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CLUJ-NAPOCA

ABSTRACT OF THE DOCTORAL THESIS

PSYCHOPEDAGOGICAL INTERVENTION PROGRAM FOR PSYCHOMOTOR DEVELOPMENT IN YOUNG STUDENTS WITH INTELLECTUAL DISABILITIES

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LIST OF ABBREVIATIONS

C.R.D.E.I.I. – Center for Resources and Documentation on Integrated/Inclusion Education

C.Ș.E.I. "Miron Ionescu" – "Miron Ionescu" School Center for Inclusive Education

ID – Intellectual Disability

VMI – Visual-Motor Integration

SRH – Secondary (Specific) Research Hypothesis

BM – Baseline Monitoring

FM – Final Monitoring

PEIPDP – Experimental Psychopedagogical Intervention Program for Psychomotor Development

VSP – Visuospatial Processing

INTRODUCTION

The doctoral thesis proposes an innovative and effective approach to psycho-pedagogical intervention for young schoolchildren with intellectual disability (hereinafter referred to throughout the thesis as ID), focusing on the development of psychomotor skills as a prerequisite for the acquisition of writing abilities. This dimension of child development has a significant impact on the child's capacity to learn and to integrate into both the educational setting and the broader social environment.

Through the proposed psycho-pedagogical intervention program, the study aimed to identify and implement appropriate didactic strategies for the development of psychomotor skills in this category of students. Accordingly, the doctoral thesis seeks to make valuable contributions to the field of psycho-pedagogy by offering practical and applicable solutions for improving the educational process and enhancing the quality of life of children with ID. Therefore, the doctoral research is justified both in terms of the practical and theoretical needs within the field of special education, holding the potential to generate significant benefits for both practitioners and the direct beneficiaries of psycho-pedagogical intervention, namely the children.

The significance of the present study lies in its potential to contribute to several key dimensions of individual development: the enhancement of the quality of life of children, the optimization of the educational process, and the advancement of the field of psycho-pedagogy. Therefore, the study proposed within the framework of the psycho-pedagogical intervention program holds the potential to generate benefits for children with intellectual disabilities, for practitioners in the field of psycho-pedagogy, and for society as a whole, by contributing to the improvement of these children's quality of life and future prospects.

The present research introduces the **Experimental Psycho-Pedagogical Intervention Program for the Development of Psychomotor Skills** (hereinafter referred to as PEIPDP), which is grounded in the use of didactic game.

The implementation of PEIPDP is necessary because psychomotor disorders and delays in psychomotor development affect both the academic performance and the social integration of children with ID. These difficulties stem from deficits at the perceptual, cognitive, and motor levels, thereby requires early specialized intervention. The coordination of movements and accurate spatial orientation are fundamental for daily activities; accordingly, a well-developed

psychomotor profile is considered to exert a significant influence on cognitive abilities such as attention, memory, and the organization of actions.

The applicability of PEIPDP derives from its clear and adaptable structure, the program incorporating materials and didactic games that were selected and implemented within the experimental framework based on the needs identified during the pre-experimental stage of the present research. The activities were accompanied by precise and specific instructions for classroom teachers regarding the manner in which each didactic game was to be implemented, as well as by an observation grid designed to monitor the child's progress. These elements enabled the personalization of the intervention according to the individual needs of each child; accordingly, the activities were designed to be suitable for children with varying degrees of severity of intellectual disability. The didactic games included in PEIPDP stimulate psychomotor development and promote active learning.

The present paper was structured in two parts: the theoretical foundation of the research (4 chapters) and an experimental part (3 chapters). The doctoral thesis ends with conclusions presented from the theoretical substantiation part, corroborated with the research part, highlighting both the development directions and the limits in the field of psychomotor development, analyzed.

The theoretical part of the research was built on the critical analysis of the specialized literature in the field of psychopedagogy, pedagogy, medicine, etc. and evidence-based practice. It brought together concepts, explanatory models and results of previous studies, providing a framework for understanding the phenomena investigated. The theoretical foundation served as a starting point for formulating hypotheses and choosing research methods, contributing to ensuring the relevance and coherence of the scientific approach.

The research itself was based on the need to integrate the theoretical basis with empirical evidence, capitalizing on both case studies and experimental research and comparative analyses. The results obtained demonstrated the importance of evidence-based practice and underlined the role of adapting interventions to the educational context and to the individual particularities of the beneficiaries. Overall, the research contributed to the outlining of clear benchmarks for the application of psychopedagogical strategies and opened new directions for future studies.

CHAPTER I. THE ROLE OF PSYCHOMOTOR SKILLS IN CHILDREN'S ACTIVITY. BRAIN FUNCTIONS AND PSYCHOMOTOR DEVELOPMENT

This chapter outlines the basic elements of psychomotricity and its components, as well as clearly establishes the motor and psychomotor development may have on the child's overall activity. Additionally, the chapter defines the main psychic functions and examines their relationship with the development of psychomotor skills.

Chapter I provides a solid theoretical foundation for the concept of psychomotor skills, highlighting its complex, multidimensional and integrative character in human development, especially in the case of children with ID. Psychomotor skills are defined in the literature by authors (Jay & Owen, 2016, Radu & Ulici, 2003, p.8, Romero Naranjo & Andreu-Cabrera, 2023, Romero Naranjo et al., 2023, Silva et al., 2009) as a dynamic interaction between motor and psychic components, going beyond the simple execution of movement. It has been analyzed both as a complex activity and as an educational method that contributes to the harmonious development of the child, supporting the formation of motor skills, cognitive functions and emotional intelligence through conscious and voluntary movement.

The relationship between perception as a cognitive process and movement is described by Epuran (2011) as the outcome of cognitive and affective processes, as well as motor acts, which psychologically regulate the individual's motor activity. Thus, motricity represents one of the functions that ensures the body's adaptation to the demands of daily life.

In order to better understand the development of psychomotor skills in children, several theoretical frameworks were examined: the Theory of Human Development (Wallon, 1942); the Maturation Theory (Gesell, 1943); the Stage Theory of Cognitive Development (Piaget, 1965); the Sensory Integration Theory (Ayres, 1972); the Ecological Systems Theory (Bronfenbrenner, 1994); and the Theory of Physical Maturation (Gallahue & Ozmun, 2012). The theories presented share a common perspective, namely that psychomotor development in children is a dynamic process, interconnected with the cognitive, affective, sensory, and social dimensions of human development. All these authors, in various ways, support the view that the evolution of motor skills is influenced by neurological maturation, environmental stimuli, and interactions with others.

These theories are mutually complementary by providing an overview of the child's development. Understanding the commonalities and the differences between them allows education specialists to create personalized interventions, adapted to the needs of each child, in their unique life context. Educational interventions must be adapted to the age and needs of each child, given that psychomotor skills are closely linked to the child's overall development. A well-structured educational environment can facilitate this process, providing the child with the necessary resources to develop harmoniously.

The theories of human development from a pedagogical perspective support us in understanding the process of applying the didactic strategies presented in Chapter IV *Approaches to the Specifics of Learning in Children with Intellectual Disabilities from the Perspective of Existing National Programmes. Strategies Adapted For Students In Special Education*. Today, the pedagogical approach can no longer be reduced to a single dimension. The factors of personality development – heredity, environment and education – must be seen as interdependent elements. Education has the responsibility to mediate between the native potential and the environmental conditions, ensuring timely chances of harmonious development. Thus, modern conceptions emphasize the holistic character of human development, overcoming the exclusivist disputes between heredity and the environment (Chiș, 2014).

Psychomotor approaches in Romanian literature emphasize the link between motor and cognitive development, highlighting dimensions such as body schema, spatial orientation and coordination (Talaghir et al., 2019). There are several classifications of psychomotor components that capture essentially the same elements related to motor and cognitive functions.

The organization of psychomotor elements has both different elements and common elements depending on the author (Albu et al., 2006, Bănică, 2011, Epuran, 2011). In the present study, the classification proposed by Albu et al. (2006) will be employed in order to provide a more in-depth analysis of the constituent elements of psychomotricity: basic motor behaviors (static and dynamic balance, movement coordination, and oculo-motor coordination), neuromotor behaviors (muscle tone and proprioceptive sensations), as well as perceptual-motor behaviors and structures (body schema, laterality, and spatiotemporal organization). This classification was selected because it is reflected in the special education curriculum, particularly within subject-specific programs, where this structural framework of components is utilized.

