour, connected to goal-directed behaviour (McCabe et al., 2004). Furthermore, others are emotion regulation, effortful control and executive attention.

The Role of Neurological Development: ADHD and the prefrontal cortex

If we want to fully understand the concept of self-regulation in early childhood, we must obtain a close examination of the Prefrontal Cortex (PFC), as it is one of the best pieces of evidence on how it mediates instinctive impulses and goal-directed behaviour and usually enables movement from a reactive to an active one.

However, in students with Attention Deficit/Hyperactivity Disorder (ADHD) there is a maturational lag in this area. Therefore, the regulation can occur later than the neurotypical students, which affects the three pillars of EF. So, it is not that the student does not want to obey, but rather cannot yet or does not have the resources.

Self-regulation is a dynamic process that encompasses both logic and emotional answers. According to Rothbart (2011), the effortful control is a temperamental dimension of inhibiting a dominant response to activate a subdominant response. While the former include reactive and automatic reactions to a stimulus, the latter is more reflective and controlled. Therefore, ADHD students often struggle with this control, which actually manifests in being able to raise their hands and wait to be called on, grab a material as soon as it is seen or run to get an object.

Therefore, Barkley (1997) states that ADHD not only involves significant performance deficits (Barkley, 2011) with keeping attention, but also has disorders in self-regulation via inhibition. When the Prefrontal Cortex (PFC) does not inhibit the first impulse, the students do not engage in the following functions. While reflective students have pause between stimulus and response, the untrained ADHD students have shorter or even no gap.

Siegel (1999) speaks about “Window of Tolerance” in which the students are calm, alert and present. There, they are able to think clearly, use logic, socialise and regulate their impulses. When they are overwhelmed by instructions or environmental stimuli, they quickly exit this zone into “Survival Mode”, a state described by authors such as Siegel (1999) or Porges (2011): either through hyper-arousal (manifesting as impulsivity, anxiety or high energy) or hypo-arousal (appearing as low energy, numbness and disconnection).

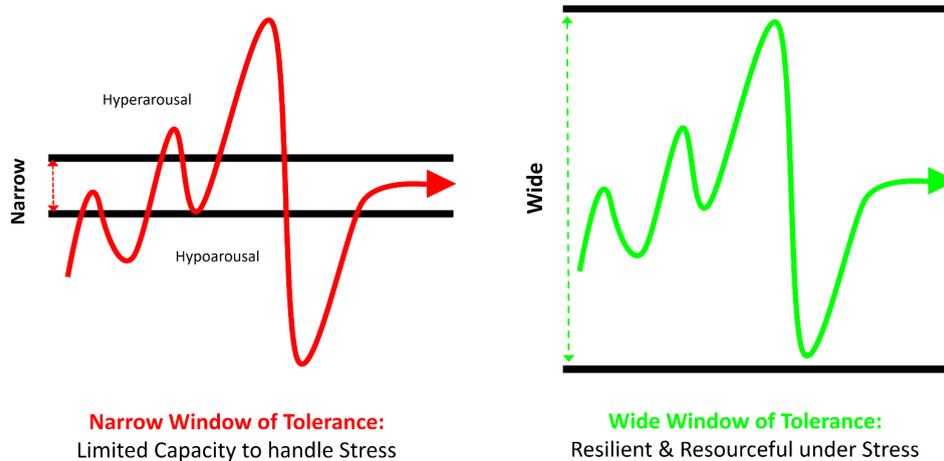


Figure 1: Difference between a narrow and a wide Window of Tolerance (Comminos, n.d.).

In this survival state, the PFC is essentially disconnected, making logic-based self-regulation biologically inaccessible at that moment. Due to the neurological maturational lag, students with ADHD often operate within a narrowed window. Therefore, a minor trigger can push them above (hyper) or below (hypo).

When teachers design training tasks for these children, it is widely recognised that the development of Executive Functions is not a predetermined or static process. Although there is a maturational lag that explains the behavioural challenges students face, the brain possesses an inherent neuroplasticity. In other words, the brain's capability to reorganise its structure and create new neural connections in response to experience (Doidge, 2007). From the educational perspective, it requires consistent practice and an environmental support that can narrow that gap (Center on the Developing Child, 2011).

COGNITIVE BASES: THE EXECUTIVE FUNCTION (EF)

Definition of Executive Function (EF) in Early Childhood

Executive Functions (formerly referred as EFs) have been described as the “building blocks for a range of important skills” (Diamond, 2013; Jones, 2016; Zelazo et al., 2016) as they consist of core neurocognitive skills that involve regions in the prefrontal cortex and often work together to support cognitive flexibility. According to the Center on the Developing Child (2011), Executive Functions act as the brain's “air traffic control” system. This system allows the developing child to manage simultaneous streams of information, prioritise actions, and filter distractions, ensuring that goal-directed behaviour can occur even in a busy environment.

It is useful to distinguish between Cold and Hot EFs in this broad construct (Zelazo & Carlson, 2012):

On the one hand, Cold EFs are those purely cognitive processes activated in abstract or decontextualised contexts. Those contexts are emotionally neutral and task-oriented, including essential strategies such as holding *information* or *following logical steps*. There is no immediate emotional reward or threat. In this case, they are linked to academic success in areas like literacy and maths. Although there are Secondary EFs derived from them such as planning & prioritising, organising or attention getting, the main skills studied in this work are:

- 1. Working memory:** It is the capacity to hold information in mind and use it. It is an active workspace that is essential for following multi-step directions. When an instruction is given, the student has to first remember the steps so as to then execute them. That is what allows them to link ideas, remember rules and instructions and make cause-and-effect relationships. As Baddeley (1986) states, this function makes students have the thread of what they are doing.
- 2. Inhibitory control:** It is the ability to override the strong internal predisposition or external stimulus and do what is more appropriate or needed (Diamond, 2013). In early childhood, it manifests both with interference control and response inhibition. While the former filters out distractions to stay focused, the latter resists the impulse to act. Together, they allow the child to transition from reactive behaviours to deliberate, goal-directed actions.
- 3. Cognitive flexibility:** It is the ability to change the perspective or switch between rules or tasks. After there is an inhibition of an old rule and the working memory has brought a new one to mind, this function appears. It enables a child to adjust when a routine or an instruction changes, allowing them to adapt to new classroom demands (Miyake et al., 2000).

Respectively, these abilities are directly associated with holding and manipulating information in mind, controlling impulses and switching between tasks. These three EFs can be measured with the Dimensional Change Card Sort (DCCS) task (Zelazo, 2006), where children are asked to sort cards by one criteria and then switch to another. Successful performance on the DCCS requires the integration of working memory to keep the new rule in mind, inhibitory control to suppress the previous sorting habit, and cognitive flexibility to execute the switch effectively.

On the other hand, Hot EFs are required in situations characterised by high emotion, motivation or social significance. The core of these functions involves social cognition, which serves as the foundation for empathy and the Theory of Mind. This capacity, extensively researched by

Baron-Cohen (1995), allows children to understand that others can have perspectives, intentions, or feelings that differ from their own.

Subsequently, it later involves navigating social pressures through behavioural systems of punishments and rewards. Students must learn to wait for their turn, regulate their impulses, and make choices in emotionally challenging situations. In the Stanford Marshmallow Experiment on delaying gratification (Mischel et al., 1972), children were presented with a choice between an immediate reward (one marshmallow) or a delayed one (two) if they can wait.

Table 1: Difference between Cold and Hot EFs. Own elaboration.

Feature	Cold EF	Hot EF
Nature	Logic	Emotion and motivation
Context	Low-arousal (calm)	High-arousal (excited or stressed)
Primary goal	Solve a cognitive problem	Regulate a social or emotional impulse

Some constructs may overlap the concept of EF, such as intelligence (Zelazo et al., 2016, p.3). Cattell (1963) proposed a distinction between fluid and crystallised intelligence. The former allows us to reason and solve new problems, whereas the latter involves accumulated facts and the use of learned information. Continuing with this analogy, EFs will relate to attentional skills that allow the adaptive use of knowledge to achieve goals not only to learn more effectively but also to apply the knowledge. However, while intelligence enables learning, EFs decide when and how to use them.

Impulsivity vs. Reflexivity and the ADHD profile

The variability in executive function performance is also explained by cognitive styles. Kagan (1965) classifies students according to how they process information and react to uncertainty, establishing the dichotomy of reflectivity-impulsivity. This model is measured through two critical variables: latency (response time) and accuracy (error rate). While reflective children show a longer latency that allows them to process information analytically and accurately, impulsive children exhibit a reduced latency, resulting in rapid but inaccurate responses.

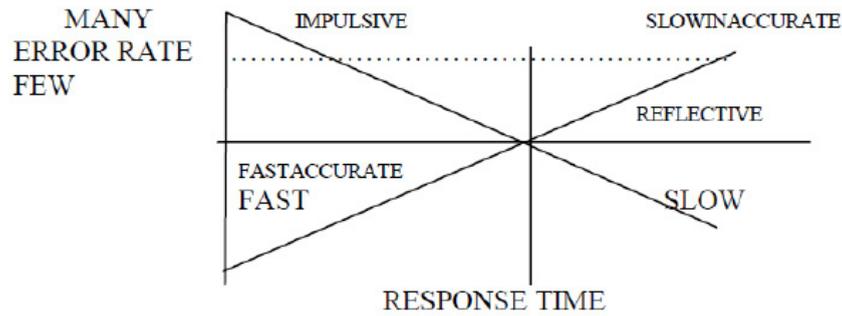


Figure 2: Relationship between Impulsivity and Reflectivity (Haghighi, Ghanavati & Rahimi, 2016).

Without the necessary initial pause provided by inhibition, other executive functions fail to activate effectively. In this profile, it manifests in three specific ways:

Table 2: Comparative of the Cold EFs. Own elaboration.

Executive function	Purpose	Manifestation of performance deficit	Consequence
Inhibitory control	Filter distractions and resist impulses to act	Verbal and/or motor impulsivity, as well as constant distractions	Interruptions, distractions and social conflicts
Working memory	Hold information and use it	Forgot of instructions and class rules	Incomplete or disorganised work
Cognitive flexibility	Change perspective and switch between rules or tasks	Resistance to changes in routine	Emotional dysregulation in transitions and changes of perspective

In the context of ADHD, this impulsivity transcends a personality trait to become an executive function deficit due to a lack of behavioural inhibition (Barkley, 1997). However, it is crucial to emphasise that this trend is not immutable. Based on neuroplasticity, authors such as Diamond (2013) argue that executive functions are malleable skills. Therefore, impulsivity in ADHD can be compensated for through training in stop-and-think strategies and the use of external mediators such as visual prompts and concise instructions that artificially lengthen response latency.

INHIBITORY CONTROL: FOSTERING REFLECTION

Operational definition of Inhibitory Control (IC)

Inhibitory Control (IC) can be operationally defined as the ability to suppress a prepotent response (the first impulse) to perform a more adaptive goal-directed action (Diamond, 2013). In early childhood, it manifests through two distinct but interrelated dimensions:

- **Interference control:** It is the cognitive capacity to ignore distracting stimuli (sensory or mental) to protect the focus on a specific task (Miyake et al., 2000). Furthermore, it manages selective attention by suppressing sounds or conversations (Posner & Rothbart, 2007). Its performance deficit overloads the working memory and makes the students lose the thread of the instruction (Barkley, 2011). However, it can be educated with visual dividers, quiet zones and clear workspaces.
- **Response inhibition:** It is the ability to withhold physical or motor impulses by creating the latency between stimulus and response. Deficit in this area causes saying answers without raising the hand or starting an activity before the instruction. They often present a “performance gap” (Barkley, 1997) between knowing the rule and executing it. Nevertheless, it can be trained with stop-and-think cues, hand signals or waiting games.

Concept of reflection

Zelazo & Carlson (2012) consider that Hot EFs generally take longer to develop and mature later than Cold EFs. While the typical age of mastery of the logical answers is 4 years old, the emotional responses take up to 5 to 7 years old. Moreover, the Cold system also acts as a prerequisite for the Hot system. That means that this logical machinery is necessary to regulate intense emotions. This is reflection, a process of re-entering information into the Prefrontal Cortex (PFC) to allow for a more complex and less impulsive evaluation (Zelazo, 2015).

The Iterative Reprocessing Model (Cunningham, Zelazo, Packer, & Van Bavel, 2007) sees the executive functions as top-down and bottom-up processes. The former has a cognitive nature, including components of executive functions like cognitive flexibility whereas the latter processes are reactive, connected to emotional reactions.

Inhibitory Control is what allows the bottom-up process to be stopped long enough for the top-down process to take over. All in all, self-regulation is the product of a dynamic interaction between reactive and reflective behaviours (Zelazo, 2015, p. 58).

Table 3: Relationship among the Iterative Reprocessing Model, the EFs and mediators. Own elaboration.

