

NEUROEDUCATION, NARRATIVE, AND REFLEXIVITY.
AN EXPERIMENTAL RESEARCH ON THE CARE OF EDUCATIONAL PROCESSES

NEURO-EDUCAZIONE, NARRAZIONE E RIFLESSIVITÀ.
UNA RICERCA SPERIMENTALE SULLA CURA DEI PROCESSI EDUCATIVI



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Giuseppa Cappuccio
Università Degli Studi di Palermo
giuseppa.cappuccio@unipa.it

0000-0002-4163-8591 

Giuseppa Compagno
Università Degli Studi di Palermo
giuseppa.compagno@unipa.it

0000-0002-5290-3717 

Cristina Giorgia Maria Pia Pinello
Università Degli Studi di Palermo
cristinagiorgiamariapia.pinello@unipa.it

ABSTRACT

Brain-based approaches and storytelling activities, developed according to the Digital Storytelling approach, are the cornerstones of the research described here, conducted with 75 third-year students in the degree program in Educational Sciences (early childhood curriculum) in the 2024-2025 academic year. The research process aimed to verify the validity of the Brain-based model with the aim of enhancing students' reflective skills, narrative competence, and critical reworking using technology.

Gli approcci di tipo *Brain-based* e l'attività di narrazione, declinata secondo la tipologia del *Digital Storytelling*, costituiscono gli assi portanti della ricerca qui descritta, condotta con 75 studenti del terzo anno del CdS in Scienze dell'Educazione (curriculum infanzia) nell'A.A. 2024-2025. Il processo di ricerca ha inteso verificare la validità del modello di *Brain-based* per potenziare negli studenti le competenze riflessive, la competenza narrativa e la rielaborazione critica utilizzando le tecnologie.

KEYWORDS

Reflexivity, care, Neuroeducation, Brain-based techniques, digital storytelling.

Riflessività, cura, Neurodidattica, tecniche *Brain-based*, *digital storytelling*

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Introduction

The current debate in educational research includes a growing number of contributions on the centrality of the reflective process in the construction of specific educational profiles: teachers, pedagogues, and educators. Studies on metacognition account for the individual's ability to critically focus on certain cognitive assumptions with a margin for personal interpretation, enabling them to make decisions and organize their life experiences autonomously.

This belief is countered by the research corpus in the field of Neuroeducation, which aims to propose a holistic view of the individual, a view that encompasses not only basic cognitive dimensions, but also higher cognitive, emotional, and motivational dimensions, with an implementation of brain synaptic interactions and connections. From a neural perspective, both learning and education occur through the stimulation of neurons, which process information and transmit it in the form of electrochemical stimulation to other neurons. To train neurons in their function as information carriers with qualitative input selection and a consequent increase in reflective, creative, and strategic capacity, it is useful to use so-called "Brain-based" approaches that provide constant stimulation of specific brain areas, promoting neural plasticity. Among the possible techniques, Brain Gym appears significant, which is a gymnastic-educational approach that positively impacts the activation of attentional, memory, and reflective processes in the prefrontal cortex. The reflective process, implemented by neuroeducation methodology, finds complete expression in narrative, which is simultaneously a narration of the self, of one's own story, and of the cognitive networks through which the mind has harnessed new, meaningful experiences. Storytelling and self-narration, throughout the lifespan of university education, are a way to overcome the indifference and superficiality of cognitive activity (studying, deepening one's knowledge, developing skills, etc.), which is often individualistic. Instead, it needs to be refocused on relationships and supported by critical depth and systematic reflection on what one does and who one is.

In a word, storytelling and reflection are the two faces of that "taking care," which is simultaneously attention to oneself and concern for others.

In its digital form, storytelling is one of the most effective tools not only for boosting motivation and attention span, but, above all for, documenting processes from a

variety of perspectives that can be translated into a wide range of communication codes.

Starting from these considerations, this article describes a research project designed and conducted to foster reflection within a shared knowledge community, consisting of 75 students attending the third year of the three-year degree course in Educational Sciences at the University of Palermo, in the academic year 2024-2025.