“Mind, environment, and body are viewed as dynamic systems embedded within one another, continuously coupled, with interactions that are ongoing and bidirectional” (Faiciuc, 2008, p. 278). Thus, psychic processes are seen as an integral part of the body that "immerses" itself in the environment, influencing and being influenced by it. This connection is very visible at the sensory-motor level that works in the first months of life and is preserved later.

Psychomotricity combines the motor dimension with the cognitive and affective one, contributing to the development of attention, memory and thinking, but also to strengthening the relationship between body and mind (Berdilă et al., 2019).

Motor actions play an important role in psychomotor development, facilitating the acquisition of knowledge, which allows the exploration of the environment and the collection of information that favors cognitive development. The interaction between the brain and motor skills appears as a partnership in the learning process. Motor coordination, fine motor skills, hand-eye coordination involve sensory-motor function. The development and improvement of motor skills often happens in parallel with cognitive development, coordination and motor planning involve cognitive processes. For example, the use of writing and drawing tools involves oculo-motor coordination, developed fine motor skills, spatial organization and orientation.

In conclusion, this chapter provides a solid theoretical basis for understanding psychomotricity and its role in the overall development of the child. By integrating the main theories, the chapter clarifies the mechanisms through which motor skills and psychic processes interact, highlighting the importance of psychic functions and psychomotor development.

CHAPTER II. PSYCHOMOTOR DISORDERS

Chapter II provides clarity on the terms: disorder, delay and deficit. Psychomotor disorders are also classified and defined.

Developmental disorder is defined as a significant disturbance of cognitive, emotional or behavioral functioning (APA, 2016), developmental delay is a temporary gap from the child's developmental milestones, and deficit as a permanent impairment of skills that influence the child's daily performance and autonomy (Gherguț, 2005). In the case of psychomotor development, they differ in severity, duration and possibility of recovery, being frequently associated with neurodevelopmental disorders, such as ID or genetic syndromes (Albu et al., 2006).

The classification of psychomotor disorders according to Albu et al. (2006), highlights three main categories: disorders of basic motor behaviors, neuromotor disorders and disorders of perceptual-motor structures and behaviors. The first include disorders of oculo-motor coordination, balance and general coordination, with a direct impact on school activities. Neuromotor disorders target muscle tone (hypertonia, hypotonia), involuntary movements and muscle control, reflecting dysfunctions of the nervous system. The third category includes disorders of body schema, laterality, satial and temporal orientation that affect the organization of actions and school adaptation.

Moving from general to particular, we highlighted the specificity of psychomotor disorders in children with ID. Disorders of coordination, balance, spatiotemporal organization and body schema, such as difficulties in performing fine and complex movements, characterized by slowness, imprecision and lack of flexibility (Albu et al., 2006, Gherguț, 2005, Grosu, 2001) are frequently encountered in children with ID.

Psychomotor development is influenced by the level of cognitive functioning, with a direct correlation between intellectual deficit and impairment of perceptual-motor structures (Arcan & Ciumăgeanu, 1980 Radu & Ulici, 2003). Thus, children with ID manifest disorders or delays in spatial orientation, laterality, visual-motor integration (IVM) and coordination of actions, which affects personal autonomy and school performance, in activities such as writing (Zikl et al., 2012).

In conclusion, psychomotor disorders in children with ID reflect the interaction between motor and cognitive development, having direct consequences on school learning and

adaptation. Understanding the conceptual differences and existing classifications allows the early identification of disorders, delays and deficits in psychomotor development and the substantiation of appropriate psychopedagogical interventions.

CHAPTER III. PSYCHOPEDAGOGICAL THEORIES ON PSYCHOMOTOR DISORDERS IN RELATION TO INTELLECTUAL DISABILITY AND GRAPHOMOTOR ACTIVITY

Chapter III introduces us to the specifics of ID, highlighting the particularities of psychic processes, psychomotor disorders in children with ID and their implications in the acquisition of the graphic act and the development of writing skills in young schoolchildren with ID.

ID is a neurodevelopmental disorder, characterized by deficits of intellectual and adaptive functions, with onset in the developmental period, with negative consequences on the process of mental maturation, development in different aspects in children. The deficit of intellectual capacities represents the disadvantage that ID creates in terms of the individual's ability to adapt to and integrate within the social environment to which they belong (APA, 2016; Dunn, 1997; Radu, 2000; Druțu, 2002). The diagnosis requires the fulfillment of three criteria: impairment of intellectual functions, impairment of adaptive function and onset in childhood (APA, 2016)

With regard to etiology, intellectual disability is understood as the result of the interaction between heredity, environment, and education, involving both endogenous/genetic factors and exogenous factors occurring during the prenatal, perinatal, and postnatal periods (Radu & Ulici, 2011; Gherguț, 2013; Verza, 2011). Furthermore, the levels of severity—mild, moderate, severe, and profound—are determined based on adaptive functioning across the conceptual, social, and practical domains, rather than solely on the basis of intelligence quotient (APA, 2016; Dutton, 1975; Schalock et al., 2010).

The common somatic and psychic characteristics of children with ID highlight the complexity and interdependence of the affected processes. Mental rigidity, genetic viscosity, heterochrony and fragility of verbal behavior reflect difficulties in adaptation, slowing down of cognitive processes and gaps in physical and mental development (Radu, 2000, Inhelder, 1963, Chelemen, 2010). From a somatic perspective, various malformations associated with genetic syndromes can occur (Arcan & Ciumăgeanu, 1980).

At the level of psychic processes, children with ID present significant difficulties in the sphere of perception, representation, thinking, memory and language. Perception is limited by narrowing the perceptual field, which affects spatial orientation, and thinking is characterized by concretism and rigidity, with difficulties in analysis, synthesis and transfer of information.

Memory, especially working memory, is affected both structurally and functionally, influencing the learning process (Vicari et al., 2016, D'Aurizio et al., 2023). Language is poor and insufficiently structured, and affective processes are marked by emotional instability and predominantly extrinsic motivation (Radu & Bratu, 2011).

These characteristics highlight the fact that the development of children with ID is marked by limitations at a cognitive, emotional and behavioral level, outlining a complex perspective. In this context, the particularities listed above directly influence the development of psychomotor skills and formation of writing skills.

In the literature, the development of graphomotor skills was presented by Bestard Revilla (2020) through three complementary directions: the ontogenetic approach, which follows the evolution from graphics to abstract symbols; the motor conditioning approach, based on repetitive sensory-motor exercises; the integrative approach, which correlates the learning of graphic skills with the social meanings of writing.

The stages of writing skill formation, as outlined by Șerdean (2008), reflect a gradual process that starts from simple to complex. The first stage, of the graphic elements, aims to develop fine motor skills and oculo-motor coordination through exercises involving the tracing of lines and simple shapes, without linguistic significance. In the stage of letter writing, these elements are integrated into symbolic structures, as the child learns the graphic code of written language and the rules of spatial organization. The stage of connected writing marks the transition to combining letters into words, with emphasis on coherence, legibility and compliance with graphic norms. Finally, the stage of fluent writing involves the automation of the graphic act, the redirection of attention toward the content of the message, and the functional use of writing.

Complementary, the model proposed by Pamfil (2009) structures the learning of writing in three stages: pre-alphabet, characterized by graphomotor preparation; alphabet, centered on the acquisition of letters and the formation of words; and post-alphabet, oriented towards the consolidation and efficiency of writing as a communication tool.

In children with ID, the acquisition of writing occurs at an individualized pace, adapted to each child’s developmental particularities, unfolding throughout the primary education cycle and, in some cases, extending into lower secondary education. The school curriculum promotes a progressive approach, moving from the acquisition of letters to their integration into

increasingly complex linguistic structures, with the aim of developing both written and oral communication skills.

The acquisition of writing skills in children with ID is closely dependent on the level of psychomotor development, writing being a complex activity that integrates fine motor components, perceptual-cognitive processes and contextual factors (Bonneton-Botté et al., 2023). Learning to write involves not only intellectual acquisitions, but also the development of oculo-motor coordination, movement control and spatial organization, being a major challenge for this category of students.

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The development of fine motor skills directly influences the quality of writing, determining the accuracy and fluency of graphic execution. Deficiencies at this level can lead to slow, effortful, and disorganized writing, with a negative impact on motivation and school performance. In this sense, psychomotor exercises and graphomotor training activities play a significant role in strengthening the skills required for efficient writing.

From a functional perspective, the psychomotor mechanisms involved in writing include correct posture, trunk stability, the positioning and mobility of the upper limbs, as well as control of writing instrument pressure (Ajuriaguerra et al., 1980). Graphic motor skills also entail the development of specific skills, such as the correct grip of the writing instrument, the maintenance of an appropriate hand position, and the automatization of movements required for the formation of graphemes.