Phase	Explanation	EF	Mediator
Level 0: Impulse	Automatic evaluation: First contact with the stimulus via dichotomic and reactive thought.	None (reactive)	Visual stop
Iteration 1: Initial Representation	Stopping the impulse: The child pauses the prepotent response by remembering basic rules.	Inhibitory control	Stop and look commands

Iteration 2: Reprocessing & Labelling	Guided Action: Use of inner language (or text-mediated language) to hold the steps in mind.	Working memory	Step-by-step guides
Iteration 3: Contextualised Evaluation	Reflection: The student understands context, goals, and consequences. Top-down regulation.	Cognitive flexibility	Goal reminders

Therefore, subsequent reflective processes can be found to involve more controlled processes, allowing less dichotomic and more contextualised evaluations. There is interaction between processes, underlying automatic evaluations engaged across multiple processes. Even when reflecting deeply, that initial automatic impulse is still there. Self-regulation does not pretend to suppress the emotion, but to make the reflective process interact with the automatic evaluation to modulate it.

PART II: INSTRUCTIONAL DESIGN VIA CO-REGULATION

THE EMOTIONAL AND RELATIONAL PATH TO AUTONOMY

Socio-Emotional Learning (SEL) as a Framework for Self-Regulation

Social-Emotional Learning (SEL) is “an approach to acquiring and applying knowledge, attitudes and skills to understand and control emotions” (Billy & Garríguez, 2021, p. 9). This perspective can definitely help students gain better emotional regulation, teaching students how to recognise and manage their emotions and stop their impulses.

SEL is a pedagogical tool to train the Hot EFs, in which there is a strong emotional basis with Cold EFs like labelling and stop-and-think strategies. With the reflective behaviour, the students will be able to not let their emotions control their actions. This approach provides strategies for the external scaffolding necessary for the Iterative Reprocessing so that the students can interiorise the actions.

Some suggestions can be introduced to achieve the five SEL competencies:

Self-awareness is the ability to recognise one's own emotions, thoughts and values, as well as how they influence behaviour (CASEL, 2020). According to Goleman (1995), it is a prerequisite for an effective self-regulation, especially an effective Interference Control. In order to suppress irrelevant stimuli, the learner must first be aware of their own attentional state (Diamond, 2013).

If we want to apply these principles into Early Childhood Education, schools are suggested to integrate this by making a daily self-check in with students about how they are feeling with an emotions jar. Another proposal can include a “Mood Meter”, inspired by emotion regulation models such as Brackett's (2019).

Self-management is the ability to regulate emotions in diverse situations, manage stress, and control impulses (CASEL, 2020). This skill enables students to take ownership of their learning journey and acquire autonomy through response inhibition, a core executive function (Diamond, 2013).

The present work pretends to demonstrate that it is possible to apply these theories with simple techniques in Nursery and Early Years schools. Examples are stop cards to encourage students to think before acting. Furthermore, evidence-based strategies such as the "turtle technique" (Schneider & Robin, 1974) provide children with a physical metaphor to inhibit impulsive reactions and achieve a state of calm.

Social awareness involves the capacity to understand and empathise with others. Therefore, students should be able to recognise the agents of socialisation (Bronfenbrenner, 1979). This competency encompasses critical skills such as perspective-taking (Selman, 1980), recognising strengths in peers, and expressing gratitude.

In Early Years, these abilities can be fostered through activities that require students to guess feelings based on non-verbal cues, a practice that strengthens both cognitive and emotional empathy (Goleman, 2006).

Relationship skills involve building healthy and rewarding peer-to-peer relationships. According to Johnson & Johnson (1989), these interactions are essential for developing communication skills, teamwork, and collaborative problem-solving. In these social contexts, cognitive flexibility plays a crucial role, as it allows students to shift their perspective and look for alternative responses during a conflict, thereby reducing the emotional burden. In those situations, instructional text can act as a mediator.

Responsible decision-making allows students to make ethical and constructive choices regarding their personal and social behaviour. This process requires children to evaluate the consequences of their actions for themselves and for the community. To foster this competency in early childhood, educators should provide guided autonomy through the use of visual organisers and instructional texts.

By implementing the five key competencies, the necessary external scaffolding is provided for children, especially those with impulsivity profiles or ADHD, to achieve regulation. It not only

acts as a cognitive mediator that reduces the emotional burden in the classroom, but also establishes a basis of co-regulation between teacher and student that fosters autonomy and resilience in collaborative learning environments.



Figure 3. CASEL's framework for systemic social and emotional learning (CASEL, 2025).

Co-regulation and positive relationship

Following the Vygotskian perspective, authors such as Bodrova and Leong (2007) approach co-regulation. For them, it is the interactive process through which the teacher provides the necessary support, structure, and modelling to help the child appropriate those regulatory tools. In the context of early childhood education, this concept is fundamental, since students are not born with the capacity for self-regulation, but rather acquire it through social mediation. As Shanker (2016) emphasises, it begins with reframing the behaviour and understanding it as an answer to dysregulation.

Instead of merely reacting to a crisis, the teacher provides predictable routines and a structured environment (Gillespie & Seibel, 2006). This ensures that co-regulation is not just a response to an outburst, but a continuous process of providing the security necessary for learning.

Rosanbalm & Murray (2017) argue that a child's ability to regulate themselves depends not only on their biological maturation, but also on a learning process mediated by the adult. Within this framework, co-regulation is developed through three key mechanisms: a positive relationship, a supportive environment and skill coaching. These three mechanisms allow co-regulation to be an integral process encompassing the affective, physical, and mental dimensions.

How to Co-Regulate



Figure 4: How to Co-Regulate (Rosanbalm & Murray, 2017).

First, the co-regulation is only effective if there is a warm, trustworthy and valued relationship between teacher and student. That positive relationship promotes the possibility of appealing in case of emotional dysregulation. This sense of security is detected through “neuroception” (Porges, 2011).

Unlike conscious perception, it is a subconscious process of the nervous system. The student is constantly questioning whether the place is safe or a threat. To do this, the nervous system monitors cues such as the teacher's voice (high-pitched and rapid vs. melodic and calm), the presence of visual, cognitive or auditory chaos, and the teacher's posture (open vs. authoritarian).

According to Porges, if neuroception detects safety, the nervous system activates the "Social Engagement System," which facilitates listening, language processing, the use of executive functions, and empathy. Conversely, if it detects a threat, the body enters survival mode, prioritising reactive behaviours over logic. It is essential to note that students with ADHD often present a narrowed Window of Tolerance. Consequently, a minor trigger is more likely to unchain a state of dysregulation.

Therefore, a positive relationship is not only a facilitator of learning, but also an “affective scaffolding” (Meyer & Turner, 2006). Secure attachment in the classroom facilitates a child's access to higher cognitive processes (Bergin & Bergin, 2009). Through empathy, non-verbal language and emotional synchrony, the instructor helps stabilise the student's nervous system (Cozolano, 2013), allowing co-regulation to eventually be internalised as self-regulation.

CREATION OF SUPPORTIVE ENVIRONMENTS

The temporal dimension

Visual schedules represent upcoming activities and prepare children for changes. Students with ADHD often experience “time blindness” (Barkley, 2011), a deficit in time perception and the anticipation ability. This phenomenon requires the teacher to transform abstract time into something physical and sensory with sand timers or visual countdowns. As Dawson and Guare (2018) suggest, they are a cognitive flexibility support, making transitions smoother by externalising the passage of time.

Having consistent timing helps students reduce anxiety and manage their internal states by following a predictable sequence of events (Ostrosky & Sandall, 2001). When children know what to expect, they do not need to exhaust their working memory resources on uncertainty (Sweller, 1988). As Diamond (2013) notes, reducing this environmental stress is essential to prevent the impairment of executive functions.

Transitions often reveal the performance gap (Barkley, 1997) in early childhood. To bridge this gap, the environment must provide inhibitory latency through structured rituals. Providing clear verbal and non-verbal signals such as a hand signal or a countdown helps to create the *reflective pause* (Barkley, 2011). As Dawson and Guare (2018) suggest, these cues allow the student to disengage from one activity and transition to the next.

Implementing a specific transition song or rhythmic clap acts as a conditioned stimulus (Pavlov, 1927). This signals the brain to initiate the next motor sequence automatically (Thaut, 2005), effectively bypassing “waiting mode” (Dodson, 2016): a state of cognitive paralysis that occurs when a student is unable to engage in a current task due to the anxiety of an upcoming transition. These rhythmic rituals provide the sensory predictability needed to transform a stressful change into a safe, automated routine.

Involving students in these routines helps them understand the closure of activities. By taking charge of their material and space, they promote a feeling of accountability, transitioning from adult-imposed order to an internalised sense of responsibility (Montessori, 1967). Dedicated play times also facilitate simple turn-taking, as well as sharing. These social interactions are the primary training ground for Hot EFs, as children must regulate their immediate desires to maintain social harmony with peers.

The routines and transitions analysed act as an external scaffolding (Vygotsky, 1978) that allows the student, especially one with an ADHD profile, to close the gap between knowing and doing

(Barkley, 2011). By transforming time into something tangible and instructions into predictable rituals, the teacher reduces the cognitive load on working memory (Sweller, 1988) and fosters the inhibitory latency necessary for reflection.

The spatial dimension

The concept of the “Silent Teacher”, originally rooted in Gattegno’s (1963) silent pedagogy and Montessori’s prepared environment, suggests that the physical setting can provide the necessary feedback for self-regulation. This concept implies that the environment is intentionally designed to guide behaviour and provide feedback.

A performance gap in the interference control leads to a deficit in filtering irrelevant stimuli, which causes cognitive overload. Therefore, there should be low-stimulus zones. Those areas must be provided with minimal visual and auditory noise: neutral colours, physical dividers, and individual workstations (Evans, 2006). As Fisher et al. (2014) suggest, the students will then be able to focus on the task rather than on background distractions.

A critical challenge for students with ADHD is a deficit in “interoceptive” awareness (Barkley, 2011); that is, the inability to perceive internal bodily cues effectively. Due to a potential maturational lag in brain areas such as the insula (Craig, 2009), these students often bypass the early physical signs of dysregulation, resulting in what is often described as “emotional blindness” (Barrett, 2017).

To address this issue, a calm-down corner should be implemented as a proactive scaffold. Moving away from a punitive “time-out” approach, this space functions as a “time-in” station (Siegel & Bryson, 2014). There, the goal is for the child to learn to register bodily sensations. This environment features self-awareness tools such as the body map (Mahler, 2016), alongside self-management sensory resources like anti-stress balls or calming bottles. Overall, they help lower physiological arousal (Dunn, 2009)

A well-designed space also sets clear boundaries and instructions. When the floor is marked with tape to define personal space during assembly, or shelves have silhouettes indicating where materials belong, the environment provides immediate feedback. These visual cues replace the educator’s voice, acting as a “control of error” (Montessori, 1967). Instead of waiting for an adult to point out an error or a rule, the student uses the environment to self-correct.

All in all, the materials and the space should allow the students to recognise mistakes independently. In this dimension, the space provides logic-based support through instructional text. This eliminates uncertainty, as they know what is expected of them in every corner of the classroom because the spatial design is explicit and predictable.

SKILL COACHING, THE COGNITIVE DIMENSION

The strategies have to be explicitly taught through modelling and guided practice, that is a skills coaching. To effectively transition from the impulsive “Level 0” to the reflective “Iteration 3”, the developing brain requires external support. In the classroom context, this is achieved through logical strategies that provide the distance needed to control emotional impulses:

Within the cognitive dimension of skill coaching, distancing strategies serve as a critical bridge between Hot and Cold EFs. According to White and Carlson (2016), psychological distancing, the capacity to step outside of one's immediate experience, enhances self-regulation in young children. Their research demonstrates that when children adopt the perspective of a third person, they show increased perseverance and better executive function performance on challenging tasks. Nevertheless, other techniques like pretending the object is just a picture or a cloud are also fruitful.

Through affect labelling (Lieberman et al., 2007), students are taught to transform vague physiological sensations into processed concepts. Tools such as the body map (Mahler, 2016) or Emotional Thermometers act as multifunctional cognitive mediators. They facilitate distancing by externalising internal states onto a visual representative, allowing the student to observe the emotion objectively. Once emotion is a symbolic representation, it can be managed.

Rooted in Vygotsky's (1978) socio-cultural theory, self-talk, or private speech, facilitates the internalisation of regulation by stating rules aloud. The concise language of instructional texts acts as a form of externalised self-talk that helps the student distance the impulse from regulated action. This engages the “phonological loop” (Baddeley, 1986), which keeps the goal active in the working memory, as the child's own voice serves as an auditory guide for their attention. A material to work on this strategy is the whisper phone.

This labelling process is the prerequisite for monitoring, which allows a student to evaluate their performance during the execution of a task. As Barkley (2011) suggests, students with ADHD often present a "self-monitoring gap." Since they have difficulty generating internal feedback, instructional texts act as an external monitor and a standard of comparison. Once this skill is acquired, they will be able to use self-correction, thus being able to check.