1. Neuroeducation and reflection on practice

The winds of change that have transformed the Italian university and school landscape, over the last twenty years, have not always found a one-to-one correspondence in the adequacy of pedagogical and teaching methods, forms, and strategies aimed at bridging the old and the new and moving from the context of complex classrooms to that of "simplex" learning communities (Berthoz, 2011). And while, on the one hand, educational research has broadened its scope, enriching itself with new approaches and perspectives on the question of education, on the other hand, these new insights have not automatically translated into transformative opportunities for university students, projected to become teachers or educators. Alongside new educational paths, the practice of critical re-flection on one's role has rarely been combined, as an act of care for oneself and for the recipients of one's professional action.

The connection between neuroscience and education cannot ignore the recognition of the body as the primary locus of knowledge and learning. Performing arts, particularly drama, allow for the integration of the cognitive with the emotional and bodily dimensions, offering individuals the opportunity to rework and re-signify their learning experience. This perspective, which can be traced back to a Pedagogy of the person, is consistent with neuroeducation approaches, promoting self-awareness as a bio-psycho-corporeal unity capable of learning through action, gesture, and relationship (Compagno, 2020). Right here, the educational dimension of care intertwines with the growth of reflective consciousness, which calls for training that integrates cognitive skills with ethical and relational responsibility (Bellingreri, Sidoti in Compagno, González Monteagudo, Sidoti, 2020). From this perspective, the neuroeducation perspective opens up to understanding the person in his/her dynamic and relational whole, and

the body becomes the primary space for learning and mediation between emotion and thought.

Starting from these considerations, this paper aims to offer some ideas for reactivating and evaluating university students' reflection on the skills they have acquired, with a view to their application in schools or educational communities. In particular, it focuses on the contribution of neuroscience and its application in the field of education and training.

This is a recent field of research that stems from the so-called American Brain-based approach (derived from the synergy between Neuro-physiology, Cognitive sciences, and Educational sciences), variously referred to in Italy as 'Neurodidattica' (Rivoltella, 2012; 2024), and focuses on identifying the brain mechanisms that regulate the processes of acquisition/learning and teaching. Neuroeducation research (Gola, 2024) focuses on the neurofunctional analysis of the brain, understood as the axis around which understanding the learning process revolves. A clear distinction emerges between synaptic output, in the case of learning, and synaptic output in the presence of a formal act of teaching: teaching involves a higher qualification of the connections between synapses, compared to the simple acquisition of information in more spontaneous and undirected learning contexts (Goswami, 2004). This also determines a significant modification of the brain's morphology, so that, over the course of life, "the brain constantly 're-constructs' itself in order to cope with ongoing changes and meet the ever-changing demands; the cognitive, behavioral, and emotional status of an organism is remodeled by this lifelong self-adjustment and self-optimization process" (Gülpinar, 2005: 300).

Brain-based action, aimed at developing pre-existing abilities or creating new ones, constitutes the driving force through which to systematically deploy series of stimuli capable of modifying the neural networks of the human brain. Such a neuroeducation approach allows us to consider the construct of 'education' in physiological terms, as brain plasticity and the neural potential for transformability and the progressive definition of brain profiles, with the consequent demarcation of cognitive styles and the hemispheric specialization of intellectual typologies (Gardner, 2005). Here, the implicit nature of neuroeducation becomes apparent, which aims to provide a holistic vision of the learner that encompasses not only the basic cognitive dimension, but also that of a higher cognitive level, with its neural mechanisms underlying complex operations such as reflection, strategic thinking, creative capacity, and value discernment.

During its development, the brain requires motor experiences for the development of higher areas, such as language and complex thought. It is no coincidence that one of the strategies for revitalizing the learning process implemented in the Brain-based approach is Brain Gym (Dennison, 2008), a series of movements and exercises that aim to stimulate the functioning of both cerebral hemispheres, with an immediate impact on the three dimensions of laterality, centrality, and neuromotor focus, according to the scientific model of the triune brain (McLean, 1975).

The idea of movement associated with the cognitive process is also fully consistent with the neuroscientific theory of mirror neurons, which, due to their mimetic and mirroring nature, are activated when seeing others perform certain actions, in a sort of dialogue that lies halfway between vision and motor impulse. These neurons can be classified both in relation to the type of action being observed and the type of relationship between the observed and the encoded action. In other words, mirror neurons rehabilitate the motor areas of the cerebral cortex, notoriously dedicated solely to executive functions, since it is precisely the individual's motor capabilities that enable the understanding of perceived actions and the degree of underlying intentionality (Rizzolatti-Sinigaglia, 2006). This not only readily points to a peculiarity of educational action—its imitative essence—but also subtly suggests privileging the strategies of imitation and mirrored movement for the purposes of cognitive specialization and the refinement of higher cognitive abilities. Mirror neurons also serve to understand the meaning of others' actions by intuiting their intentions, thus adopting the most appropriate interaction strategies and developing the ability to infer and constantly reorient one's own actions.