The impairment of psychomotor skills in children with intellectual disabilities generates significant difficulties in the aquisition of writing skills, manifested since the pre-graphic acquisition stage. These include imprecision of movements, poor visual-motor coordination, slowness in execution, and reduced control of fine muscles (Bestard Revilla, 2020). Given the fact that fine motor skills involve a high level of precision and control, it also requires cognitive functions at the same time, which accentuates the difficulties in performing graphic tasks in children with ID.

Working memory deficit negatively influences motor coordination, affecting the child's ability to plan, maintain and adjust the action sequences necessary for writing (Molitor et al., 2020; Van der Fels et al., 2015). In parallel, spatial orientation and organization disorders cause frequent errors in the reproduction of graphemes, manifested by deformations, omissions or additions of elements (Ajuriaguerra, 1980).

On a practical level, these difficulties are reflected in several dimensions of the written act: the direction of writing (left-right inversions), the defective positioning of letters in the graphic space, variations in the size and shape of graphemes, as well as the inadequate organization of words in sentences. Laterality and body schema disorders also contribute to the emergence of mirror writing phenomena and global page disorganization.

Poor oculo-motor coordination and insufficient fine motor control affect the execution of graphemes, causing inadequate pressure on the writing instrument, rigidity or limited movements, which leads to rapid fatigue and decreased writing quality (Datchuck, 2015; Varuzza et al., 2014). In this context, the education of the hand and the development of visual-motor coordination become essential for the organization of the graphic space and for the formation of a readable and coherent writing (Grosu, 2002).

In conclusion, the chapter establishes the conceptual context of ID, highlights the close relationship between it and psychomotor development, the formation of writing skills, emphasizing the complex and interdependent character of these processes. The cognitive, affective and motor particularities of children with ID directly influence the acquisition of the graphic act, generating difficulties in coordination, spatial organization and execution. Writing is thus outlined as a multidimensional competence, dependent on the development of psychomotor skills. The impairment of psychomotor skills is reflected in graphic errors, slow pace and reduced readability. In this context, adapted psycho-pedagogical intervention is necessary.

CHAPTER IV. APPROACHES TO THE SPECIFICS OF LEARNING IN CHILDREN WITH INTELLECTUAL DISABILITIES FROM THE PERSPECTIVE OF EXISTING NATIONAL PROGRAMMES. STRATEGIES ADAPTED FOR STUDENTS IN SPECIAL EDUCATION

In Chapter IV, the specifics of learning influenced by the presence of ID are presented, an aspect that determines the investigation of the most appropriate ways/methods, means of training psychomotor skills, and it is also analyzed how the particularities of learning are influenced by the presence of ID. The theme is deepened by capitalizing on the didactic game as a method of educating psychomotor skills, highlighting its role in the psychomotor development of children with intellectual disabilities.

Learning is a fundamental process of psychobehavioral development, achieved through the interaction between external factors (educational, family and social environment) and the internal psychic processes of the individual (Golu, 2011). In the case of children with intellectual disabilities, this process is marked by specific particularities, determined by cognitive, psychomotor and adaptive limitations, which influence the pace, efficiency and generalization of acquisitions.

From the perspective of learning typologies (Illeris, 2014), children with intellectual disabilities (ID) predominantly engage in mechanical learning and learning through assimilation, whereas higher-order forms, such as accommodative and transformative learning, are constrained by their level of cognitive development and limited capacity for abstraction. Motor learning, particularly sensorimotor learning, constitutes the foundation of development, representing the earliest form of learning through which the child explores the environment and acquires adaptive competencies.

The pedagogical principles of individualization and differentiation of instruction, together with the effective use of the zone of proximal development, constitute essential benchmarks in the organization of educational intervention. Adapting teaching methods, materials, and instructional strategies to the specific characteristics of each child facilitates the development of functional acquisitions and enhances learning efficiency.

Adapting the educational process for children with intellectual disabilities involves complex interventions, which simultaneously target contents, materials and teaching strategies,

in order to facilitate access to learning and avoid cognitive overload. The selection of relevant content, the use of concrete materials and visual aids, as well as the clear and phased presentation of information contribute to increasing understanding and strengthening procurement. Teaching strategies must be interactive, structured and adapted to the individual learning pace, becoming tools for mediating between the curricular requirements and the student's potential.

The psychopedagogical intervention is carried out on the basis of the initial assessment and involves setting clear objectives, selecting appropriate methods and monitoring progress. It aims at the integrated development of the cognitive, psychomotor, socio-emotional and personal autonomy areas, being supported by a multidisciplinary team and the active involvement of the family.

The school curriculum for special education, in the Reading-Writing-Communication discipline, reflects a progressive and adapted approach, which integrates the development of psychomotor skills as the foundation of writing skills. The learning activities evolve from pregraphic exercises to the consolidation of functional writing, respecting the principle of moving from simple to complex and capitalizing on previous acquisitions. The pace of learning is individualized, and the process can be extended according to the student's level of development.

In this context of adapted educational approaches and the role of integrated interventions in the development of children with intellectual disabilities, the importance of using interactive and motivating teaching methods is highlighted. Among these, the didactic game occupies a central place, due to its formative and therapeutic valences, contributing significantly to the development of psychomotor skills and to facilitating learning in an accessible and attractive way for the student.

In the dictionary of Game Pedagogy, the didactic game is defined as "a game used for the purpose of instruction, education and training of preschoolers and young schoolchildren, a fundamental form of didactic activity as a means of achieving education" (Răduţ-Taciu et al., 2021, p.204). Didactic play is one of the "methods that achieve the transition from play to learning" (Catalano, 2019, p.240). Thus, the didactic game, in relation to the purpose of education and to the individual particularities of children, can fulfill various functions in the pedagogical process: means of instruction, effective method in the pedagogical process,

procedure accompanying another teaching method, form of organization of the child's activity and life (Chiș, 2018)

The structure of the didactic game includes components such as the purpose and didactic task, the content, the rules, the playful elements and the materials used, all of which are coherently integrated to support the achievement of educational objectives (Catalano, 2019, Chiș, 2018, Glava & Glava 2002). Also, evaluation is an integral part of the didactic game, being related to pre-established criteria and the objectives pursued (Stan & Catalano, 2019).

Through the use of the didactic game, children with intellectual disabilities are supported in the development of psychomotor skills, in the acquisition of social rules, in the spatio-temporal organization and in increasing the level of involvement and motivation. Thus, the didactic game becomes a pedagogical tool and is used in research both as a method and as a means and form of organizing the educational activity.

The didactic game is defined as an organized and goal-oriented activity, which integrates formative and evaluative dimensions, offering the child opportunities for exploration, self-evaluation and body expression. Games in general and especially psychomotor games are a way of learning for children in the primary cycle. The child learns because he plays. Object manipulation in the sensorimotor and preoperative period are learning levers (Wauters-Krings, 2014).

In this context, the main categories of games used in psychomotor development are highlighted: motor games, object manipulation games, logic games, functional games and exercise games, directed games and interactive games. Psychomotor games promote the development of memory, attention, imagination. The main purpose of psychomotor skills is to develop motor, cognitive and socio-emotional skills (Romero Naranjo, 2020). One more reason to integrate games that aim to develop fine motor coordinators and perceptual-motor behaviors.

Also, the role of the teacher in organizing and directing playful activities is emphasized, having the function of learning facilitator and mediator between spontaneous exploration and educational objectives. Through the proper structuring of games and the selection of teaching materials, effective educational contexts are created, which support the harmonious development of the child.

In this perspective, the role of didactic games in the psychomotor development of children with intellectual disabilities is highlighted, emphasizing their integrative character on

the motor, cognitive and socio-emotional dimensions. Structured games, oriented towards educational objectives, contribute to the formation and consolidation of movement coordination, spatio-temporal orientation and body awareness, thus facilitating the control and regulation of psychomotor behavior (Camargos & Maciel, 2016).

Through psychomotor games, perceptual processes and the ability to process information from the environment are stimulated, which leads to a holistic development of the child. In the case of children with intellectual disabilities, these activities become essential for the development of body schema, laterality, balance and general coordination, as well as for understanding the relationship between one's own body and the environment.

It also highlights the contemporary context marked by the influence of technology and the limitation of playing spaces, factors that reduce the opportunities for spontaneous motor development. In this regard, the need to promote non-digital teaching games and the active involvement of teachers in organizing attractive activities is underlined.

In conclusion, the didactic game is configured as a pedagogical tool in educating the psychomotor skills of children with intellectual disabilities, through its integrative character and through the ability to correlate the motor, cognitive and socio-emotional dimensions of development. Through structured playful activities, the child is actively involved in learning situations that simultaneously require the coordination of movements, spatio-temporal organization, behavior regulation and use of basic cognitive functions.