In conclusion, external scaffolding should not be understood as a series of isolated aids, but rather as a supportive ecosystem. As discussed, effective co-regulation progresses from emotional security and time predictability to the physical organisation that dictates behaviour. However, this scaffolding must adhere to Vygotsky's principle of gradual fading, so that they are internalised in inner speech and self-monitoring skills.

INSTRUCTIONAL TEXT AS A COGNITIVE MEDIATOR OF EF

The cognitive nature of instructional text

The cognitive nature of instructional text in early childhood lies in its capacity to function as a cultural tool that restructures mental processes (Vygotsky, 1978). Unlike verbal instructions, which are evanescent and place a high demand on the phonological loop (Baddeley, 2000), instructional text is permanent.

This stability is not merely a formal change, but a strategic shift that mitigates what Leahy and Sweller (2011) describe as the “transience effect”: the loss of information in working memory when a stimulus disappears before it can be effectively encoded and integrated. By providing a permanent external record, it alleviates the executive burden of maintaining information in the phonological loop.

This cognitive relief is further optimised through Dual Coding Theory (Paivio, 1971). In Early Childhood Education, text is inherently multimodal, integrating words and icons. According to Paivio, information is processed through two independent but interconnected channels: one verbal and one visual (non-verbal). Consequently, this beneficial redundancy ensures that even if one channel becomes overloaded, the visual-spatial channel maintains the mental representation of the goal.

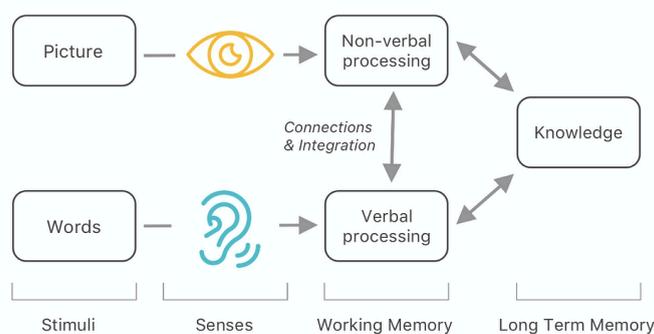


Figure 5: Representation of the Dual Coding Theory (Caviglioli, 2019)

Ultimately, this synergy between permanence and multimodal processing transforms the instructional text into a tangible cognitive object that facilitates self-monitoring (Flavell, 1979). Because the instruction is externally and consistently present, the environment provides a constant standard of comparison. This allows the child to independently verify their progress and detect errors, thereby transforming the external scaffold into an internal habit of reflection and paving the way for autonomous self-regulation (Bodrova & Leong, 2007).

Instructional text as a Cognitive Scaffold

Within the framework of the Iterative Reprocessing (IR) Model (Cunningham et al., 2007), Instructional text serves as the essential semiotic mediator. Its primary role is to intervene in the temporal gap between stimulus and response, a period often truncated in students with ADHD (Barkley, 1997).

By providing a permanent and static visual anchor, the environment exerts a proactive inhibitory influence that interrupts the initial bottom-up impulse. This intervention artificially generates the necessary latency period, allowing the Prefrontal Cortex to initiate the first cycles of reprocessing (Zelazo, 2015). Without this external pause, the cognitive system would remain in a reactive state, unable to access higher-order thought.

Furthermore, as the complexity of reflection increases through successive interactions, the demand on the Central Executive and working memory grows exponentially. To preserve the integrity of the objective, the instructional text serves as a stable external representation of the target goal. This scaffold ensures that the mental representation of the task remains active, salient, and undistorted throughout the entire iterative cycle.

From Co-regulation to Internalisation: The role of concise language

Rooted in Vygotskian theory (1978), the use of instructional text facilitates the migration of control from the social plane (inter-psychological) to the individual plane (intra-psychological). Within this progression, the linguistic properties of the text are essential for the development of Inner Speech, as they provide the symbolic material for self-regulation.

To ensure this internalisation is effective, the instructional text must contain concise, imperative, and consistent language. This brevity is a requirement for cognitive efficiency: concise prompts are more easily assimilated into the child's private speech. As the student repeats these verbal cues aloud while engaging with the text, they reinforce the phonological loop. That transition is particularly critical for self-regulation in children with ADHD (Winsler et al., 2009).

This process of internalisation, however, is not spontaneous; it requires a deliberate pedagogical shift. During the initial stages, the teacher models the use of the text. Gradually, the permanence of the written/iconic prompt allows the learner to initiate the "reflective loop" independently. This reduces reliance on the More Knowledgeable Other and fosters the internalisation of executive commands. That allows the child to govern their own behaviour through self-directed verbal cues and achieve what Bodrova and Leong (2007) describe as the transformation of an external mediator into a mental tool.

Design Principles based on Cognitive Load Theory (CLT)

The structural effectiveness of the physical environment is grounded in Cognitive Load Theory (CLT). According to Sweller (1988), the human brain possesses a finite capacity for processing new information within the working memory. However, that capacity is significantly more restricted in students with ADHD due to deficits in interference control. From this perspective, a chaotic environment or purely verbal instructions generate an unsustainable extraneous load (irrelevant mental effort), leading to cognitive overload and hindering the learning process.

To mitigate this, the physical environment must be engineered as a Linguistic and Symbolic Support system. This represents the practical application of the Silent Teacher concept. This optimisation is achieved through two primary design strategies:

- **Externalised inhibition through visual prompts:** Placing step-by-step task indicators directly within action areas provides what Barkley (2011) defines as "externalised inhibition." By situating the symbolic sign at the point of performance, the environment prompts the child to create the necessary latency for reflection.
- **Spatial scripting and mediated materials:** The internal logic of a task should be embedded in its physical setup. For instance, organising materials from left to right follows the natural flow of literacy and cognitive sequencing. This arrangement acts as a spatial mediator that reduces the demand on high-level executive functions.

The success of these interventions, however, depends on their spatial integration. This is supported by the Spatial Contiguity Principle (Mayer, 2001). This theory posits that learning is optimised when related verbal and iconic information are presented in close physical proximity. By anchoring the instructional text to the relevant material, there is no need for exhaustive visual search. That economy of search preserves the student's limited attentional resources for the germane load, the actual execution and consolidation of learning.

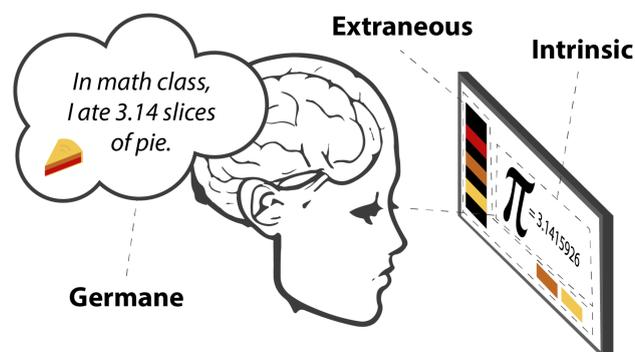


Figure 6: Representation of the Cognitive Load Theory (Clark & Kimmons, 2023).

RESEARCH AND PROPOSAL DESIGN

As previously mentioned, the proposal was partially implemented with a later improvement along my 2nd Internship as a Foreign Language Teacher with Early Years in a school in the North West of Ireland. Therefore, the following pedagogical proposal is grounded in a dual approach: the systematic research of neuro-educational theories and the empirical insights. It represents a refined and optimised learning situation that builds upon lived experiences, direct observations, and the subsequent analysis of classroom dynamics.

CONTEXT

School

Firstly, the main characteristics of the context in which the research is put into practice will be set out. The school is a Catholic institution that provides education from the age of five to the age of thirteen. Compulsory education in primary schools commences with Junior Infants at the age of 5-6, continues with Senior Infants, and then encompasses from fifth to sixth grades.

In the Irish education system, National Schools constitute a distinct denomination of schools. The institution has its foundations in Catholic tradition. Concurrently, the institution is receptive to students from minority backgrounds, with a significant presence of students from diverse nationalities and the welcoming of minority communities.

In accordance with the principles of inclusion, the school ensures that the students with special needs are provided with appropriately qualified staff members. The individuals responsible for the oversight of this initiative are both Special Educational Needs (SEN) specialists and Special Needs Assistants (SNAs). The former are responsible for the creation of Individualised Education Plans and the adaptation of curricula; In contrast, the latter focus on the provision of care and assistance with teaching tasks, acting under the guidance of the teacher.

The language of instruction in this educational establishment is English, in contrast to the Irish-language educational institutions known as Gaelscoileanna, in which Irish is the working language. The language is regarded as ambient, and bilingualism is a feature of the classroom environment. Nevertheless, it is not regarded as a bilingual school, as the core and non-core subjects are taught in English.

Routines and programmes

The school has established a system of twinning arrangements between the different classes. This system is intended to ensure that all students have access to learning opportunities through the provision of mentoring from more experienced students. The organisation of the classes is such that Junior Infants are twinned with the sixth class, Senior Infants with the fifth class, and so on.

The learning stations method has a number of purposes. As outlined in the timetable, this approach fosters independent and autonomous learning, contributing to students' personal growth and the development of a mature sense of compromise. This methodology has been employed in two specific contexts in Senior Infants: firstly, in the thematic project, and secondly, in the literacy lift-off.

Within the junior block, a number of students with special educational needs (SEN) participate in sensorial circuits, overseen by SNAs. These sensory-based movement activities have a preparatory effect on children, facilitating the achievement of optimal levels of alertness and concentration. They are carried out on a daily basis in the corridor.

The classroom

Upon entering the classroom, the coat hanger and the entrance to the toilets can be located. The students are seated at five tables in groups of three to six people. Each table is equipped with a designated box containing specific materials, including colours, scissors designed for children, glue, erasers and pencils. When the subjects are engaged with, the assistants from each group proceed to the box and retrieve the necessary materials/resources.

In the context of assembly moments, there is a mat with its orientation directed towards the digital whiteboard. Sitting in a specific place has a positive impact on children, encouraging self-control and attentiveness. To the left, there is a small board on which the date may be inscribed. To the right, there is a calendar in which the person in charge may record their tasks.

The facility is divided into several sections. In addition, there is a library and a calm-down corner where students can retreat if they experience sensory overload or are unwell. The space is furnished with cushions and fidgets with the aim of ensuring comfort. Furthermore, the class is also adorned with several murals.

As it was previously mentioned, the group is a Senior Infants class. There are three groups of this level and, the one I had the chance to work with, has 22 students, 12 girls and 10 boys. Due

to the special needs of the class, an SNA supports more individual work with SEN students in core moments of the day.

Among this class diversity, there is one student from the Travelling community with learning difficulties and that presents absenteeism; a student diagnosed with ADHD with a high impulsivity scale; and four students who have English as an Additional Language (EAL).

There are also two students without a diagnosis but whose characteristics are described in order to understand the educational approach followed rather than trying to typecast them: Student 1 has less eye contact, withdrawn into own world, sensitivity to stress, need for routine and predictability...; Student 2 has a need for routine and predictability, sensory hyper stimulation, attachment to specific objects, particularly sensitive to certain tastes, specific interests...

Intervention

The learning situation that has been designed for the nature reserve thematic project is scheduled to take place from the 3rd of April to the 7th of May. The students were tasked with the design of a model of habitat as part of a series of a seven lessons proposal. The animals in question are the giraffe, penguin, monkey, elephant and dolphin.

METHODOLOGY

The classroom environment is intentionally structured to function as a primary agent of self-regulation. To achieve this, the methodology adopts an active, globalised, and experiential approach, where the spatial and pedagogical dimensions work in tandem.

The pedagogical structure is framed within a Project-Based Learning (PBL) model, centered on a cohesive guiding thread: the design and creation of a natural reserve for a final exhibition. The project directly engages the Hot EFs through sustained motivation and emotional involvement. It is organised into four progressive phases: activating prior knowledge, hands-on investigation at learning stations, model construction, and final oral communication.

The classroom is reorganised into simultaneous and autonomous working stations. This arrangement allows for reduced-group dynamics that are essential for co-regulation, as it enables the teacher to provide targeted, real-time intervention during social negotiations or conflicts. Furthermore, the systematic rotation between stations serves as a physiological and cognitive tool, helping students refresh their attentional focus and effectively manage their energy levels throughout the session.

Finally, the methodology adheres to the Universal Design for Learning (UDL) framework to ensure inclusivity. It offers multiple means of representation: incorporating tactile textures, visual imagery, auditory stimuli, and manipulative blocks. Therefore, the design accommodates diverse sensory profiles. Simultaneously, it provides multiple means of action and expression, allowing students to demonstrate their understanding through various channels, from artistic modelling to verbal classification. This ensures that the executive demands of the task do not become a barrier to learning.

Instructional design foundations

This present learning is specifically designed to act as an external scaffolding for the executive functions. Recognising the neuroplasticity of the brain, there are cognitive, temporal and spatial mediators with several purposes: reduce the cognitive load, broaden the latency of answer and facilitate the flexibility needed to achieve self-regulation. That will allow the student to start moving from an impulsive answer to a reflexive and self-directed one.