Neuroscience therefore provides important insights for educational innovation, shifting attention from the level of mere intellectual knowledge to the transversal implementation of higher cognitive processes through the motor activation of brain areas responsible for multiple functions. The Brain-based approach also opens new paths for teachers to guide their students towards self-awareness as a bio-psycho-operational unit (Tokuhamma-Espinosa, 2010).

This leads us to rethink university teaching itself in terms of expertise in activating reflexivity as a superior macro-faculty that oversees the development of the person, in an overall harmonization since “educare è continuare a fare spazio, fin da subito, alle infinite modalità di espressione di ciascuno, e come tali, ignote e sempre da scoprire; è riuscire a superare presunte certezze, rompere schemi (...)” (D’Alonzo et al., 2024, p. 63).

2. Well-being and narration of the training experience

Among the complex cognitive operations related to reflective capacity is that of narration, a skill of historical-factual sequencing not immune to strong emotional-affective connotations. Within the itinerant circularity between present and past, the "narrating brain" constantly recalls experiential segments of its own life and presents them not only as archived and revisited memory traces, but as pieces of a cognitive and emotional mosaic that form the backdrop to the individual. In this sense, narration sounds like a performative act capable of generating awareness and transformation. The story, whether oral, written, or theatrical, becomes the symbolic place in which the individual reworks their experience, integrating cognitive, emotional, and corporeal dimensions. González Monteagudo (2020) highlights how biographical and narrative approaches represent spaces of emancipation and personal growth, in which the individual learns to give shape and meaning to their own story. Similarly, Sidoti (2020) interprets narrative education as a healing strategy, capable of promoting responsibility towards oneself and others. The narrative dimension, meant as a 'staging' of the self, therefore takes on an educational and therapeutic value, as it allows one to inhabit one's own story and translate the profound meanings of personal development into corporeal and symbolic language. This process of self-narration and self-representation fosters the emergence of embodied knowledge, in which mind and body contribute to the construction of identity and well-being.

The meaning of narrative work lies in the recovery and valorization of memory, the subjectivity of experience, and the word as self-expression. This recovery permeates every aspect of the formative experience and is based on the interlocutor's willingness to listen, his or her permeability to others, and respect for the stories being told. "Tales are marks that leave traces of the human struggle for immortality. (...) They are formed like musical notes of compositions (...). The words that are selected in the process of creating a tale allow the speak-er/writer to play with options that no one has ever glimpsed. The marks are magical." (Zipes, 1999, p. 2). A reflection on some key words used by Zipes leads us to consider storytelling as a path to the immortality of one's self and one's experience — both private and professional — and, therefore, as an art that creates immortal objects, everlasting texts, which, passed down orally or in writing, preserve intact the very human need to survive time. The person who tells stories, then, is not unlike the musician and

composer, who weaves melodies and harmonies based on the as-sociation — more or less original — of the same set of notes. In narrating, one continually selects, rearranges, deletes, and revises parts, until the story and the experience itself take shape. Storytelling is part of the formative experience. The activity of narrating constitutes a cognitive operation, inevitable and common to each of us (Jedlowski, 2000, 112): it means developing relationships, connections, entering into relationships.