In this context, the didactic game contributes significantly to the overall development of the child with intellectual disability, facilitating not only psychomotor acquisitions, but also school adaptation and social integration, by forming functional skills necessary for active participation in the educational and community environment.

CHAPTER V. RESEARCH DESIGN

Chapter V, refers to the purpose and objectives pursued by the PEIPDP. The hypotheses, research variables, methods and and assessment and intervention instruments used in the three stages (pre-experimental, intervention and post-experimental) were formulated, we described how the research participants were selected and the criteria for their selection.

V.1. Research Questions

1. What is the impact of PEIPDP on psychomotor dimensions in young schoolchildren with mild and moderate ID: oculo-motor coordination, coordination of movements (fine motor coordination of the hand and fingers, accuracy), orientation and spatial organization.
2. To what extent does the psychomotor development of young schoolchildren with mild and moderate ID influence the quality of graphic behaviors involved in writing letters and numbers?

V.2. Aim and Objectives of the Research

The aim of this research is to present, implement, and examine the formative and informative value of the PEIPDP program among young school-age children with mild and moderate intellectual disabilities enrolled at the Special Secondary School – Resource and Documentation Center for Integrated/Inclusive Education (C.R.D.E.I.I.) in Cluj-Napoca (currently known as the School Center for Inclusive Education "Miron Ionescu," Cluj-Napoca).

Objectives

1. To evaluate students with intellectual disabilities through standardized and curriculum-based assessments in order to determine their current psychomotor and cognitive developmental status.
2. To determine the psychomotor training needs of young learners with mild and moderate ID by analyzing initial assessment data across core domains: eye–hand coordination, fine motor coordination (precision and dexterity), and spatial orientation and organization.
3. To develop and implement a play-based psycho-pedagogical intervention program targeting psychomotor development.
4. To implement the PEIPDP program within the target group.

5. To select and/or design developmentally appropriate games aligned with identified psychomotor needs.
6. To systematically observe and document students' behaviors during intervention activities using structured observation tools completed by classroom teachers.
7. To evaluate the overall effectiveness of the intervention program in terms of psychomotor development, re-education, and functional recovery.

V.3. Research Hypotheses

The general hypothesis of the research is formulated as follows: The application of the psycho-pedagogical intervention program based on the didactic game to young schoolchildren with mild and moderate ID, will contribute to the development of psychomotor skills and will influence the quality of graphic behaviors involved in writing letters and numbers.

Secondary/specific research hypotheses hereinafter referred to as IS.(components of the general hypothesis) that are deduced from the general hypothesis formulated above are:

IS1. The implementation of PEIPDP, in young schoolchildren with mild and moderate ID, will contribute to the development of basic motor coordination - components related to hand-eye coordination and fine motor coordination (fine muscles, dexterity and manual precision).

IS2: The use of PEIPDP in young schoolchildren with mild and moderate ID will contribute to the development of perceptual-motor behaviors and structures (spatial orientation and organization).

IS3: The application of PEIPDP to young schoolchildren with mild and moderate ID, will influence the quality of the graphic behaviors involved in the writing of letters and numbers: handwriting (letter, syllable, word, numbers) in relation to shape, size, organization of the writing space.

IS4: The application of PEIPDP to young schoolchildren with mild and moderate ID, is a significant predictor for the quality of graphic behaviors involved in writing letters and numbers.

V.4. Research Variables

Independent variable (VI): the program used in the experimental phase that we called PEIPDP. It consists of organized didactic games, having a well-established goal and specific objectives, structured so as to favor the development of psychomotor components: hand-eye coordination, fine motor coordination (fine motor muscles of the hands, dexterity and manual precision, orientation and spatial organization in the participating children.

Dependent variables:

(a) The degree of psychomotor development of young schoolchildren, which is explained for IS 1 and 2 by measuring:

V.D.1 Development level of basic motor skills

V.D.1. 1. Development level of fine motor coordination

V.D.1. 2. Development level of hand-eye coordination

V.D.2 Development level of behaviors and perceptual-motor structures

V.D.2. 1. Development level of behaviors, orientation and spatial organization.

b) the level of writing skills of young schoolchildren, which is explained in specific hypothesis 3, measuring:

V.D. 3 Quality of graphic behaviors involved in writing letters and numbers: handwriting (letter, syllable, word, numbers) in relation to shape, size, organization of the writing space.

V.5. Research Methods and Assessment and Intervention Instruments

V.5.1. Research Methods

Subchapter V.5.1 presents all the research methods used in the investigative approach, highlighting their complementarity in the analysis and optimization of the psychopedagogical intervention.

The observation method was used both in the pre-experimental stage and during the implementation of the intervention program, aiming to collect qualitative and quantitative data on the students' involvement in playful activities, the completion of tasks and the progress in reaching the higher levels of games. The observations were systematically made by the teachers involved and recorded in specific tables, facilitating the continuous monitoring of the evolution of each student and the adaptation of the intervention to individual needs.

The pedagogical experiment aimed at integrating the didactic game into the learning activities, in order to develop psychomotor skills in young schoolchildren with intellectual disabilities. The games were adapted to the level of development of the students and organized

progressively, on levels of difficulty. The intervention program was carried out over a period of 16 weeks, with a frequency of three weekly sessions, being implemented by the classroom teachers under the coordination of the researcher, and the students' progress was monitored through observational tools.

The method of studying curricular and school documents was used to substantiate the selection of participants and to analyze the educational context. The study of school documents provided relevant information on the level of preparation and particularities of the students, including the specifics of disability, while the analysis of the curricular documents aimed to identify the psychomotor skills provided in the school curricula and their correlation with the learning rhythm specific to the subjects in the primary cycle, in special education.

The case study method completed the investigative approach by in-depth analysis of the implementation of the intervention at the level of each class, highlighting the particularities of adaptation and personalization of the activities according to the level of psychomotor development of the students, materialized in the elaboration of three case studies.

V.5.2 Assessment tools

The subchapter presents the evaluation tools used in the research, selected in order to measure the students' performance and to substantiate the psycho-pedagogical intervention.

The NEPSY battery was used as a complex tool for assessing neuropsychological development, with the fields of Sensorimotor Functions and Visual-Spatial Processing being selected, relevant for the analysis of the components involved in graphomotor activity. Applied individually, under controlled conditions, it allowed the investigation of manual dexterity, oculo-motor coordination, visual-motor integration and spatial orientation, highlighting any specific psychomotor difficulties.

The Harris laterality test was used to determine functional dominance in the hand, eye and foot, providing relevant information about the lateral organization of the child. The results obtained had a diagnostic and explanatory role, facilitating the understanding of the relationship between the type of laterality and the level of development of fine motor coordination, spatial orientation and graphic behaviors involved in writing.

The Piaget-Head spatial orientation test aimed to evaluate the ability to organize and structure the space, with emphasis on the left-right coordinates. Through its gradual and diversified structure, the instrument has made it possible to identify spatial orientation

difficulties relevant to school learning, especially in the field of writing and adaptation to the requirements of the educational environment.

The curricular tests aimed to assess writing skills, by analyzing graphic aspects such as the shape, size and organization of the writing space. Built in accordance with the school curricula specific to special education, they allowed the monitoring of students' progress and the identification of difficulties in the formation of writing skills, in correlation with the level of psychomotor development.

Overall, the tools used provided an integrated perspective on the students' psychomotor development.

The instrument used during the intervention is designed taking into account the age and individual particularities of the children, the type of disability and the level of psychomotor development.

V.6. Research participants

The group of participants included in the research consisted of 22 children with mild and moderate ID selected from 74 primary school students. They are divided into: the second grade (8 students), the third grade (9 students) and the fourth (5 students) all enrolled at the Special Secondary School Resource and Documentation Center on Integrated Inclusive Education Cluj-Napoca. The age of the students at the time of the first assessment was between 8 years 3 months and 11 years 8 months.

CHAPTER VI. RESEARCH STAGES

In *Chapter VI* we detailed *the stages of the research*. The pre-experimental stage aims to identify the level of psychomotor development, the level of written language acquisition, data necessary in the design of PEIPDP. The intervention details the content of the PEIPDP and its implementation. The post-experimental stage aims at the final evaluation.

In Table VI.1. We will briefly present the stages of the research with the objectives, methods and tools specific to each.