The instructional design is conceived as a scaffolding system where different dimensions of the Executive Functions operate in synergy to foster autonomy. Firstly, to manage the limited capacity of Working Memory, there are instructional texts and pictograms. By reducing the cognitive load through these visual cues, students can maintain the thread of the task without saturation. This support is further reinforced by the use of evidence sheets, which act as a physical record.

However, for Working Memory to be effective, it requires the support of Inhibitory Control. By dividing sessions into short, structured blocks and implementing stop-and-think cues, the design artificially creates the necessary latency between impulse and action. This is complemented by the Silent Teacher, thus allowing the child to self-correct and inhibit inappropriate responses through environmental signalling rather than constant adult intervention.

This inhibitory foundation paves the way for Cognitive Flexibility. The rotation through stations and the use of visual chronometers facilitate the complex process of disengagement, helping students transition between activities and mental sets. Through teacher-led skill coaching and non-verbal cues, students learn to switch perspectives and negotiate conflicts.

Finally, all these processes are protected by Interference Control. By intentionally designing low-stimulus zones, the environment filters out auditory and visual noise. This spatial scaffolding ensures that selective attention remains shielded, allowing the student to focus exclusively on the learning objective and ensuring that the entire executive machinery can function without external overload.

LEARNING OBJECTIVES AND OUTCOMES

Table 4: Learning objectives and outcomes. Own elaboration.

		Learning objectives	Learning outcomes
S O C I O - E M O T I O N A L	Self-awareness	To facilitate the recognition and naming of physical sensations and emotions.	Students can express the physical sensations and emotions with resources like the Body Map or the Mood Meter.
	Self-management	To implement external scaffolding strategies to help them calm down.	Students can come back to the Window of Tolerance by realising exercises like the Turtle Technique.
	Social awareness	To create investigation contexts that require cognitive empathy for the needs of their classmates and other living beings.	Students justify their choices based on the well-being and the survival of the animals studied. Moreover, they show empathy with peers.
	Relationship skills	To structure reduced group dynamics and twinning to model conflict resolution.	Students negotiate turns and share the working space with non-verbal protocols.
	Responsible decision-making	To guide students in making reasoned choices that obligates them to prioritise logic over immediate wish.	Students justify their selections based on research, inhibiting instant gratification.
C O G N I T I O N	Inhibitory control - Response inhibition	To implement structured pauses and reflection moments to stop the impulsive reaction.	Students stop the impulse of acting and use the pause before interacting with the material.
	Inhibitory control - Interference control	To design low-stimulus zones and use physical dividers to filter out distractions.	Students keep focus on the task, ignoring irrelevant stimuli.
	Working memory	To transform verbal instructions into visual, manageable and permanent sequences.	Students successfully complete tasks by following a visual sequence without losing track of the objective.
	Cognitive flexibility	To structure investigation environments that require a change in the rules or a switch of perspectives.	Students transit among activities and classification criteria fluently and without frustration.
	Self-monitoring	To integrate register tools and control of error to foster self-monitoring.	Students check their evidence sheet and correct their findings by comparing them with the standard provided.
L A N G U A G E	Self-directed speech	To provide tools like the whisper phones and model the use of self-instructions to guide the task.	If needed, students whisper the steps of the task while realising, using language to maintain the objective in the memory.
	Academic language	To introduce and visibilise specific terms with visual scaffolding and concise texts.	Students correctly name the habitat elements and the needs of the animals.
	Verbal reasoning	To encourage them to explain their designs.	Students explain and justify their choices.

CLASSROOM MANAGEMENT TECHNIQUES

All classes start with a welcome ritual. Upon arrival, each student is instructed to place their photograph in the Mood Meter. In the event of encountering difficulties, the body map can be used as a tool to identify the specific region in which a sensation is experienced. In the event that a student is operating in survival mode, the teacher will initiate a brief co-regulation, such as the turtle technique, prior to the commencement of the lesson. Alternatively, the instructor may suggest that the student retreats to the calm corner.

The environment is delineated by the use of coloured floor tapes and individual tablecloths, in addition to visual organisers that provide step-by-step instructions. In the event of entering a state of hyper-arousal or encountering a station with a high sensitive charge, there are noise-cancelling headphones available.

The implementation of visual waiting cues mitigates the reactive system, with techniques such as animal prints before the material at each station. In this exercise, students are instructed to position their feet and count to three prior to making contact with the resources. In addition, there are established methodologies for requesting silence, such as the use of an explorer glove.

Whisper phones serve as an external register for the working memory, thereby assisting students in performing tasks and maintaining concentration. Whispering the steps of the task while performing it and listening to oneself (self-talk) reinforces the retention of instructions by means of the phonological loop. Additionally, checklists accompanied by pictograms enable the collective to engage in self-regulation by indicating the completion of each step.

In order to reduce the occurrence of time blindness, the temporal element is transformed into a tangible sensory stimulus with sand timers and visual countdowns. To facilitate transitions, a preliminary pre-warning with rhythm is initiated five minutes prior to the routine. The process commences with a soft auditory stimulus, such as a rain stick, which is followed by a change in the pictogram on the central panel. During the change, the students will be required to follow the footprints on the floor in order to successfully reach the next station.

In the context of peer coaching, a diverse group is assembled to ensure the presence of both reflective and impulsive students. The former assumes the role of the More Knowledgeable Other, facilitating the self-regulation of the latter. Additionally, assistance is provided by former classmates from Year 5, who assist with the role and provide support. The responsibility for ascertaining whether students are within their Window of Tolerance falls both to the reflective students and to the buddies. This is achieved by means of a portable Mood Meter.

FINAL PRODUCT

The final objective of the learning situation is to apply the knowledge of animal needs to the design of a habitat plan and its construction. Initially, the students will reunite with the research sheets from previous lessons. Eventually, they will convene in groups to discuss the animal under investigation. They will then proceed to distribute the essential elements on a map, taking into account the spatial arrangement and size. The map plays an instrumental role in the inhibition of impulses through planning and organisation. Furthermore, by determining the location of the water or shelter, they demonstrate cognitive flexibility in prioritising and filtering distractions.

A number of additional tasks include the creation of a feeding schedule. In this setting, the abstract concept of time is transformed into a visual and tangible form, thereby reducing feelings of anxiety and enhancing comprehension of cause-and-effect relationships. In addition, a selection of materials required for the construction of the model will be made from a catalogue. This approach is designed to promote the adoption of responsible decision-making practices, prioritising the selection of functional materials over those that are based on aesthetic considerations. The planning process culminates in a planning sheet that serves to document the tasks and the individuals responsible for their execution. This task prepares students by encouraging them to anticipate the tasks they will be required to complete.

Afterwards, they will revise safety guidelines to work properly and distribute the resources. Then, the construction of the models will commence in small groups, with the assistance of the buddies and following the design that has been planned. The students will receive the necessary support from the instructor throughout the process. In the course of this task, the participants will have the opportunity to practice their interpersonal skills by engaging in activities such as sharing, negotiation and the allocation of tasks.

The communication of their results will be accomplished through the medium of an exhibition. In that location, the model accompanied by the selected animal will be showcased. The logic behind the placement of these elements will be explained, following a contextualised evaluation. In such cases, the internalisation of the learning situation reaches its maximum peak, as the student becomes independent in the tasks with which they were previously unable to cope.

LESSONS DESIGNED TO REACH THE FINAL TASK

Introduction

The educator makes an introductory presentation, outlining the mission: the establishment of a natural reserve, with a particular focus on the study of animals. Then, the visual schedule located on the board is consulted, thereby providing an overview of the steps: “*First, we think (telescope), then we sort (mural), then we choose (tablet)*”.

The initial activity involves a brainstorming session to activate prior knowledge on the subject of habitats and animals. The presentation will commence with the display of five habitat images, followed by a discussion regarding the identification of the environments and the species that inhabit them. Concurrently, the discourse is documented on the board through pictograms. The magic telescope will be employed, with the individual possessing it assuming the role of the speaker.

The students proceed to the stations, where they locate their habitat table, with the buddies from Year 5 joining their respective teams. The groups are then tasked with the classification of animal cards according to their respective habitats. This is initially conducted on their tables and next on the large central mural. Prior to sticking a card, students are required to position their feet on the red stop footprint and count to three. Finally, the concept of animal movements is introduced (i.e. swimming, crawling, flying and walking) to enable the students to illustrate how they move and perform the same categorisation exercises.

Thereafter, each group has a tablet to select a particular animal for study. If two students express a desire for the same animal, the buddy may use perspective-taking strategies. Initially, a waiting area will be established to accommodate the animal flashcards, thereby ensuring the animals' placement is managed efficiently. They will assist the students in the identification and labelling of their own emotions and those experienced by their peers. Then, the goal will be identified, and a fair answer will be negotiated. The participants' choices are finally documented on the pictogram checklist.

In this preliminary phase of the research, the participants will formulate their initial hypothesis by making guesses about the characteristics they believe the animals possess. The investigation will then commence into the animal's diet, aspect, and environmental needs. Relevant information is documented on the registration sheet. During this phase, the waiting box is also present in case some students struggle with immediate gratification. Finally, the teams exhibit their chosen animal and its assigned habitat.

Station 1: How much does this animal measure?

The teacher presents that students must acquire the ability to measure with precision. Firstly, the teacher will introduce the non-standard measurement with the use of blocks. Following a preliminary demonstration of the blocks, the teacher will encourage the students to measure their water bottles and books. In order to facilitate this process, the procedure will be explained and documented in the form of instructions: *"1. Start at the end; 2. No gaps between blocks."*

The students will later gather in stations to use blocks for the purpose of measuring animal cut-outs. In this setting, the students will work their working memory by counting the blocks, maintaining the number in their mind, and recording the data. The table will have an error control ruler with a reference for each animal, thereby enabling them to self-correct the exercise. Ultimately, the items will be arranged from shortest to tallest. Prior to reaching a decision, they are required to arrange the cut-outs in a designated waiting line, during which they employ self-talk: *"The lion is 8, the frog is 2. 8 is more than 2"*.

Then, the educator will undertake a DCCS (Dimensional Change Card Sort) task by means of a modification to the established unit. The collective will determine a non-standard unit (i.e. pencils, paper clips, books) for the purpose of recording size. The teacher will ask questions such as: *"Why does the dog measure 5 paper clips but only 2 pencils?"*

Ultimately, the team will gather and determine a methodology for measuring larger objects like a new surprise animal. In this setting, the instructor will introduce the concept of estimation. Therefore, the students will be required to undertake a practical exercise in which they will be expected to estimate the length of new classroom objects. The estimation will be conducted in accordance with a unit that has been previously established. As each student will use one, during the Assembly time, the teacher will introduce the need of acquiring a consensus.

Station 2: What does my animal need to live?

The lesson commences with a discussion of the concept of habitat and the fundamental requirements for animal survival. In order to intervene, the protagonists will use the magic telescope. In this setting, the educator will re-introduce the concept of habitat and undertake a review of the needs. During these designated periods, students will rotate through a series of sensory stations, at which point they will be required to adhere to the stipulated safety regulations prior to commencing the activity.

A selection of stations will be constructed, incorporating elements such as ice (with ice bags), desert (with warm sand), and ocean (with containers of water), amongst others. In this setting,

students will engage in a rotation, during which they will interact with and perceive the elements, identifying the emotions they evoke. In the event of sensory overstimulation, students are provided with headphones and are also given the opportunity to develop self-management strategies. However, the act of engaging with the sensory experience acts as a regulatory mechanism for the nervous system, prompting students to focus on present stimuli.

Furthermore, the task of measuring and recording the temperature will be assigned. This will be conducted using the thermometer. By employing external scaffolding, the teacher explains how to do the observation of the liquid's fluctuations in height. Then, they will be required to document the information on the evidence sheet. During the activity, participants will be prompted to see which animals would inhabit each station. In conclusion, the participants will perform the following actions: wash their hands, collect materials, clean up, and prepare for the next activity.

Later, the educator will present contrasting climates, namely those characterised by water shortage and elevated temperatures, such as the desert, and those marked by water abundance and low temperatures. In this section, students will be prompted to categorise flashcards according to whether they believe the animals in question possess certain needs or not.

In conclusion, the participants will be given five tokens and priority cards concerning water, toys, food, and shelter. With them, they buy the most essential elements for their habitats, doing Decision-Making in a Hot EFs moment. During this task, they experience the impulse of buying without thinking for an instant gratification, so the activity focuses on inhibit the primary wish to think of the survival of the animal. Then, they have to explain their choices and share their purchases. In this process, the teacher will redirect the mental processes of the students in case of an incorrect choice.

Station 3: What is this sense?

During this lesson, the teacher will introduce the five senses through a series of questions concerning their definition and the manner in which they and animals use them. The presentation will be accompanied by flashcards of the senses, with an instructional text that acts as a mediator and allows the students to focus on the concept. Subsequently, the instructor presents the lesson's challenge, to rotate through stations and record observations on the designated worksheet.