Barthes (1998) states that narration can be recognized as the human activity par excellence, and while culture cannot exist without telling and narrating oneself, conversely, both of these processes cannot occur except within the framework of a culture. Writing a story means planning a plot: one must plan in advance what thesis one wants to support on the topic addressed and how to conclude it, what questions one wants to raise, and what order one wants to give to the narrated sequence in order to elicit the intended effects. Stories are used for learning, and what one must focus on is the ultimate act of learning (Schank, 2007). Narrative thinking can be conceived of as a highly specialized cognitive modality structuring experience and constructing interaction with the social world. A narrative learning environment includes narration from a problem-posing vs. problem-solving perspective and can serve to convey thematic learning and develop social skills. Today, thanks to the advent of technology, storytelling takes on multiple characteristics, amplifying its communicative potential, not only for those who enjoy it, but also for those who produce it. Indeed, we live in a world pervaded by stories: not only the media, but also news, politics, corporate communications, and advertising construct their identities and symbolic spaces through discourse that, increasingly deprived of rational arguments, is nourished and strengthened by the emotional power of narratives, with their wealth of founding myths, archetypal characters, and existential progressions (Salmon, 2007; McDrury and Alterio, 2003; Petrucco and De Rossi, 2009). Some research suggests that narrative form could be used as a teaching tool across the entire curriculum and in relation to every subject, as it is fundamental to the process of constructing knowledge through the interpretive elaboration of experiences (Schank, 2011). Web 2.0 tools — iPhones, iPods, iPads, and smartphones — are trans-forming the way we imagine the world, even though the foundation of their functioning remains the relationships established between people: the ability of technologies to preserve memory depends on the human will and sensitivity to use it. Storytelling is certainly not a lost and forgotten art: it is defined as the modern

expression of the ancient art of storytelling (Ohler, 2008) and consists of using digital media to create enriched stories to be told, shared, and preserved. It is precisely these three moments that are crucial. Story-telling is always a cognitive-reflexive act that calls upon superior thinking abilities. Narrative discourse always addresses another, who, depending on the context, could be an individual, a group, or another imaginary entity, understood as a projection of ourselves (Smorti, 1994; Orr, 1996; Bakhtin, 1988). By writing a digital story, we realize the importance of personal feelings and emotions linked to a significant event, worthy of being told and shared. Lambert (2009) states that the future of digital storytelling is closely linked to the use of mobile devices. Immersion in increasingly participatory, socializing, and creative online environments, and the use of web 2.0 tools, allows everyone not only to access mainstream stories proposed by the media, but also to write their own story, then publicize it online and make it the protagonist of the media space. A new symbolic space emerges, which Castells (2010) defines as mass self-communication, where there is a strong and uninhibited tendency to hybridize heterogeneous cultural forms, to bring individual and collective sources and content into conversation, to produce individual stories in harmony, but also in counterpoint and almost in mediated interaction (Thompson, 1998) with the system of recognized sources. In recent years, digital storytelling has become a learning tool that en-gages teachers and students through the use of digital technology and media. The key characteristics of this narrative type are interactivity and a significant level of engagement, as well as the resulting strengthening of motivational variables and engagement that storytelling offers. Several terms are used to describe this narrative type, such as digital documentaries, computer-based stories, digital essays, electronic memoirs, and interactive storytelling. Each of these terms shares a common denominator: they all refer to the art of telling stories using a variety of media, including graphics, audio, video, and web publishing.

2.1. Formative assessment as a practice of caring and reflective learning

Digital storytelling has had a positive impact on education. Hull and the New London Group, a coalition of uscholars and educators working in media literacy, have spent the last decade seeking to broaden the definition of literacy to accommodate the needs of students learning in a digital world. The Center for Digital Storytelling (CDS) in Berkeley, California, is known for developing and

disseminating the seven elements of Digital Storytelling introduced by Lambert (2002).