Table VI.1. Research Stages, Objectives, Methods, and Specific Instruments

Stage	Objectives	Method	Research Instruments
Pre-experimental stage	Analysis of curricular documents Selection of research participants Application of tests for initial assessment. Elaboration of the intervention program	Study of school documents Observation	**Nepsy Battery** *Sensorimotor Domain* Rhythmic Fingerbeat Test Visual-Motor Accuracy Test Imitation Hand Position Sample *Field of visual-spatial processing* Sample copying the drawing Arrow Sample **Harris Laterality Test** (Laterality Type) **Space orientation test (right-left) Piaget-Head** (spatial orientation on left-right coordinates) **Knowledge/curricular tests developed**
Intervention	Application of the psycho-pedagogical intervention program based on didactic play in order to develop psychomotor skills in children with ID.	The pedagogical experiment Observation	PEIPD Observation tables for each game.
Post-experimental stage	Application of tests for final evaluation. Data interpretation.	Case Studies (3)	**Nepsy Battery** *Sensorimotor Domain* Rhythmic Fingerbeat Test

	Comparison of data from the initial assessment with those from the final assessment. Interpretation of the data obtained during the intervention.		Visual-Motor Accuracy Test Imitation Hand Position Sample *Field of visual-spatial processing* Sample copying the drawing Arrow Sample **Space orientation test (right-left) Piaget-Head** (spatial orientation on left-right coordinates)

In the *pre-experimental stage* , 22 students from the second and fourth grades, with mild and moderate intellectual disability, out of a total of 74, were selected, based on the established criteria and the analysis of the school files. The initial evaluation (pre-test) was carried out in October, in order to determine the level of psychomotor development and writing skills. The evaluation was applied individually and included tests from the NEPSY battery (sensorimotor and visual-spatial domains), Harris laterality test, Piaget-Head spatial orientation test (right-left) and curricular writing tests. The results obtained provided the necessary benchmarks for substantiating and individualizing the psycho-pedagogical intervention.

The intervention started in November based on the information obtained in the pre-test. We identified the delays in the psychomotor field of the students in the target group, we selected the games, we formulated the objectives of the intervention program. From December to mid-May, the PEIPDP was held with students at school. The human resources involved in this psycho-pedagogical intervention together with the researchers were the psycho-pedagogical teachers and the teacher educators who teach in the primary cycle in the classes selected in the intervention program. We opted for either the psychopedagogical teacher or the teacher educator to apply the PEIPDP and monitor the students' progress so that there is constancy in the application of the program and in monitoring.

Content of the intervention program

PEIPDP includes games organized according to the didactic game method with a well-established goal and objectives pursued for the development of selected psychomotor elements.

Table VI.2. The component elements of psychomotor skills aimed at being developed by PEIPDP.

Components of psychomotor skills		Objectives pursued by the PEIPDP
Basic motor coordination	Oculomotor coordination (hand-eye coordination) Coordination of movements (coordination of fine movement of the hand and fingers, precision of movement)	Development of hand-eye coordination Development of fine muscles of the hands and fingers. Development of movement precision Execution of finger movement in different positions
Perceptual-motor structures and behaviors	Spatial orientation and organization	Workspace organization Development of visual-spatial perception Spatial orientation on coordinates up, down, right, left, forward, inside

Table VI.2 highlights the main components of psychomotor skills targeted in the PEIPDP, together with the specific objectives of the intervention. The program was structured to develop both basic motor coordination (hand-eye coordination, precision and dexterity of fine movements) and the perceptual-motor structures and behaviors involved in spatial orientation and organization.

A set of 16 games structured according to the model of the didactic game, along with their methodology of application, was introduced. The methodology comprises four elements: the game created by us or acquired, a set of rules, instructions for teachers following the structure of the didactic game as a central method, and an observation table of behaviors in accordance with the purpose and objectives of the program. The games follow the individual characteristics of the children and are designed for different levels of development.

The games were organized into two main categories presented in Table VI.3.

Table VI.3. Game Categories

Games that target basic motor behaviors	Games targeting perceptual-motor structures and behaviors
1. Letters and Numbers Made of Modeling Clay	9. Pyssla
2. Bead Game	10. Tangram
3. Finger Puppets	11. In the orchard
4. Threading	12. My City
5. Tricky Clips	13. Friends in the forest
6. Bracelet	14. Read and draw
7. Sequential Motor Skills Game	15. The Little Detective
8. Tracing Paths	16. Color Sequences

Table VI.3 presents the categories of games used in the PIPDP. The games were selected according to the objectives of the program and divided into two main groups: games that develop basic motor behaviors and games that develop perceptual-motor structures behaviors. Through their playful and progressive character, these activities favor the development of psychomotor skills and support the formation of graphic behaviors involved in writing.

In Table VI.4, the PEIPDP is presented in a modular structure. The program comprises eight modules, each allocated a duration of two weeks and incorporating two games. The games aimed at developing fundamental motor coordination are implemented during the first four modules, with a frequency of three hours per week. The games targeting the development of perceptual-motor structures and behaviors are implemented during the final four modules, also with a frequency of three hours per week. Each module spans a period of two weeks.

Table VI.4. Modular Organization of PEIPDP

Module	Time	Games	Objectives
1	S1 – S2	Letters and Numbers Made of	Development of hand-eye coordination. Development of fine motor skills and manual dexterity Developing Movement Accuracy

		Modeling Clay Bead Game	Practice of object grasping using the thumb, index, and middle fingers of the dominant hand.
2	S3 – S4	Finger Puppets Threading	Practice of object grasping using the thumb, index, and middle fingers of the dominant hand. Strengthening of finger musculature. Development of movement accuracy. Execution of finger movements in varied positions.
3	S5 – S6	Tricky Clips Bracelet	Development of fine motor skills and manual dexterity Practice of object grasping using the thumb, index, and middle fingers of the dominant hand Strengthening the fingers muscles
4	S7 – S8	Sequential Motor Skills Game Tracing Paths	Development of fine motor skills and manual dexterity Strengthening the fingers muscles Developing Movement Accuracy Development of hand-eye coordination
5	S9 – S10	Pyssla Tangram	Workspace organization Development of hand-eye coordination Development of fine motor skills Development of visual-spatial perception
6	S11 – S12	In the orchard My City	Spatial orientation on the coordinates top down, right, left, front Oculo-motor coordination Development of visual-spatial perception Workspace organization
7	S13– S14	Friends in the forest Read and draw	Spatial orientation on the coordinates top bottom, right, left, front, back, next Development of visual-spatial perception Workspace organization
8	S15 – S16	The Little Detective	Development of visual-spatial perception Workspace organization Spatial orientation

		Color Sequences	Oculo-motor coordination

The post-experimental phase had the role of evaluating the effects produced by the intervention and providing an objective picture of the progress made by the participants. This stage followed after the 8th mode was completed and the observation tables were completed. The final tests were carried out in mid-May and included a series of psychometric instruments and curricular tests, each having a well-defined role in the analysis of students' performances: the Nepsy battery, the sensorimotor field (the rhythmic fingerbeat test, the visual-motor accuracy test, the hand position imitation test), the visual-spatial processing field (the drawing copying test, the arrow test); Space orientation test (right-left) Piaget-Head; knowledge/curricular tests developed.

The post-experimental phase was important in validating the research hypotheses, allowing an objective comparison between the pre-test and post-test performance of the participants. It provided clear answers on the effectiveness of the methods applied and the degree of improvement in the students' skills.

CHAPTER VII. PRESENTATION AND ANALYSIS OF RESULTS

Chapter VII includes the results of the research interpreted statistically, specific processing, using the SPSS program, version 20, for the variables of interest of the research subject. We included 3 case studies, one for each class (II, III, IV).

VII.1. Statistically Interpreted Research Results

Specific analyses were conducted using the statistical software SPSS, version 20, for the variables of interest related to the selected research topic: hypothesis testing, descriptive statistics, correlations, and regression models.

In the following section will present the results obtained for each assessment tool used.

Harris Test

The application of the Harris Test highlighted the fact that most of the participants (68.2%) have a well-fixed laterality, which excludes the need for a specific intervention at this level of development. Detailed dominance analysis shows that more than two-thirds of students use their right hand, eye and leg as dominants, confirming a stable lateral structure. However, in a lower percentage of participants (31.8%) there are formulas of unfixed laterality (DSD, DdD, DDS, dDS, dDD), an aspect that can negatively influence the writing learning process (e.g.: mirror writing, reversal of the writing direction). These results underline the importance of continuous monitoring of students with unfixed laterality, in order to prevent possible school difficulties.

The hypotheses formulated will be studied by formulating the statistical hypotheses specific to each analysis. With the exception of the Harris laterality test (used only for initial descriptive purposes), each research tool is applied at two different time points in time, in order to concretely capture the impact of PEIPDP.