In the hearing station, the students will be blindfolded and required to use their ears to locate the source of a sound, such as a bell, a rattle, or an instrument. In the course of this task, participants will be required to wait, listen and process the stimuli presented to them. This will need the

suppression of irrelevant auditory stimuli, such as that from other stations, thereby facilitating the concentration of them on the task at hand.

The students are required to engage in the practice of selective attention in the sight station. They will locate camouflaged animal symbolic representations (i.e. pictures or toys) within real materials such as leaves or branches, serving as an interference control. During this process, students are required to pause and reflect after initially observing the animal, scanning it analytically.

In the taste and smell stations, they will try different tastes and odours. The former will contain small samples, such as a pinch of salt, sugar or lemon juice, while the latter will have containers with cotton balls in different scents, including vanilla extract, coffee grounds or lemon peel. The ultimate objective is to articulate the emotional responses experienced, thereby translating the emotion into language.

Students, particularly those encountering challenges with interoception, will register sensations at the touch station. When engaging with certain textures in an opaque box, such as a smooth stone, soft fur/felt, or a spiky pinecone, they will have to prioritise their sensory experience over mere tactile sensation. The focus on sensory stimulation either reduces or increases levels of arousal, depending on the texture. Then, they will be prompted to identify the sensations using adjectives. These will then be employed to assist them in establishing a correlation between the texture and the covering.

The evidence sheet is fundamental, as it functions as an error control mechanism, which enables self-correction. Upon completion, the students will present their findings. A debate will be held on the question of which sense is most important for certain animals. In this section, the concept of cognitive flexibility is employed, with the student engaging in reflection to formulate logical hypotheses concerning survival.

Station 4: What is my animal covered with?

The lesson commences with the introduction of a mystery box, from which the teacher extracts samples, including wool, a feather, and a net that serves to simulate scales. In this setting, students are required to engage with the materials and guess their tactile properties. They are required to exercise patience, as they are expected to wait for their turn to contribute.

Subsequently, the participants will be presented with images of animals and tasked with their classification according to various categories: fur, feathers, scales, and shells. During this activity, they will recall both the categories and the animals, while ignoring other criteria such as

colour or size. The mural fulfils a function in terms of error control, since it provides a basis for comparison between samples and names.

Later, the students will create a silhouette with art materials that simulate its covering, such as cardboard, yarn, felt, fabric, cotton, glitter or play-dough. The teacher will assume a guiding role by asking questions to the students about the identification of suitable materials. The students will then be tasked with selecting the appropriate material by engaging in a logical comparison with the covering.

To conclude, the students present their creations and provide a detailed explanation of the materials selected for the cover, along with the purpose of each component. Therefore, students practice self-distancing skills by directing their attention towards the needs of another living being. The lesson concludes with a transition phase, during which the classroom and materials are cleared and made ready for the next lesson.

ANALYSIS OF THE SCOPE OF WORK

This section provides an analysis and critical evaluation of the learning situation, rooted in the investigation realised and the empirical observations gathered during the internship. It contrasts the classroom reality with the neuro-pedagogical principles previously discussed. By examining the interaction between young learners and the mediators, I aim to identify how the instructional scaffolding can effectively address the performance gap.

Socio-emotional area

The classroom climate contributed to creating a neuroception of security. Several factors like the Mood Meter and welcome rituals helped to activate the Social Engagement System. As evidence, they were more open and collaborative. The students who started the day in the red zone and received co-regulation like the turtle technique, respiration or the use of the calm-down corner were able to return to the class activity.

The relationship between the Senior Infants and the 5th grade students was a powerful co-regulation strategy as well. Acting as the More Knowledgeable Other not only helped them with their tasks, but also acted as an effective scaffolding. As a result, they reduced the weight of the emotional demand over the teacher and model regulation techniques, which allowed them to maintain themselves on the Window of Tolerance.

A critical result is how the climate design affected the responsible decision-taking strategy. Based on observation and investigation, when choosing between toys or food for their animals, the students will successfully face instant gratification issues and will be able to inhibit their personal wishes. This shows that a structured climate allows them to practice cognitive empathy and logic reflection on Hot EFs situations.

The calm-down corner was used as a proactive time-in rather than a punitive time-out, which positively helped Student 2 to go back to the Window of Tolerance. Following the investigation lines researched, it will also successfully become a place in which it is possible to help the students identify their corporal signs of dysregulation (with tools such as the body map) and voluntarily ask to go. With this latter insight, the students are able to recognise their own inner state and autonomously regulate themselves.

The physical and temporal environment

As seen during the observation stage, the physical delimitation of the space with colour tapes and the use of space dividers significantly reduces conflicts. This lowered the uncertainty regarding space. This acted as an interference control that allowed them to focus their selective attention on the materials, ignoring the visual stimuli of the rest of the class. Therefore, these resources will definitely work in controlling impulsivity.

There is also a reported reduction of time blindness. As evidence, the Student 1 with need of predictability lowered his reassurance-seeking behaviours like asking for how much time is left with the sand timer. Furthermore, the transition rituals resulted in a directed task switching with less anxiety from both students and the teacher, as less verbal speech from the latter is needed thanks to non-verbal language, rhythm and mediators.

The use of waiting cues functions as a mediator to inhibit responses. Following the principles studied, these mediators reduced the needed latency between stimulus and response. The students who mainly present the performance gap will be able to stop their impulses with the scaffolding of an environment that fosters patience and goal-directed actions.

Instructional text

The combination of text and icon allows students with neurodiverse and culturally diverse profiles (EAL, ADHD, impulsive...) to bypass individual limitations. As seen in the measuring tasks, students mitigate the transience effect by having an externalised resource of the Working Memory. It allows students to focus their energy on counting rather than struggling to remember what to do next. Consequently, this resource significantly reduces the extraneous cognitive load.

During the sessions, it was observed that students frequently moved the instructions from the external text to their own private speech. They would repeat the words found on the mediators while working, using their own voice as an auditory guide. This transition is critical for the maturation of EFs, as it allows co-regulation to be internalised as self-regulation. The text provides the symbolic material necessary for the child to begin governing their own behaviour.

Finally, the instructional text serves as a permanent self-monitoring standard. Students were observed checking the posters to verify their progress before moving to the next step. As a control of error, the environment provides immediate feedback. This reduces the dependency on the educator, as students no longer need to wait for an adult to confirm their tasks. The instructional text thus empowers the student, fostering the inhibitory latency needed for reflection and autonomous progress.

CONCLUSIONS

The project addresses the performance gap by externalising the executive functions that are still maturing. The environment acts as a Silent Teacher where physical boundaries and waiting cues give the needed inhibitory latency. This allowed the students to go from reactive and impulsive to goal-directed behaviour. As a conclusion, the environment that provides scaffolding can make the students develop their cognitive potential.

Another impactful insight is that cognitive growth is aligned with emotional security. The classroom climate and the use of co-regulation strategies kept the students in their Window of Tolerance. This symbiosis guaranteed the neuroception of security and allowed the executive functions to work under pressure.

As a progress to autonomy, the instructional text and the visual cues reduced the dependence of the students from the teacher. The transformation of the external instructions in the private speech and the use of self-monitoring standards for control of error fosters a bigger self-efficacy. As a result, they learned to do complex tasks independently.

The design of the final product serves as an evidence of how the students will potentially apply the EFs. The previous training will allow a fluid transition to cooperative work, where physical scaffolding will be a social regulator. If a technical difficulty appears, they will show resilience, as there has been previous work on cognitive flexibility to tolerate frustration autonomously.

By providing multiple means of representation and action (basis of the UDL), the environment ceases to be a barrier and becomes an enabler. This ensures that a student's success is determined by their cognitive potential rather than their executive or linguistic limitations. Ultimately, what is essential for some becomes beneficial for all, creating a classroom where diversity is an asset to the collective learning experience.

This study intends to show a transformation of the teaching role, as it moves from being the only source of regulation to designing a complete learning environment. Therefore, the lesson not only resides on the knowledge acquired but also on the ability of the Senior Infants to recognise their inner state. All in all, we have built the infrastructure of autonomy.

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APPENDIX

APPENDIX I: THEORETICAL FRAMEWORK

The Optimal Zone: Calm Activation & Deactivation

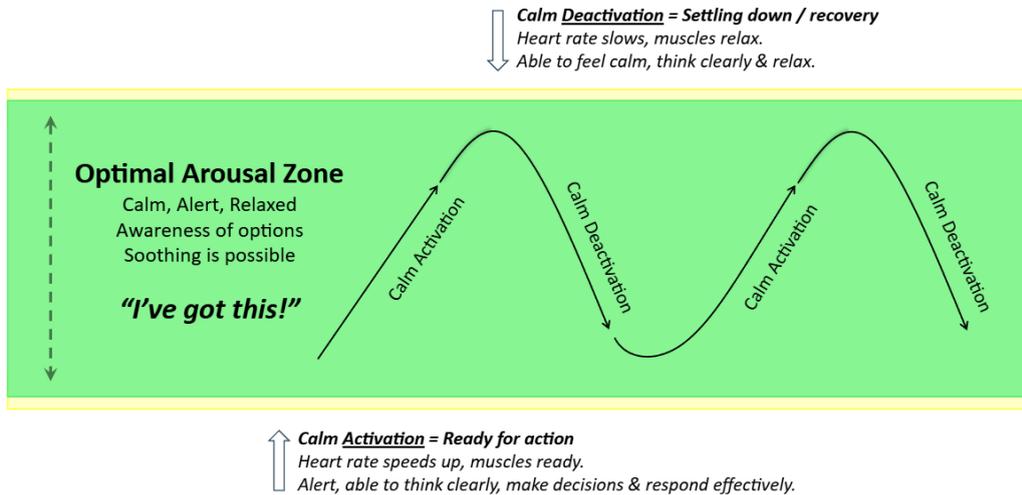


Figure 7: The optimal zone: Calm activation & deactivation (Comminos, n.d.).

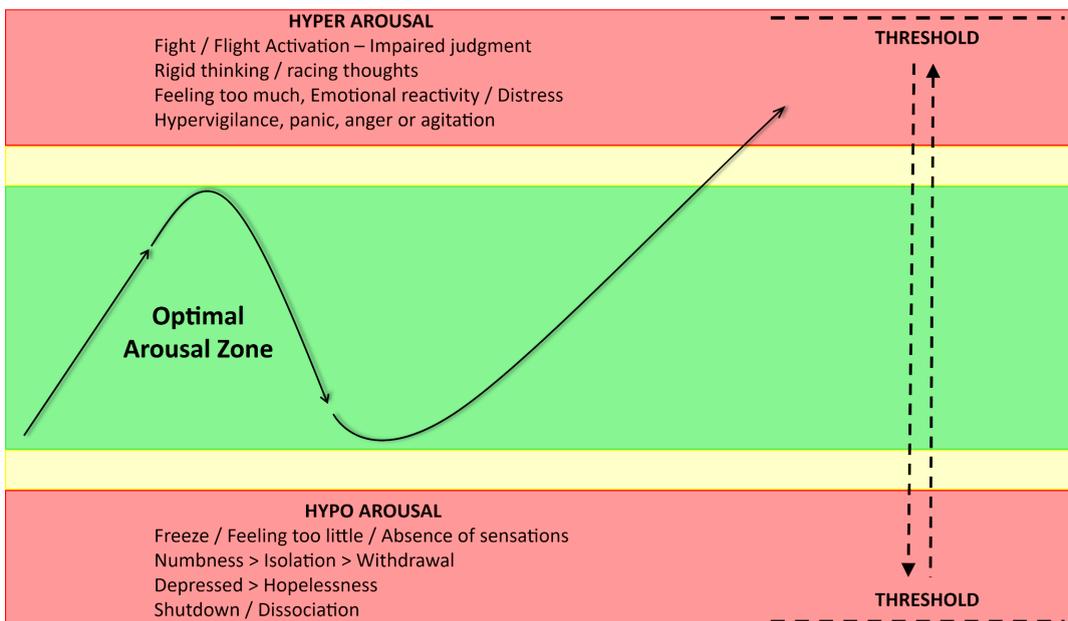
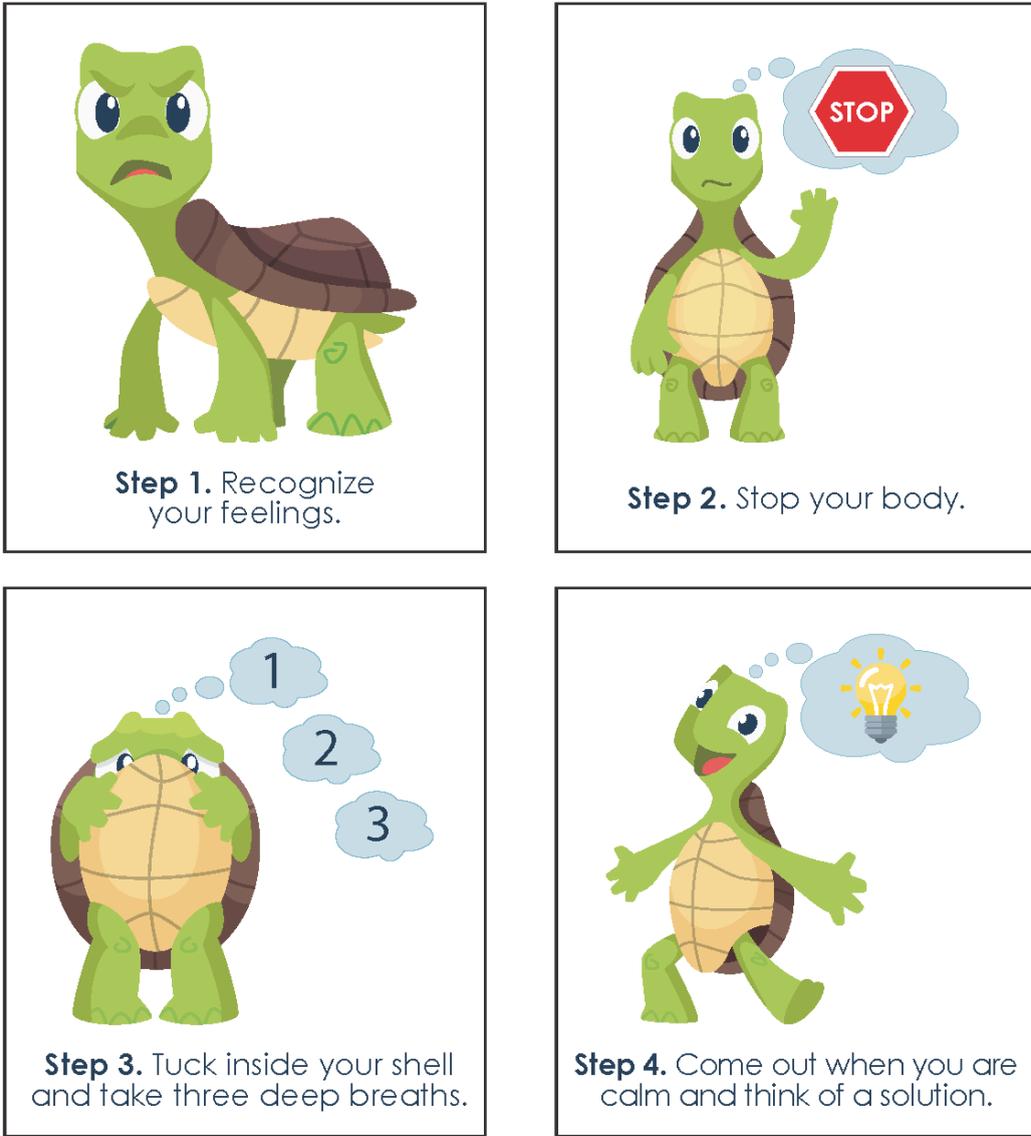