Teachers who support students in sharing experiences and practicing storytelling processes: encourage cooperative activity; value the emotional aspect; connect theory to practice; stimulate students' critical thinking skills; value experience; encourage self-regulation; and build new knowledge. Digital storytelling is a disciplinary resource that enables reflection and storytelling to foster deep learning and provides students with the opportunity to engage with others' thinking processes and enable the development of scaffolding. Where digital stories are used for reflection the learning may not always be apparent as narrative models of knowing are models of process in process. Thus, although the group stories evidenced some, but not high levels, of reflection they were useful as an engaging focus for collaborative reflection. Such a group process at induction is seen as a means of assisting individual students both in reflecting and in entering the higher education student community, although its use does need to be carefully integrated and sufficient time allowed. In the context of university education, formative assessment can be understood as a true practice of care (Mortari, 2015): an educational gesture that accompanies, listens, and guides, rather than measures or classifies. From this perspective, assessment means caring for the learning process, recognizing the uniqueness of each learner and promoting their personal and professional development (Boud & Falchikov, 2007). Feedback, a constituent element of formative assessment, is configured as a space for dialogue and shared reflexivity, in which the educator acts as a facilitator of awareness, supporting self-regulation and the construction of meaning (Black & Wiliam, 1998; Allal, 2007). The act of assessment, if experienced within the framework of care, is rooted in an ethic of responsibility toward others and toward knowledge itself (Cambi, 2010; Mortari, 2002). It thus becomes a pedagogical tool capable of promoting deep learning, oriented not only towards performance but also towards the development of reflective, empathetic, and relational skills (Castoldi, 2016; Le Boterf, 2010). This perspective calls for an evaluative pedagogy inspired by the paradigm of complexity (Morin, 1999), capable of intertwining clinical and human knowledge, technique and sensitivity, objectivity and narrative (Charon, 2008). Finally, embracing formative assessment as a care practice implies a redefinition of university curricula in a relational and transformative way: an invitation to build educational contexts that care not only for knowledge, but for the people who learn (Bobbo, 2020; Zannini, 2002). In this sense, assessment is no longer the final moment of a journey,

but the very place where professional competence is formed, reflected, and regenerated, in the constant tension between knowledge and care.

3. The research

The teaching/learning process is more effective when narrative methods are used, grounded in concrete contexts outside the educational environment and involving students' social lives. Reflection on appropriate methodologies and strategies to support the learning process is linked to the recognition of the centrality of experience, the organizing principle of educational practice. By engaging and empowering students, experience encourages them to critically reflect on their learning, to revisit the criteria that informed their choices, to consider themselves and the situation from a different perspective, to evaluate the results achieved and their effects, to identify new perspectives, and to plan new research avenues. This paper presents the results of a study conducted with 75 third-year students of the Bachelor's Degree in Educational Sciences (Early Childhood Curriculum) in the 2024-2025 academic year. Through this research process, we aimed to verify the validity of the Brain-based model, with the aim of enhancing students' reflective skills, narrative competence, and critical working, using technology.

3.1. Research Hypotheses

As part of the research project, we predicted that at the end of the experimental action (Brain-based approach), performance in the experimental group would significantly improve, indicative of the development of reflective skills, narrative competence, and critical reflection.

It was hypothesized that the Brain-based methodology used during the Experimental Pedagogy and Assessment Science course would significantly improve the following students' abilities:

- the ability to reflect on their own learning process;
- the ability to critically evaluate their own work;
- the ability to critically reflect.

After formulating the specific hypotheses, we proceeded to select the initial, ongoing, and final survey instruments, define the research plan, and design and develop the training methodology that would be tested to test the hypotheses.

3.2. Assessment Tools

To assess the acquisition of reflective and narrative skills, two focus group sessions and digital storytelling conducted by each instructor using the Alterio and McDrury (2003) model were used. The two focus group sessions took place at the beginning of the course (September 2024) and during the final exams (January-February 2025). Focus groups were chosen because they are particularly effective for collecting qualitative data in a limited time, prioritizing in-depth analysis. Focus groups also offer unique and unpredictable perspectives on the topic, which was essential for acquiring significant data on the tutors' attitudes and beliefs. The use of focus groups is important because they simulate/anticipate the decision-making process, reducing uncertainty. According to Palumbo (2001, p. 170), this is a cooperative form of knowledge production, but also more pragmatic because it is anchored to planning or decision-making purposes. As Trinchero (2004, pp. 245-246) notes, focus groups are useful for empirically identifying ordinary descriptions of reality shared by students, recognizing that group interviews do not eliminate the subjectivity of those interpreting data regarding specific opinions and attitudes, but can reduce it through a stipulative process of knowledge creation. Once the theoretical premises of the investigation and the knowledge needs it aimed to address had been defined, these questions could be translated into a form appropriate for the students. The outline was constructed based on the objectives of the investigation, the individual's theoretical expertise, paradigms, previous research, and the literature on the topic. We attempted to ensure that the outline included well-formulated questions relevant to the topic under consideration. It was ensured that the questions were asked in the most direct and straightforward manner possible, without ambiguities or grammatical forms that might lead the subjects to predetermined answers. The outline of guiding questions was constructed based on the research objectives, following Krueger's (1998) recommendations. Alongside the moderator, each focus group was accompanied by an assistant moderator, who observed the discussion and noted key elements, such as the interviewees' nonverbal behavior, any leadership or reporting relationships, members' areas of influence, and the impact of their opinions on

others' positions. During each discussion, the moderators attempted to cover all the topics on the outline, dedicating equal time to each. The funneling strategy (Frisina, 2010, p. 41) was used, meaning the most important topics were placed at the center of the discussion, addressed approximately halfway through the meeting, after the students had become familiar with and begun to explore the topic.