VII.1.1. Descriptive Statistics

Nepsy test applied in the pre-experimental and post-experimental stage raw scores

We statistically analyzed the Nepsy Test for raw scores and for scaled scores. We opted for these variants because in the raw scores you can see a significant difference between the pre-test and post-test values. After calculating the scaled scores, we noticed that some samples have the same value in both stages.

The NEPSY test applied in the pre- and post-experimental stage generally shows an improvement in student performance, evidenced by the increase in average scores in most tests in the post-test. An apparent exception is the "Rhythmic Fingerbeat" test, where the decrease in

the score (measured in time) actually indicates a faster and more correct execution, therefore progress.

In the pre-test (see table.. VII.1.), the variability of the results differs significantly between samples. The highest amplitude occurs in "Rhythmic Finger Beat", suggesting large differences between pupils in fine motor coordination, while "Imitation of Hand Positions" shows the lowest amplitude, indicating high homogeneity. The other tests ("Visual-motor accuracy", "Copying drawing", "Arrows") show moderate variations, reflecting individual differences in skills.

Table VII.1. Descriptive Statistics, Raw Scores, NEPSY Pre-Test

Statistical Indicator	Finger tapping	Imitation of hand positions	Vizuomotor precision	Design copying	Arrows
Mean	136.09	18.23	18.14	40.32	13.59
Median	119.00	19.00	19.00	40.50	13.00
Mode	97	19	20	33[a]	12[a]
Standard deviation	62.595	3.449	6.784	14.317	5.885
Skewness	1.820	-.587	.008	-.266	.187
Kurtosis	3.373	-.244	-.170	-.520	-1.186
Range	253	12	27	53	19
Minimum	70	12	5	10	5
Maximum	323	24	32	63	24

a. Multimodal distribution; the lowest mode is reported

Source: own processing in SPSS

The central trend indicators (median and mode) confirm these observations: most students perform closely in some tests, but in others discrepancies appear suggesting uneven distributions and the influence of extreme scores. In general, the "Arrows" test remains the most difficult, with low scores in both pre-test and post-test.

In the post-test, the improvement trend is maintained: the means increase, the medians shift in a favorable direction (with the exception of the Finger Tapping test, where a decrease indicates progress), and the modal values suggest better performance for most students, especially in "Design Copying" and "Visuomotor Precision".

Table VII.2. Descriptive Statistics, Raw Scores, NEPSY Post-Test

Statistical Indicator	Finger tapping	Imitation hand positions	Vizuomotor precision	Design copying	Arrows
Mean	114.64	19.23	19.50	43.91	15.59
Median	100.50	20.00	20.50	45.50	15.00
Mode	64[a]	20	21	47	15[a]
Standard deviation	50.690	2.991	6.745	14.111	5.771
Skewness	1.712	-.970	-.217	-.402	-.211
Kurtosis	2.647	.364	.011	-.246	-1.064
Range	194	11	27	53	19
Minimum	64	13	6	13	5
Maximum	258	24	33	66	24

a. Multimodal distribution; the lowest mode is reported

Source: own processing in SPSS

Additionally, the score distributions (skewness and kurtosis) deviate from normality in both the pre-test and post-test, indicating slightly distorted or flattened distributions.

Overall, the results suggest an improvement in the assessed abilities (fine motor skills, visuomotor coordination, and visual perception), as well as the presence of persistent individual differences among students, which require the adaptation of educational interventions.

Nepsy test applied in the pre-experimental and post-experimental stage, scaled scores

Next we will look at the scaled scores for the NEPSY test. There is a slight improvement in students' performance in the post-test stage, compared to the pre-test, which suggests a positive effect of the PEIPDP intervention program on psychomotor development.

The mean values remain relatively close between the two assessment moments, but a consistent upward trend can be observed, especially for the global variables "Basic Sensorimotor Functions" and "Basic Visuospatial Processing," which record the highest scores. Among the subtests, "Imitating Hand Positions" maintains the best results, while "Finger Tapping" remains the most difficult, even though it shows slight improvement.

The central tendency indicators confirm these trends: the medians generally increase in the post-test, indicating improved performance for most students. The most noticeable progress is observed in the "Design Copying" subtest, where the increase in the median reflects significant improvement in visuospatial abilities. In contrast, for "Basic Sensorimotor Functions," a slight decrease in the median is observed, suggesting a less uniform progression in this domain.

In the pre-test phase (see Table VII.3), the analysis of statistical indicators reveals varying levels of variability across subtests, with the smallest range recorded for "Finger Tapping" (8 points) and the largest for "Basic Visuospatial Processing" (64 points), indicating more pronounced individual differences in this domain. The median values show that half of the students obtained scores of at least 5 points on most subtests, 6 points on "Imitating Hand Positions," and 2.50 points on "Design Copying," while for the global variables the level is significantly higher (68 points). The modal scores confirm these trends, indicating generally moderate performance, as well as more pronounced difficulties in certain subtests, particularly in "Design Copying" and "Arrows."

Table VII.3. Descriptive Statistics, Scaled Scores, NEPSY Pre-Test

Statistical Indicator	**Finger tapping**	**Imitation hand positions**	**Vizuomotor precision**	**Basic Sensorimotor Functions**	**Design copying**	**Arrows**	**Basic Visuospatial Processing**
Mean	4.50	6.73	5.23	68.45	5.00	5.55	72.64
Median	5.00	6.00	5.00	68.00	2.50	5.00	68.00
Mode	5	6	5	68[a]	2	4[a]	60[a]
Standard deviation	2.241	2.567	2.114	10.108	4.276	2.483	16.780
Skewness	-.279	.817	1.035	.261	.800	1.131	1.022

Kurtosis	-.378	.278	1.254	-.094	-.849	.900	.565
Range	8	10	9	39	12	10	64
Minimum	0	3	2	50	1	2	51
Maximum	8	13	11	89	13	12	115

a. Multimodal distribution; the lowest mode is reported

Source: own processing in SPSS

In the post-test phase (see Table VII.4), the variability of scores remains relatively low for most subtests, with ranges between 7 and 14 points, the highest being recorded for "Design Copying," indicating the persistence of individual differences in this area. The modal scores generally remain at levels similar to those in the pre-test, suggesting stability in the most frequent performances; however, the slightly higher mean and median values indicate an improving trend. For the global variables, the central values remain high, confirming the consolidation of sensorimotor and visuospatial abilities at the group level.

Table VII.4. Descriptive Statistics, Scaled Scores, NEPSY Post-Test

Statistical Indicator	**Finger tapping**	**Imitation hand positions**	**Vizuomotor precision**	**Basic Sensorimotor Functions**	**Design copying**	**Arrows**	**Basic Visuospatial Processing**
Mean	4.95	6.82	5.23	69.45	5.82	5.86	75.91
Median	5.00	6.50	5.00	67.00	4.00	5.00	70.00
Mode	5	6	5	65	2	4	57
Standard deviation	2.257	2.239	2.137	9.984	4.542	2.660	18.547
Skewness	-.266	.894	.867	.232	.720	.695	.684
Kurtosis	-.551	1.293	1.060	-.427	-.891	-.679	-.595
Range	7	9	9	37	14	9	58
Minimum	1	4	2	52	1	2	54

Maximum	8	13	11	89	15	11	112

a. Multimodal distribution; the lowest mode is reported

Source: own processing in SPSS

The distribution of scores (mode, skewness, kurtosis) indicates that performance does not follow a normal distribution, with individual variations and non-uniform trends still present within the group. The range of scores remains relatively similar between the pre-test and post-test, indicating that differences among students persist.

Overall, the results show a moderate positive evolution, with more obvious progress in the area of visual-spatial processing and less in the sensory-motor sphere, confirming the efficiency of the intervention program, but also the need to continue it in order to consolidate and standardize the results.

Piaget-Head spatial orientation test (right–left) applied in the pre-experimental and post-experimental stage

The analysis of the results obtained in the Piaget–Head Spatial Orientation Test (right–left) highlights a moderate improvement in participants' performance in the post-experimental stage compared to the pre-test. The increase in the mean values (from 14.23 to 17.77) and the median (from 14.50 to 18.00), as well as in the 75th percentile (from 18.25 to 23.50), indicates an overall progress at the sample level, suggesting the effectiveness of the applied intervention (see Table VII.5).