Figure 8: Specification of the hypo and hyper- arousal (Comminos, n.d.).

APPENDIX II: RESOURCES OF INSTRUCTIONAL DESIGN

NCPMI The Turtle Technique



Step 1. Recognize your feelings.

Step 2. Stop your body.

Step 3. Tuck inside your shell and take three deep breaths.

Step 4. Come out when you are calm and think of a solution.



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Pub: 06/14/19

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Figure 9: The Turtle Technique (Schneider & Robin, 1974).

The x- and y-axes form four quadrants.

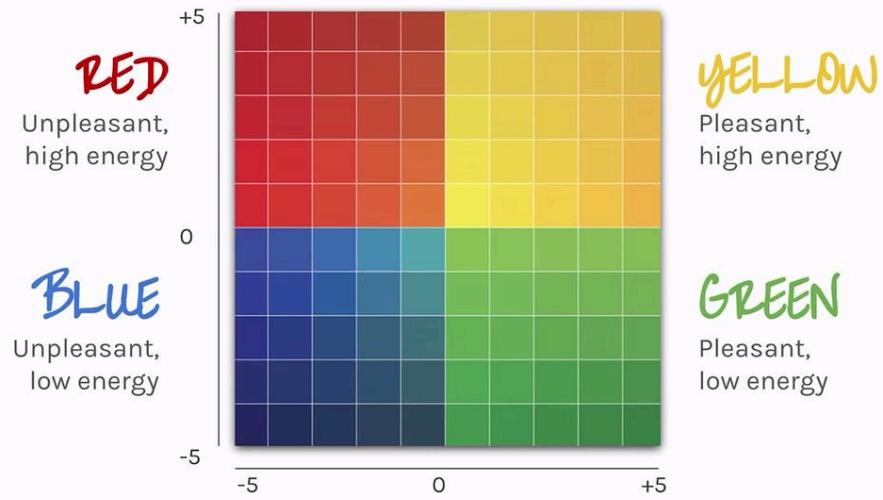


Figure 10: The Mood Meter (Brackett, 2019).

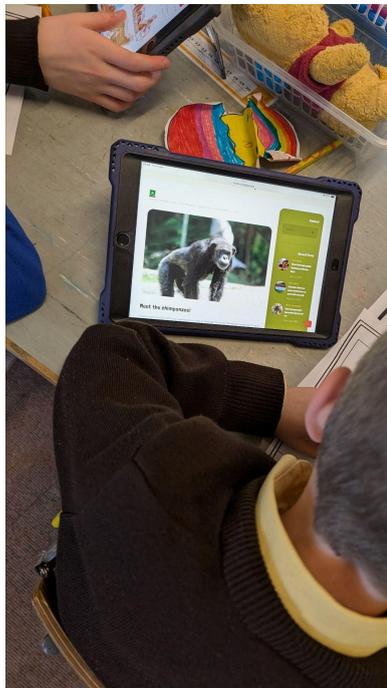


Figure 11: Classroom. Own elaboration.

APPENDIX II: UNIT IMPLEMENTATION



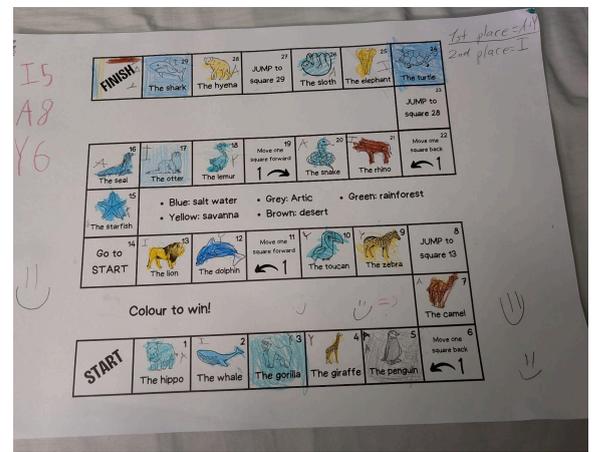
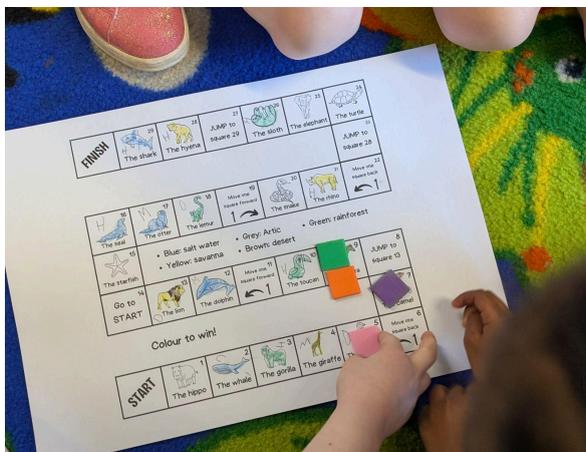
Figure 12: Measurement of objects. Own elaboration.



Figures 13 to 16: Animal investigation. Own elaboration.



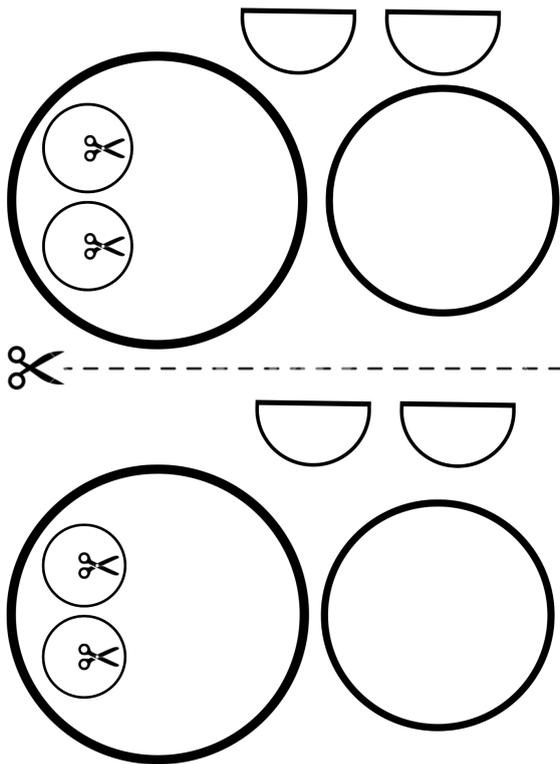
Figures 17 to 19: Habitat investigation. Own elaboration.



Figures 20 and 21: Habitat board game. Own elaboration.



Figure 22 and 23: Penguin. Own elaboration.



Figures 24 and 25: Polar bear. Own elaboration.



Figure 26: Classification exercise. Own elaboration.



Figure 27. Guess who. Own elaboration.



Figure 28: Bingo. Own elaboration.

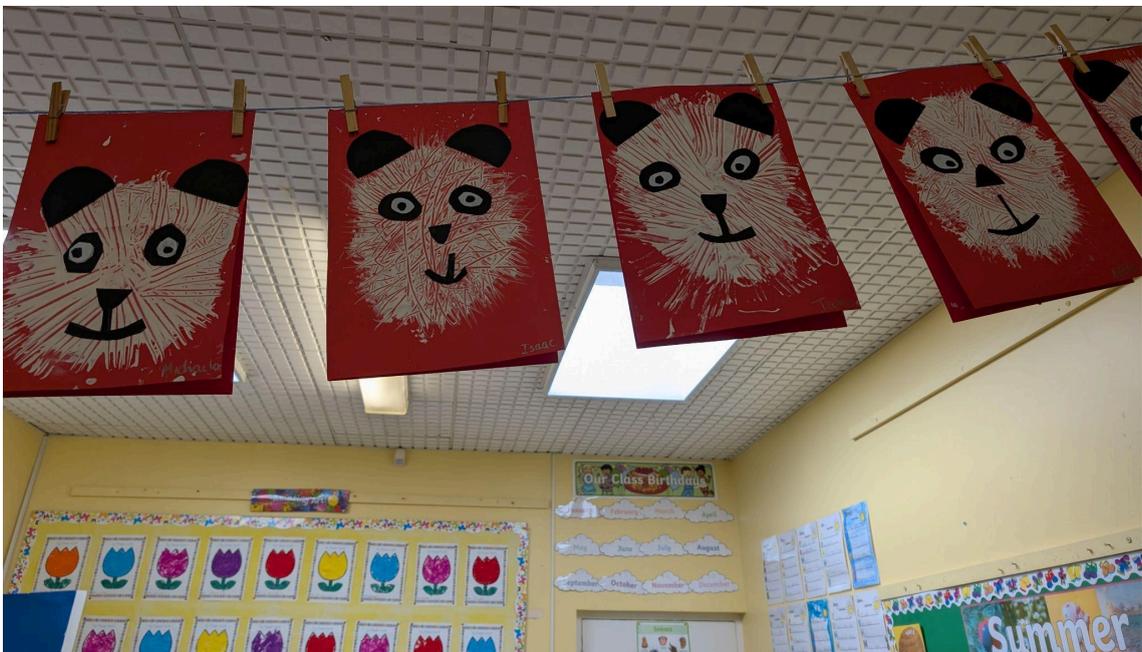
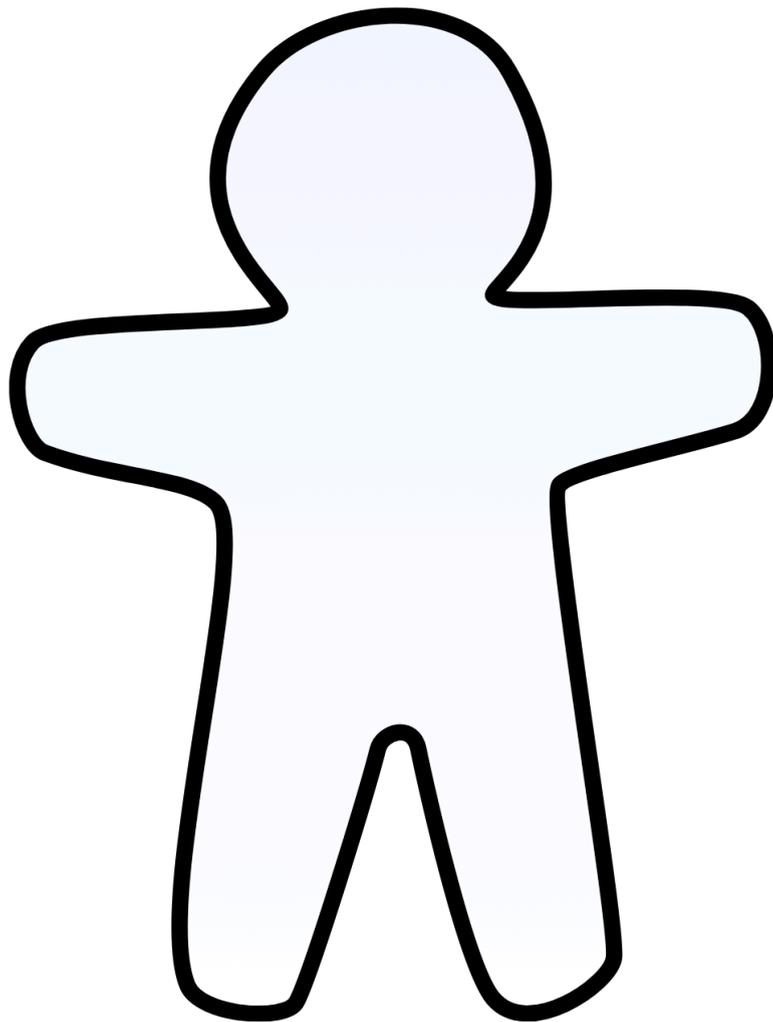


Figure 29: Panda. Own elaboration.