The thematic areas chosen for the focus groups were:

- personal reflection on the learning process within the Experimental Pedagogy and Assessment course;
- the comparison of self-regulation and self-assessment strategies used in the learning process and those used in the study;
- reflection on the process of critical reworking during the learning process.

The material collected from the focus groups was systematized by the research team into a set of statements and connections between statements, following an approach similar to that used in text analysis and ethnographic research (Losito, 1993), but taking into account the specificity of the material resulting from the dynamics established during the group discussion (Krueger, 1998). To analyze the material from the sessions, grids and diagrams were prepared to systematize opinions and positions on the topics covered.

In the research report on the focus group results, to ensure the re-searchers' interpretations were consistent with the observed situation, we also included some specific words spoken by the focus group participants. This format outlined the main findings in clear and concise language, citing—where appropriate—participant opinions, but in very limited numbers and chosen only for their relevance and informative content.

Each group averaged twenty participants; each focus group lasted an average of one hour and thirty minutes. Even though a focus group is by its nature an open-ended research experience, and therefore its results can hardly be precisely predetermined like a statistical survey, we nevertheless attempted to ensure that the analysis was systematic, took into account certain predefined and explicitly stated criteria, and was verifiable.

Finally, we chose to evaluate the Digital Storytelling created by each student through a grid using the model by Alterio and McDrury (2003), two researchers from New Zealand, who outline a theory of Storytelling as a tool for effective learning by relating the art of narration to the processes of reflective learning. In the Learning Process, drawing on Moon's (1999) five-stage map, McDrury and

Alterio (2003) create a reflective learning model that represents how people identify, tell, and construct a story through collaborative processes. The model includes five stages of learning through storytelling:

1. Story finding (finding an interesting story). In this first stage, the teacher presents a story that raises questions and reflections—for example, a video, a poem, a photo, or a short story—and invites students to find and present a story on a specific topic.
2. Story telling (describing, deconstructing). In the second stage, the teacher encourages students to make initial sense of the story.
3. Story expanding (reflecting, making meaningful). In this third stage, the teacher invites students to reflect on the deeper meanings of the story.
4. Story processing (questioning, researching). In the fourth phase, the teacher assists students in highlighting the story's significant elements and promoting a shift in their perspective on the problem.
5. Story reconstructing (imagining alternatives). In this phase, the teacher asks students to explore how they might modify the story and promotes effective action to reconstruct the story.

In McDrury and Alterio's model, the story is shared in ways that allow both the narrator and the listener to explore the story's issues, patterns, and themes.

3.3. Research Methodology

The research program for the development of media and narrative skills involved two steps.

The first step aimed to design and develop the program using the Brain-based methodology, which would develop specific reflective, narrative, and critical reworking skills in university students as part of their teacher-training journey, given that "It appears that the introduction of neuroscience into an Initial Teacher Education Program can support and facilitate the transfer of neuroscientific knowledge into best practices in the classroom" (Ferrari & McBride, 2011, p. 85).

The second step tested and sought to consolidate the training methodology in the teaching module of play/planning, documentation, and assessment in early childhood of the Degree in Educational Sciences (early childhood curriculum) at the University of Palermo.

Among the unique applications of the Brain-based approach, we used Brain Gym, literally "brain gymnastics," to construct the activity. This involves a series of movements that activate basic and higher cognitive functions, ranging from comprehension and communication to reflection and metacognition (Dennison, 1992). With Brain Gym activities, we activated a combined use of different sensory, perceptive, and expressive channels that engage the entire person in the learning and/or training process, promoting effective integration between the physical, mental, and emotional body. This approach allowed the trainees to gain greater self-understanding and to notice how their skills improved and their commitment became less tiring. We started with Dennison, who structured his learning system based on MacLean's concept of the triune brain. Therefore, we started from the comparison between MacLean's brains and its three dimensions: the laterality dimension, the centering dimension, and the focusing dimension, considered as "physical access to brain function" (Di Gesù, 2013).