Table VII.5. Descriptive Statistics, Total Cumulative Scores, Piaget–Head Spatial Orientation Test (Right–Left), Pre-Test and Post-Test

Statistical Indicator		**Total Cumulative Score (Pre-test)**	**Total Cumulative Score (Post-test)**
Target Group size	Valid	22	22
	Missing	0	0
Mean		14.23	17.77
Median		14.50	18.00
Mode		6	21
Standard deviation		5.952	6.369
Skewness		.152	-.253

Kurtosis		-.927	-.955
Range		20	22
Minimum		6	5
Maximum		26	34
Percentiles	25	8.75	12.00
	50	14.50	18.00
	75	18.25	23.50

Source: own processing in SPSS

However, the obtained scores remain below the standard reference value (34 points), reflecting a still incompletely developed level of spatial orientation and organization ability. More noticeable improvements were recorded in the 7-, 9-, and 11-year-old age groups, where the median values and percentiles increased in the post-test phase, suggesting greater responsiveness to perceptual–motor interventions at these ages.

Overall, the results support the partial effectiveness of the PEIPDP program in developing spatial orientation, while also highlighting the need to continue the interventions in order to achieve an optimal level of performance.

Curricular Writing Test applied in the pre-experimental and post-experimental stage

The results obtained at the curricular test of applied writing highlight a general improvement in the participants' performance in the post-experimental stage, compared to the pre-experimental one, for both variables analyzed: writing letters and numbers, respectively the organization of the writing space.

With regard to letter and number writing, the increase in the mean values (from 12.86 to 14.82) and the median (from 14.00 to 15.50) indicates an improvement in graphic skills for the majority of participants (see Table VII.6). Furthermore, the reduction in range and standard deviation suggests a homogenization of results in the post-test stage, along with a slight increase in maximum performance. The percentile values confirm this trend, indicating that a significant proportion of students achieved higher levels of task performance in writing.

Table VII.6. Letter and Number Writing – Pre-Test, Post-Test

Statistical Indicator	**Pre-test Score**	**Post-test Score**
Mode	17	18
Standard deviation	4.074	3.375
Skewness	-1.058	-1.110

Kurtosis		.132	.361
Range		13	11
Minimum		4	7
Maximum		17	18
Procentiles	25	10.00	12.75
	50	14.00	15.50
	75	16.00	18.00

Source: own processing in SPSS

In the case of the organization of writing space, the differences between the two stages are more moderate, yet they maintain the same positive direction. The increase in the mean (from 7.36 to 8.14) and the median (from 8.00 to 9.00) reflects an improvement in the ability to spatially structure writing. The stability of the range and the similar values of the standard deviation indicate a relatively constant distribution of performance, while the increase in the modal value highlights a shift in frequency toward higher scores (see Table VII.7).

Table VII.7. Organization of Writing Space – Pre-Test, Post-Test

Statistical Indicator		**Pre-test Score**	**Post-test Score**
Mode		8	9
Standard deviation		1.706	1.670
Skewness		-1.264	-1.990
Kurtosis		.993	3.402
Range		6	6
Minimum		3	3
Maximum		9	9
Procentiles	25	7.00	7.75
	50	8.00	9.00
	75	9.00	9.00

Source: own processing in SPSS

Overall, the data obtained support the efficiency of the educational intervention in the development of writing skills, both at the level of graphic execution and spatial organization, highlighting more pronounced progress in the graphomotor dimension and a gradual evolution in the structuring of the writing space.

Games applied in intervention

For the games applied in the PEIPDP program, the database included the data obtained from the monitoring carried out by teachers in the classroom for each individual game. As descriptive statistics, the mean, median, mode, standard deviation, skewness, kurtosis, and range were calculated. Among these, particular attention was given to the mean, median, and mode, which are analyzed in detail in the following sections. In addition, the analysis of the games was grouped according to the specific behaviors targeted by each game: games specific to basic motor behaviors (the first 8 games) and those specific to perceptual–motor structures and behaviors (the last 8 games).

The monitoring of students' behaviors was statistically justified by transforming observational data into quantifiable variables, which allowed the application of descriptive statistics (mean, median, modal, standard deviation). They provided an objective picture of the level of involvement and performance, as well as the degree of homogeneity of the group. In addition, the division of the games on basic motor and perceptual-motor behaviors facilitated the comparative analysis between different types of skills, ensuring methodological coherence between the objectives of the program and the statistical tools used. For each game we have Baseline Monitoring (BM) on the first application of the game and Final Monitoring (FM) on the last application of the game

Games that target basic motor behaviors

The results obtained from the application of games that target basic motor behaviors highlight a positive evolution in participants' performance between the BM and FM across all eight analyzed games. The increase in mean and median values for each game, as well as in the total score of motor behaviors (from 81.5 to 98.86 points for the mean and from 83.5 to 102.5 points for the median), indicates a generalized progress at the group level, confirming the effectiveness of the educational intervention based on didactic games.

The "Bead Game" stood out with the highest values of the statistical indicators, reflecting a significant impact on the development of eye–hand coordination and fine motor skills. In contrast, the "Finger Puppets" game recorded the lowest scores, suggesting a higher level of difficulty and the need for a longer period of practice to consolidate fine and isolated finger movements.

The analysis of dispersion indicators highlights low variability for certain activities (Letters and Numbers Made of Modeling Cla, Threading, Bracelet, Tracing Paths), suggesting a relative homogeneity of performance, as well as higher variability in the case of the ”Bead Game” and the total score, indicating individual differences in rithm of motor development. The negatively skewed distributions of the final scores show a concentration of results in the higher value range, confirming the progress of the majority of participants.

Overall, the data support the formative role of didactic games in the development of basic motor behaviors, highlighting significant improvements in coordination, precision and manual dexterity, as well as the effectiveness of the PEIPDP program in stimulating children's motor development.

Games targeting perceptual-motor structures and behaviors

The results obtained from the application of games targeting perceptual-motor structures and behaviors highlight a significant improvement in participants’ performance between BM and FM across all eight analyzed games. The increase in mean and median values, as well as in the total score (from 77.45 to 99 points for the mean and from 79 to 105 points for the median), indicates a generalized progress at the group level, confirming the effectiveness of the final modules of the PEIPDP program.

The game "Pyssla" stands out for the highest values of statistical indicators, highlighting an impact on the development of oculo-motor coordination, visual-spatial organization and precision of execution. In contrast, the game "My City" scores the lowest, reflecting a higher level of complexity of tasks and the demand for more advanced perceptual-cognitive and motor skills.

The analysis of the dispersion indicators reveals a low variability for games with simpler tasks, which suggests a homogenization of performance at the group level, and a higher variability for complex activities, indicating individual differences in the development. The negative asymmetric distributions of the final scores highlight a concentration of results in the area of high values, confirming the progress of the majority of participants and the reduction of gaps in the case of basic tasks.

Overall, the results support the formative role of didactic games in the development of perceptual-motor structures, highlighting improvements in spatial orientation, visual-spatial perception, hand-eye coordination and the ability to organize the workspace, as well as the efficiency of the educational intervention in stimulating the overall development of children.

VII.1.2. Analysis of Pearson Correlation Coefficients, Initial Scores, Games, and Writing Skill Variables

The relationships between the quantitative variables represented by writing skill scores and those of all the applied games were investigated. The "dependent" variables are "Letter and Number Writing" and "Organization of Writing Space" for the pre-test. For the post-test, the calculation of coefficients was not performed, as statistically validated relationships identified at the initial stage are expected to be maintained in the post-test, given that the same assessment instruments were used. The coefficients were calculated only between the games and the quality of graphic behaviors involved in letter and number writing, since the intervention program is based on these games; therefore, they are the ones expected to have a concrete influence (i.e., to be significant influencing factors) on the development of these writing skills.

The analysis of Pearson correlation coefficients highlights the existence of positive and statistically significant associations between performance in didactic games and writing skills, both for the variable "Letter and Number Writing" and for "Organization of Writing Space." For all 16 analyzed games, the coefficient values (generally ranging between 0.3 and 0.8) indicate direct relationships of moderate to high intensity, suggesting that the development of motor and perceptual–motor behaviors is associated with improvements in the quality of graphic behaviors.

In the case of games targeting basic motor behaviors, the strongest correlations with letter and number writing were identified for activities involving fine motor skills and eye–hand coordination (such as "Tricky Clips," "Letters and Numbers from Modeling Clay," and "Finger Puppets"), while the organization of writing space correlates more strongly with games that require visuomotor coordination, accurate spatial orientation, and movement control—skills that are essential for structuring writing space (for example, "Tracing Paths" and "Tricky Clips").

If the scores of the first 8 analyzed games will increase, the same will happen in the case of the scores of writing letters and numbers, and those of the organization of the writing space.