APPENDIX III: BODY MAP

Body map



Cheeks

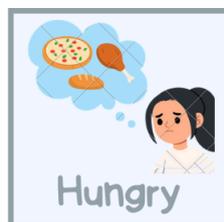
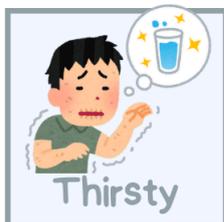
Mouth



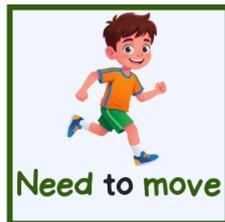
Skin



Belly



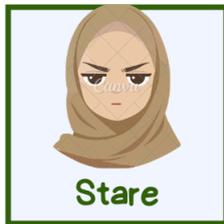
Energy and movement



Hearing



Sight



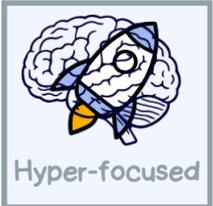
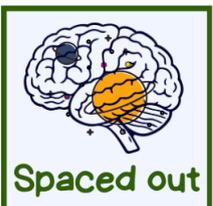
Smell



Taste



Brain and thoughts

Calm	 <p>Can think</p>	 <p>Focused</p>		
Speed	 <p>Hyper-focused</p>	 <p>Jumping thoughts</p>	 <p>Hot</p>	 <p>Noisy</p>
Off	 <p>Can't think</p>	 <p>Sleepy</p>	 <p>Tired</p>	 <p>Overloaded</p>
Glued	 <p>Stuck</p>			
Fog	 <p>Distracted</p>	 <p>Dizzy</p>	 <p>Spaced out</p>	 <p>Blurry</p>

APPENDIX IV: SAMPLE OF THE BOOKLET

NATURE RESERVE

Name _____



Penguin

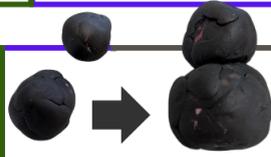


Body and head

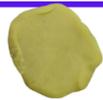
1  2  **Mold two black spheres;**

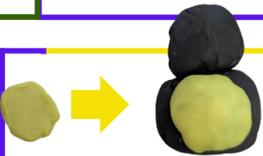
1  **one small**

and

2   **Put them together.**

1  **one big.**

3   **Mold one yellow circle and**  **roll it.**

4   **Put it in the big circle.**



Penguin's limbs

Webbed feet with claws

5   +  
Mold two small orange circles and roll them.

6     
Make them cuts with a knife.

7     
Put them under the big sphere.

Flippers

8   +  
Mold two black flippers and roll them.

9      2
Put them on the body.

Penguin's eyes

10     **Mold** two small yellow circles and roll them.

11   **Mold** two small black dots.

12   **Put** the dots in the yellow circles.

13   **Put** them in the small sphere.



3

Penguin's bill

14   Mold one cone.

15    Put it in the small sphere.



Finish!



Head
Eyes
Body
Webbed feet
Claws
Bill
Flippers

APPENDIX V: RUBRICS AND CRITERIA FOR FORMATIVE AND SUMMATIVE ASSESSMENTS

Table 5: Socio-emotional learning. Rubrics and criteria. Own elaboration.

Criteria	4 points	3 points	2 points	1 points
Self-awareness	Names emotions and localises them in Body Map autonomously. Uses the Mood Meter without being asked to.	Identifies feelings but needs guidance with the Body Map with instructional cues.	Recognises being out of the Window of Tolerance but does not identify neither the physical sensation nor the cause without adults.	Does not name the feelings nor the emotions. Has a fight-or-flight response without consciousness.
Self-management	If overwhelmed, applies calming techniques like the Turtle Technique independently and returns to the Window of Tolerance.	If overwhelmed, gets to calm down and regulate following instructions of a signal or visual cue.	If overwhelmed, requires instructions from a teacher and that they do the exercise with them to calm down.	Stays all the time out of the Window of Tolerance and does not respond to calming strategies.
Social awareness	Justifies designs based on the wellbeing of the animal. Shows respect for their peers.	Shows empathy towards the animal and peers, but requires questions to guide it.	Focuses on their wishes, but they are capable of rectifying if they are reminded of the need of the animal.	Acts based on instant gratification and immediate interests. Does not perceive the animal needs nor their partner's.
Relationship skills	Negotiates turns and shares working space using the non-verbal protocols autonomously.	Follows rules of sharing materials when the teacher indicates.	Depends on the others to mediate in each interaction to avoid conflicts.	Does not integrate in the group dynamic. Enters in conflict for the space despite the scaffolding.
Responsible decision-making	Constantly prioritises logic over wish or instant gratification.	Takes reasoned decisions after consulting the instructional text that marks the survival criteria.	Chooses by visual impulses, but changes to a logical option if they are shown a dichotomic choice.	Chooses randomly or impulsively. Does not inhibit the wish of instant gratification.

Table 5: Cognitive learning. Rubrics and criteria. Own elaboration.

Criteria	4 points	3 points	2 points	1 points
Inhibitory Control: Response Inhibition	Stops and uses inhibitory latency systematically before touching a material.	Respects the reflection pause only when the teacher signals the visual mediator or the floor.	Tries to stop the impulse but requires the teacher to give a verbal instruction every time.	Acts reactively. Manipulates the materials ignoring pausing signals.
Inhibitory Control: Interference Control	Maintains the focus on the station, ignoring the noise or the movement of other groups.	Briefly distracts with external stimuli but returns to the task after signaling the working zone.	Needs constant reminders to keep focus on the activity.	Abandons the task after irrelevant stimuli. Does not work with partners near.
Working Memory	Completes the multi-step tasks relying on the instructional text and pictograms autonomously.	Follows the visual sequence but needs external confirmation before moving to the next pictogram.	Relies on the picture but gets lost. Needs someone to mediate.	Requires step-by-step instruction of another person.
Cognitive Flexibility	Manages transitions and switches between rules positively, showing resilience.	Accepts the change after doubt. Needs extra time to switch.	Shows rigidity. Needs an adult or buddy to guide physically in the change to avoid getting blocked.	The change of rules or activity generates a paralysis that the external scaffolding is unable to stop. Does not tolerate variation.
Self-monitoring	Uses the evidence sheet or the visual model as a standard of comparison to validate the work, correcting errors autonomously.	Sees the error if they are asked to compare their work with the model.	Needs to be specifically marked where the error is to perceive. There is no spontaneous monitoring.	There is no consciousness of error. They terminate the task no matter if they fulfill the criteria.

Table 6: Language learning. Rubrics and criteria. Own elaboration.

Criteria	4 points	3 points	2 points	1 points
Self-directed Speech	If needs self-directed speech, uses resources autonomously (whisper phones, private speech...) to guide actions and keep focus.	If needs self-directed speech, uses resources when the teacher models the instruction. Needs impulse.	If needs self-directed speech, repeats unchained words of the instruction and does sequence the conduct. Needs adults to follow the steps.	If needs self-directed speech, does not use the language as a cognitive support. Producing random sounds that do not help to concentrate.
Academic Language	Incorporates and uses autonomously and successfully specific terms.	Recognises and points the meaning of these technical terms but needs intervention to integrate them in sentences.	Uses a generic language and requires intervention to offer words to repeat it.	Does not show understanding of the specific terminology of the project, even with visual scaffolding.
Verbal Reasoning	Explains actions based on research, using drawings or mediators if language is difficult to use for them.	Justifies elections when they are asked direct questions of multiple options.	Simply responds and struggles to establish logical connection between the design and the animal needs.	Does not communicate the reasoning behind actions. Elections look random.

APPENDIX VI: UNIT TEMPLATE

Nature reserve (3 rd of April - 7 th of May)	
About the learning situation/ Where the learning situation fits	
<p>The Nature Reserve project is strategically situated in the third term of the academic year. This placement is intentional for several reasons:</p> <p>This learning situation acts as a multidisciplinary bridge between several key areas:</p> <ul style="list-style-type: none"> - Social, Environmental and Scientific Education (SESE): It directly addresses the "Living Things" strand, focusing on animal life, habitats, and environmental care. - Mathematics: It integrates the "Early Mathematical Activities" and "Measurement" strands through the use of non-standard units (blocks) and data sorting. - Language: It aligns with the Primary Language Curriculum by fostering oral language through peer-to-peer coaching and the acquisition of specific academic vocabulary. - Social, Personal, and Health Education (SPHE): It supports the "Myself and Others" strand, utilizing the Mood Meter and co-regulation strategies to develop emotional intelligence. <p>By April, Senior Infants have already established basic classroom routines. They have also developed the attentional control required to transition from teacher-led activities to autonomous learning stations. Furthermore, the twinning system has had two terms before, which created the social trust necessary for it to function as a co-regulation tool.</p> <p>This project fosters higher executive demands of the 1st grade. It fosters Project-Based Learning with Universal Design Learning. This project is divided into three stages and five weeks. During the first two weeks, they will focus on research and habitats, with information gathering; in the third and fourth weeks, they will work on sensory regulation and measurement; finally, they will work on the design and the construction in the fifth week.</p>	
Prior Learning	Important resources
<ul style="list-style-type: none"> ● Listen to different stories, stories and instructions ● Take turns ● Express ideas ● Blend simple sounds ● Start to write simple letters and words 	<p>Human resources: Teacher, student teacher, SNAs, Senior Infants and buddies</p> <p>Places: class organised by stations</p> <p>Tools: iPads and booklet</p>
Language used in the learning situation	
<p>Instructional language:</p> <ul style="list-style-type: none"> - Follow instructions. - Visual sequences. - Self-directed speech. <p>Academic and specific terms:</p> <ul style="list-style-type: none"> - <u>Nouns:</u> Habitat, shelter, scales, fur, camouflage, gills. - <u>Verbs of inquiry:</u> Measure, estimate, compare, sorting. - <u>Adjectives:</u> Rough, smooth, warm, cold. <p>Language for Self-Regulation:</p> <ul style="list-style-type: none"> - <u>Stop-and-Think Cues:</u> "Feet on the footprints. Count to 3. Now touch." - <u>Conflict resolution:</u> "I see you want the dolphin. Student X also wants it. What is a fair plan?" - <u>Interoception & emotions:</u> "I feel in the yellow zone because I am excited." 	

Introduction		
Learning objectives	Learning outcomes	
To activate prior knowledge about animals.	Name habitats and animals that live in each one.	
To model the action language.	Correctly classify the images of animals in their habitat.	
To guide and give tools for the investigation.	Choose an animal from its assigned habitat.	
Discourse/Text targeted	Evidences for assessment	
<p><u>Text level:</u> to inform/to describe</p> <p><u>Sentence level:</u> Classification and answer questions / Choosing sentences.</p> <p><u>Word level:</u></p> <p>7. Habitat names 8. Animal names 9. Action verbs</p>	<ul style="list-style-type: none"> ● Oral responses during brainstorming. ● Animal card sorting on the mural. ● Choice of the animal registered in the group record. <p>Language targeted:</p> <ul style="list-style-type: none"> ● Actions ● Association between the animals, the habitat and the actions 	
Outline of leading activities		
<p>The lesson begins with a large group presentation of the project, followed by a brainstorming session about habitats and animals to activate prior knowledge. After organising into groups and assigning habitats, the small groups work on sorting animal cards on the mural, where the associated actions are also introduced. They then research and choose a specific animal for their assigned habitat, recording their selection. The next phase involves guided initial research on the animal's basic characteristics. The lesson concludes with a large group presentation by each team about their habitat and chosen animal.</p>		
Assessment criteria		
All of the students must be able to	Most of the students will be able to	Some of the students could...
Correctly classify most of the animal cards into their habitat.	Correctly classify all animal cards into their habitat.	Correctly classify all animal cards, identify errors in their classmates and help them.
Name at least 3 habitats and one animal that lives in each one.	Name all the habitats and mention 2-3 animals.	Name all the habitats, mention several animals and explain why.
Choose an animal from the provided list for its assigned habitat.	Choose an animal from the list with a simple reason.	Choose an animal, justify the choice in relation to its habitat, and mention one characteristic they want to investigate.