The right/left laterality dimension is involved in the communication and coordination of the right hemisphere with the left hemisphere in the neocortex. In the motor sphere, all movements that cross an ideal line dividing the right side of our body from the left side, corresponding to the corpus callosum, are implicated: writing, reading, movement on a piano keyboard, drawing the bow of stringed instruments, observing the street while crossing the street, cutting food on the plate, tying one's shoelaces, brushing one's teeth, etc., and any other movement that allows our sensorium (eyes and ears in particular) to perceive what is happening and what is in the surrounding space to the right and left. In the cognitive sphere, it corresponds to the communication between logical and analogical information thanks to the passage of neurotransmitters through the neural network of the corpus callosum.

The second dimension involves the limbic system and the cerebral cortex, and in the motor sphere, it involves those movements that ideally divide the upper body from the lower body. Naturally, the perception of a balanced center of gravity is the optimal situation an individual must seek to allow for better blood flow to the brain and therefore greater oxygenation.

The front/back focusing dimension manifests itself in the coordination between the brainstem and frontal lobes and is involved in activities that require movement from back to front and vice versa, in crossing the line that ideally separates the front from the back of the body. Activities involved include looking in the rearview mirror to gauge the space available, certain movements when returning a tennis racket or

a soccer ball, and all movements that involve the perception of the area behind our body in relation to that in front. The primary reflex function for the preservation of the species (fight/flight) coordinates with the cortical function in evaluating the most biologically advantageous solution for social life. The "guardian tendon reflex," which is activated in the event of a threat, is followed by physiological relaxation, resulting in a well-balanced posture. In the cognitive domain, when a sense of balance and serenity is perceived, learning flows naturally, and the processes of deep attention, concentration, and understanding occur spontaneously.

A balanced posture with respect to this dimension is flexible and leaned slightly forward, as if "ready to go." When a posture block occurs during focus, stiffness in the knees is observed. The person experiences difficulty devising strategies, actively participating in the environment, intuiting meanings, and understanding events. Often, they perceive difficulty in starting something. Conversely, a person with a good aptitude for focus is flexible and open to the elements—surprise in the moment—and is capable of following through on projects and completing them to begin new ones. Dennison subsequently integrated the three cognitive-spatial dimensions with four other dimensions (motivation, crucial, breathing, and body regular) and developed a total learning condition through four activities: Positive, Active, Clear, Energetic (PACE), each corresponding to specific movements. The Positive activity corresponds to Cook's Cross Contacts, which restore balance after emotional or environmental stress; the Active activity corresponds to the Cross Crawl movements, which activate communication between the two cerebral hemispheres; the Clear activity corresponds to the Brain Points, which stimulate the production of neuro-transmitters at the synapse level; and finally, the Energetic activity corresponds to the introduction of a conductor of electricity into the body, namely Water. Dennison identified 26 bodily movements of interhemispheric coordination. Of these, eleven activate the connection between the two hemispheres and stimulate the lateralization process by activating the eyes, hands, feet, and head. Dennison gave these exercises unique names, such as Cross Crawl, Lazy 8s, Double Doodle, Alphabet 8s, The Elephant, and so on. These exercises work bilateral crossed movements and activate cognitive processes by implementing higher-order ones. The research methodology used was qualitative.

3.4. The Experimental Intervention

The experimental action for its implementation envisioned and achieved three phases. In the first phase (October 1-30, 2024), the first focus group session was conducted and Brain-based activities were developed for the development of reflective, narrative, and critical reworking skills. In this first phase, while the activities were being developed, the module began by introducing the ordinary factor. The second phase (November 3 - December 21, 2024) of the intervention was characterized by the introduction of the experimental factor, specifically the Brain-based methodology, according to a well-defined schedule. The intervention lasted a total of 60 hours. The program consisted of three weekly meetings, each lasting two hours, for a total of 30 meetings. In the third phase (January 28 - February 20, 2025) of the intervention, the data from the Digital Storytelling sessions and the final focus group session were processed.

4. Discussion of the Results

The analysis of the collected data allowed us to identify the changes that had occurred among the students; the assessment sessions also served as an opportunity to make adjustments and reorganizations. The students involved in the research, as previously noted, were 75 students attending the Educational Sciences program, Module on “Playful Teaching & Planning, documentation, and evaluation in early childhood” in the 2024/2025 academic year. Most of the students were between 20 and 25 years old, and approximately 67% came from towns in western Sicily, while the remaining 33% were from the province of Palermo. 91% of those attending were enrolled in their second year; 7% were also enrolled in their second year but working, and the remaining 2% were enrolled in years after the second. Ninety percent of the students attending had a high school diploma in the humanities (social/psychological/pedagogical high school, classical high school), while the remaining 10% had a degree in science or business. Most students (89%) had already taken and passed at least two exams in the first semester.

4.1. Focus Groups

The data collected through the two focus group sessions were analyzed using NVivo software, which offers a suite of procedures useful for describing, analyzing, and interpreting the diverse materials and data generated during a research process. Data were divided into three thematic areas to which the questions referred:

- personal reflection on the learning process within the Experimental Pedagogy and Assessment Science course;
- comparison of self-regulation and self-assessment strategies used in the learning process;
- reflection on the process of critical reworking during the learning process.

In the first focus group session, held before the start of the research process, the second-year students collaborated lively. The results reveal a rather critical situation. 79% of the students interviewed emphasized that they rarely reflect on what they learn during a university course, and that often the goal is simply to pass the exam. "Very few teachers stop to reflect with us on the skills developed during the course," admitted 69% of students. They admit that before starting a course, they don't obtain the relevant transparency sheet but wait for the teacher's presentation of the course. Regarding the comparison of self-regulation and self-assessment strategies for learning, 70% stated that if the teacher doesn't provide guidance on all phases of the work, they have difficulty independently regulating the process, and if the teacher asks for a self-assessment at the end of the course, they become anxious. Reflection on the critical review process reveals that students often focus more on the formal aspects of a course (organization, exams, ongoing tests) rather than on reviewing the course completed, the skills developed or strengthened, and the difficulties encountered.

The second focus group session conducted during the summer exam session revealed a significant increase in students' perceptions of their coursework, as well as their perceptions of the learning process and the skills developed. In particular, most students noted how the Brain Gym program allowed them to work on their minds and bodies, and how this benefited their learning process. They all agreed that the reflective, narrative, and critical exercises allowed them to approach the exams fully aware and responsible for their learning process and the challenges they had yet to overcome. Students emphasized that the self-regulation and self-assessment activities helped them understand themselves better and, in particular, to pass exams more easily while simultaneously focusing on their studies. Thanks to the self-assessment strategies implemented, they were able to participate in the meaning of their grades. Finally, the critical reflection promoted during the program helped them recognize how challenging the assessment process is.

Conclusions

Although the intervention was initially disorienting for students (as no other subject in the degree program required them to strengthen narrative, reflective, and critical reworking skills, along with content knowledge), at the end of the intervention, students appreciated and positively evaluated the process implemented and created a product that was the result of a long and demanding process.

Digital Storytelling offered students the opportunity to examine and learn from complex situations through reflective dialogue. Attempts to integrate stories into learning and assessment processes were complex, and a series of ethical issues were considered. The storytelling activities allowed them to creatively imagine experiences or recall others that, in some way, represent aspects of their personal and formative lives.

The reflection strategies used and the creative writing activities played a significant role in the construction of Digital Storytelling, not without emphasizing the almost miraculous value that storytelling shared with peers demonstrated. Digital Storytelling facilitated the integration of theory and practice, and the experimental products illustrated specific stories, highlighting students' understanding of certain processes.

The results indicate that the use of technology and participants' openness to change improved their reflective, narrative, and critical reworking skills; the students, in fact, completed excellent projects.

We recognize that our findings cannot be generalized, but the process undertaken can serve as a tool for university professors to help students improve the quality of their studies, maintain focus, and become aware and responsible for their learning process.

Author contributions

This paper, the result of the collaboration between the two researchers, is divided as follows: Giuseppa Cappuccio is the author of the introduction and of paragraphs 3, 3.1, 3.3; Giuseppa Compagno is the author of paragraphs 1,2 and the conclusions; Cristina Giorgia Maria Pia Pinello is the author of paragraphs 2.1, 3.2, 4 e 4.1.

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