Station 1: How much does this animal measure?		
Learning objectives	Learning outcomes	
To model the measuring technique.	Successfully line up objects to measure.	
To facilitate comparative language.	Line up the animal cut-outs from the shortest to the tallest.	
To foster estimation and reasoning.	Choose an animal from its assigned habitat.	
Discourse/Text targeted	Evidences for assessment	
<p><u>Text level:</u> to inform</p> <p><u>Sentence level:</u> ordering and comparison sentences</p> <p><u>Word level:</u></p> <ul style="list-style-type: none"> - Action verbs: “measure”, “compare”, “order” / “line up” / “record” - Concepts: “units”, “height”, “size”... - Comparative and ordering adjectives: “shorter”/”taller”, “shortest”/”tallest” 	<ul style="list-style-type: none"> ● Photo of the final recording chart with visual data ● Evidence sheet <p>Language targeted:</p> <ul style="list-style-type: none"> ● Apply terminology for ordering ● Identify and name the key measurement concepts ● Articulate precise relationships ● Use comparative adjectives to describe results 	
Outline of leading activities		
<p>In this station, students will use non-standard units to measure certain animals. They will certainly align the units and carefully select the correct measure for each animal. Then, they will be able to compare the results with the accurate comparative and ordering adjectives with the intention of ending up ordering all the animals from shortest to tallest. They will record their findings on the evidence sheet so that their understanding of measurement and ordering concepts is stated.</p>		
Assessment criteria		
All of the students must be able to	Most of the students will be able to	Some of the students could...
Accurately align units, ensuring no gaps or overlaps.	Consistently measure, demonstrating a reliable procedure.	Self-correct procedural errors to ensure the recorded data is precise and reliable.
Record the correct number of units for each animal.	Use appropriate comparison terms.	Specify the difference in height with complete sentences.
Align the animal cutouts from lowest to highest based on measurement.	Demonstrate a reliable measurement procedure and apply it consistently with different units.	Justify why one non-standard unit is better than another for a specific purpose.

Station 2: What does my animal need to live?		
Learning objectives	Learning outcomes	
Guide sensorial experimentation.	Compare and describe different habitat elements regarding on what they are feeling.	
Model the register of data.	Record temperature measurements using a thermometer.	
Foster decision-taking.	Prioritise what the animals need for survival.	
Discourse/Text targeted	Evidences for assessment	
<p><u>Text level:</u> to inform / to compare</p> <p><u>Sentence level:</u> Use of comparative adjectives to describe results.</p> <p><u>Word level:</u></p> <ul style="list-style-type: none"> - Action verbs: “measure”, “record”, “classify”... - Nouns: “habitat”, “temperature”, “water”... - Adjectives: “warm”, “cold”, “hot”, “dry”... 	<ul style="list-style-type: none"> ● Completed Evidence Sheet with temperature recordings and observations. ● Record temperature measurements ● Animal classification choices ● Tokens elections / Priority Card justification <p>Language targeted:</p> <ul style="list-style-type: none"> ● Using sensory words to explain what they feel. ● Giving a reason ("Because...") for why they spent their "money" (tokens) on a specific survival item. ● Compare habitats. 	
Outline of leading activities		
<p>The class begins with a general discussion about animal habitats and needs. The main activity involves rotating through sensory stations (hot sand, ice, water) where students touch, feel, and measure the temperature with a thermometer to record data and associate animals with those micro-habitats. After recording the data, students will classify animals according to their water requirements, contrasting extreme habitats such as the desert and the ocean. The session culminates when students use priority cards to buy the most essential elements for their animals' survival, justifying and arguing their choices.</p>		
Assessment criteria		
All of the students must be able to	Most of the students will be able to	Some of the students could...
Record a temperature measurement with the thermometer safely and simply.	Record measurements consistently and identify if the result is hot or cold.	Self-correct procedural errors and establish causal relationships between the recorded temperature and the animal's needs.
Identify and name at least two elements essential for the animal's survival.	Classify animals into at least two types of habitats based on their specific needs.	Differentiate and correctly name multiple complex elements, explaining the difference between habitats
Select the most vital item when spending their tokens.	Compare two elements and explain why certain items are more essential than others.	Justify the choice of purchased items by arguing their impact on survival using "because".

Station 3: What is this sense?		
Learning objectives	Learning outcomes	
To facilitate the identification of the five senses and their organs.	Identify the five senses.	
To model and encourage the use of sensory descriptors.	Associate each sense with its corresponding organ.	
To guide students in linking sensory perception to animal survival.	Explain the role of each sense in animal survival.	
Discourse/Text targeted	Evidences for assessment	
<p><u>Text level:</u> Descriptive text</p> <p><u>Sentence level:</u> Simple descriptive sentences</p> <p><u>Word level:</u></p> <ul style="list-style-type: none"> - Sensory adjectives: “smooth”, “rough”, “soft”... - Verbs of perception: “smell”, “hear”, “see”... - Nouns: “sight”, “hearing”, “smell”... 	<ul style="list-style-type: none"> ● Observation checklist ● Worksheet/Recording Chart linking senses to organs and functions ● Verbal explanations <p>Language targeted:</p> <ul style="list-style-type: none"> ● Appropriate sensory terms. ● Simple descriptive sentences. 	
Outline of leading activities		
<p>The lesson begins with a large group discussion, using flashcards to introduce the senses. The core activity involves students rotating through five hands-on stations, one for each sense: Smell (identifying odors with covered containers), Hearing (finding the source of a sound while blindfolded), Sight (searching for camouflaged animals), Touch (feeling different textures in habitats), and Taste (tasting different flavors). During the rotations, students record their observations on a record sheet, matching each sense with its corresponding organ and function. The session concludes with the completion of the record sheet, a large group discussion about the correct associations, and a final critical thinking activity to discuss which sense is most crucial for the survival of certain animals.</p>		
Assessment criteria		
All of the students must be able to	Most of the students will be able to	Some of the students could...
Identify and name at least three of the five senses.	Identify and correctly associate the five senses with their organs.	Identify the five senses, associate them, and describe the main functions of each organ.
Describe the outcome of at least two stations using simple terms.	Describe your experiences at the stations using appropriate sensory terms.	Use a variety of sensory adjectives and verbs of perception to describe and compare results.
Name a sense and say a general way in which it helps an animal.	Explain the role of each sense in survival, giving concrete examples.	To justify and argue why one sense is more crucial than others for an animal's survival.

Station 4: What is my animal covered with?		
Learning objectives	Learning outcomes	
Facilitate the identification and naming of different animal body coverings.	Identify and name types of animal coverings	
Guide the classification of animals based on their physical characteristics.	Correctly group animals based on their covering	
Promote the representation of animal coverings through creative art.	Represent and justify animal coverings through art.	
Discourse/Text targeted	Evidences for assessment	
<p><u>Text level:</u> To describe / To inform</p> <p><u>Sentence level:</u> Description and classification sentences</p> <p><u>Word level:</u></p> <ul style="list-style-type: none"> - Nouns: “fur, hair, feathers, scales...” - Adjectives: “soft, rough, smooth...” 	<ul style="list-style-type: none"> ● Classification Chart/Mural ● Finished silhouette ● Observation checklist <p>Language targeted:</p> <ul style="list-style-type: none"> ● Label the material and covering. ● Join the animal with its characteristics. ● Reasoning language. 	
Outline of leading activities		
<p>This lesson focuses on identifying and classifying animal coverings (fur, feathers, scales). It begins with a sensory activity where students touch tactile samples. The main activity is classifying images on a mural, requiring students to justify their choices. Afterward, students create the silhouette of an animal using art materials that simulate its covering. The session concludes with the presentation and explanation of the creations, detailing the function of the chosen covering (insulation, camouflage).</p>		
Assessment criteria		
All of the students must be able to	Most of the students will be able to	Some of the students could...
Identify at least three types of body coverings with visual and lexical support.	Identify and name at least four types of covers and include two descriptive adjectives.	Identify multiple cover types, use descriptive terms fluently, and name the main function.
Correctly classify three animals into the corresponding group.	Independently classify most of the presented animals and justify the placement.	Correctly classify all animals and establish a classification rule for each group.
Use an art material that represents your animal's covering in silhouette.	Use the most suitable art material for your animal's cover and verbally explain your choice to another team.	Justify in detail the choice of material, relating it to the function of the animal's covering in its habitat.

Habitat design and exhibition planning		
Learning objectives	Learning outcomes	
To guide the spatial design of a habitat based on animal needs.	Design a map of their animal's enclosure.	
To facilitate the justification of design choices using causal language.	Justify the size and distribution of the enclosure elements.	
To promote collaborative planning and material selection.	Establish a work plan and select materials.	
Discourse/Text targeted	Evidences for assessment	
<p><u>Text level:</u> Expository / Instructive</p> <p><u>Sentence level:</u> Justify decisions, describing spatial distribution.</p> <p><u>Word level:</u></p> <ul style="list-style-type: none"> - Names of habitat elements: “pool”, “tree”, “cave”, “shade”... - Verbs of location: “in the center”; “to the right of”... 	<ul style="list-style-type: none"> ● Sketch/Map of the designed enclosure. ● Oral responses from the group. ● Materials list and task distribution recorded. <p>Language targeted:</p> <ul style="list-style-type: none"> ● Name the elements and say where they are. ● Use prepositions and comparatives. ● Justify decisions and organise work. 	
Outline of leading activities		
<p>This lesson focuses on students applying their knowledge of animal needs to design a habitat plan and plan its future construction. Students will primarily work in small groups to create a justified map of the distribution and size of essential elements (water, food, shelter) within the enclosure of a chosen animal, integrating concepts of spatial arrangement. In addition to designing the plan, they will create a feeding schedule and select recycled materials to build a model.</p>		
Assessment criteria		
All of the students must be able to	Most of the students will be able to	Some of the students could...
Include at least the three basic elements.	Include the distribution with the appropriate size of basic and secondary elements.	Include the spatial distribution and size of the elements, integrating handling or display considerations.
Justify elements based on a key animal need.	Justify the location and size with measurement and causality.	Justify all the ideas on the map and explain why it is a good place for the animal.
Establish a basic list and assign one task to each member.	Establish a detailed list of materials and a clear work plan.	Establish the materials and the work to make all parts of the habitat and show that everyone knows what to do.

Model construction and final exhibition		
Learning objectives	Learning outcomes	
To facilitate the collaborative construction of a physical model.	Create a model that reflects the planned design.	
To model and support the use of collaborative language.	Exhibit their work	
To scaffold the final oral presentation of the project.	Argue their decisions, explaining why their habitat is perfect for the animal's survival.	
Discourse/Text targeted	Evidences for assessment	
<p><u>Text level:</u> Instructive / Expository</p> <p><u>Sentence level:</u> Clear instructions, description of the process, explanation of the functions.</p> <p><u>Word level:</u></p> <ul style="list-style-type: none"> - Names of materials - Classification - Function terms 	<ul style="list-style-type: none"> ● Physical model ● Final Oral Presentation ● Observation of group management <p>Language targeted:</p> <ul style="list-style-type: none"> ● Ask for materials. ● Describe actions. ● Organise discourse to explain what they did and how the model is. 	
Outline of leading activities		
<p>The lesson begins with a large group review of the work plan and materials safety guidelines, followed by resource distribution and a review of roles. The main activity is the construction of the model in small groups, following the planned design, with support and troubleshooting provided by the teachers. Afterward, the cleanup and preparation for the exhibition will take place. Finally, each team gives a large group oral presentation, showcasing their model, the animal they presented, and the rationale behind their design, while the teacher models active listening and the formulation of thoughtful questions.</p>		
Assessment criteria		
All of the students must be able to	Most of the students will be able to	Some of the students could...
Finalise a coherent model with safe use of materials.	Create a clean and proportional model that reflects their initial sketch.	Innovate in the construction, adding complex textures or features not in the original plan.
Use basic language to collaborate (i.e., "Can I have the glue?").	Manage resources and tasks proactively without losing calm.	Demonstrate leadership by coordinating tasks and supporting teammates during technical problems.
Communicate the purpose of the model by naming its key components.	Justify the design and describe the process.	Argue decisions, defending the design with confidence.