For the games targeting perceptual–motor structures, the highest correlations were recorded in relation to the games "The Little Detective," "Tangram," and "Friends in the Forest," both for writing and for the organization of graphic space.

The strongest direct relationships with the variable "Letter and Number Writing" were found for the games "The Little Detective" ($r = 0.845$), "Tangram" ($r = 0.829$), and "Friends in the Forest" ($r = 0.800$). These results indicate that activities based on recognition, visual

analysis, spatial orientation, and reconstruction through manipulation contribute to the development of graphic behaviors related to the correct writing of letters and numbers.

With regard to the variable "Organization of Writing Space," the highest correlations were identified with the games "The Little Detective" (r = 0.761), "Friends in the Forest" (r = 0.697), and "Tangram" (r = 0.678). This association confirms that spatial orientation and the correct placement of visual elements in the game are reflected in the way children subsequently organize the graphic space of the page.

The analysis of Pearson correlation coefficients for the last eight games also highlights positive and statistically significant associations of moderate intensity, both in relation to "Letter and Number Writing" and "Organization of Writing Space."

Overall, the results confirm the existence of a functional relationship between the development of psychomotricity and the quality of graphic behaviors involved in letter and number writing, supporting the formative value of the didactic games used within the PEIPDP program and their relevance for optimizing the process of learning to write.

VII.1.3. T-Tests for Mean Differences (Testing the Research Hypotheses)

T-tests were applied, using a significance threshold of 5% for validation. The general null hypothesis in the case of t-tests is H0: "There is no statistically significant difference in the mean scores of the tested variable depending on the time of testing (pre-test compared to post-test, BM compared to FM)," along with the corresponding alternative hypothesis.

The first set of t-tests for dependent samples covers all games applied under the intervention programme.

For ease of interpretation of the results, the tests on the games have been divided into two sections. The first section refers to the scores reported for the first 8 games applied under the PEIPDP. The second section refers to the last 8 games applied. The specific statistical hypothesis H1 "There is a statistically significant difference in the mean game scores between BM and FM" is tested.

The null hypothesis for this first test is rejected at a significance level of 0.1% (Sig. values < 0.001) for the variables analyzed within this first t-test. The statistically confirmed mean difference between the BM and FM scores ranges between 1.682 and 4.409 points for the games, all in favor of FM, with higher mean scores (see Table VII.8).

Table VII.8. Dependent t-test for the first 8 games – BM versus FM score

BM Score – (minus) FM Score	**Mean Difference**	**Calculated t-value**
1. Letters and Numbers Made of Modeling Clay	-1.682***	-16.547
2. Bead Game	-4.409***	-21.562
3. Finger Puppets	-2.045***	-45.000
4. Threading	-1.682***	-12.205
5. Tricky Clips	-2.409***	-19.141
6. Bracelet	-1.500***	-13.748
7. Sequential Motor Skills Game	-1.773***	-11.063
8. Tracing Paths	-1.864***	-18.695

***Sig (2-tailed)=0.000. Semnificativ la 0.1%

Source: own processing in SPSS

The mean differences range between 1.682 and 4.409 points, all in favor of FM, indicating that the scores obtained after the implementation of the game-based program are significantly higher than those recorded at BM. The largest difference was observed for the "Bead Game" (4.409 points), confirming its formative value and its capacity to stimulate the development of basic motor behaviors. In contrast, the smallest difference (1.500 points) was recorded for "Bracelet," but even in this case the increase is statistically significant, demonstrating the effectiveness of the game.

The null hypothesis for this test is rejected at a significance level of 0.1% (Sig. values < 0.001) for the analyzed games. The statistically confirmed mean difference between BM and FM scores for the last applied games ranges between 2.136 and 3.818 points, all in favor of FM, with higher mean scores (see Table VII.9).

Table no. VII.9. Dependent t-test for the last 8 games – BM versus FM score

BM Score – (minus) FM Score	**Mean Difference**	**Calculated t-value**
1. Pyssla	-3.818***	-26.951
2. Tangram	-2.591***	-12.061
3. In the orchard	-2.909***	-10.752

4. My City	-2.455***	-10.069
5. Friends in the forest	-3.045***	-19.778
6. Read and draw	-2.318***	-12.167
7. The Little Detective	-2.273***	-11.400
8. Color Sequences	-2.136***	-12.941

***Sig (2-tailed)=0.000. Semnificativ la 0.1%

Source: own processing in SPSS

The mean differences range between 2.136 and 3.818 points, all in favor of FM. The largest increases were recorded for the "Pyssla" game (3.818 points) and "Friends in the Forest" (3.045 points), indicating that activities involving a higher level of visuospatial organization and fine motor skills produced significant progress in the development of perceptual–motor structures and behaviors. Games such as "Tangram" and "In the Orchard" also showed consistent differences (2.591 and 2.909 points, respectively), demonstrating their formative value.

Research Hypothesis 1: **The implementation of the PEIPDP program in primary school children with mild and moderate intellectual disabilities will contribute to the development of basic motor coordination, specifically components related to eye–hand coordination and fine motor coordination (fine musculature, dexterity, and manual precision).**

The first specific hypothesis is tested by conducting paired-samples t-tests on the components related to eye–hand coordination and fine motor coordination (fine musculature, dexterity, and manual precision). The main components captured through the NEPSY instrument are "Basic Sensorimotor Functions" and "Basic Visuospatial Processing."

The set of statistical hypotheses formulated for this test consists of the null hypothesis H0: "There is no statistically significant difference in the mean scores of the analyzed variables between the pre-test and post-test," and the alternative hypothesis H1: "There is a statistically significant difference in the mean scores of the analyzed variables between the pre-test and post-test." The intention is to demonstrate/validate the statistical hypothesis H1.

Table VII.10. shows that there are differences in the mean scores of each item included in the analysis between the pre-test and post-test, generally higher in the post-test. An exception to this pattern is the "Finger Tapping" item, with a mean of 114.64 points in the post-test, lower than the pre-test mean of 136.09 points. As mentioned above, for "Finger Tapping," the raw score is measured in seconds, representing the time during which the child performs the finger

movements. Therefore, a higher raw score indicates a longer time required to execute the movements, reflecting slower and/or inaccurate performance, whereas a decrease in execution time corresponds to a lower raw score and indicates faster and/or more accurate movement execution.

Table VII.10. Dependent t-test for Nepsy instrument components – raw score pre-test versus post-test

Component	**Pre-Test Score – (minus) Post-Test Score**	**Mean Difference**	**Calculated t-value**
Basic Sensorimotor Functions	Finger tapping	21.455***	5.422
	Imitation hand positions	-1.000***	-4.387
	Vizuomotor precision	-1.364***	-4.271
Basic Visuospatial Processing	Design copying	-3.591***	-9.140
	Arrows	-2.000***	-4.997

***Sig (2-tailed)=0.000. Semnificativ la 0.1%

Source: own processing in SPSS

For the results reported above, the null hypothesis for this test is rejected at a significance level of 0.1% (Sig. values < 0.001). The statistically confirmed mean difference between pre-test and post-test scores ranges between 1 point and 21.455 points, in favor of the final testing, with higher mean scores (see Table VII.10).

The specific hypothesis tested is fully validated. The implementation of the psychopedagogical intervention program based on didactic games in primary school children with mild and moderate intellectual disabilities contributes to the development of basic motor coordination.

Research Hypothesis 2: **The use of the psychopedagogical intervention program based on didactic games in primary school children with moderate intellectual disabilities will contribute to the development of perceptual–motor behaviors and structures (spatial orientation and spatial organization).**

The hypothesis involves performing a t-test dependent on the results of the Piaget-Head instrument between pre-test and post-test. The set of statistical hypotheses formulated for the present test consists of the null hypothesis H0 "There is no statistically significant difference in the average of the scores analyzed between pre-test and post-test, for the analyzed age group",

with the alternative H1 "There is a statistically significant difference in the average of the analyzed scores between pre-test and post-test, for the analyzed age group".

Table VII.11. Group statistics for the Piaget-Head tool – total score pre-test versus post-test

		Mean	Target Group Size	Standard Deviation
6-Year-Old Group	Total Score (Pre-test)	2.91	22	0.294
	Total Score (Post-test)	2.95	22	0.213
7-Year-Old Group	Total Score (Pre-test)	4.32	22	1.937
	Total Score (Post-test)	5.36	22	1.293
8-Year-Old Group	Total Score (Pre-test)	2.86	22	0.640
	Total Score (Post-test)	2.86	22	0.640
9-Year-Old Group	Total Score (Pre-test)	2.36	22	2.341
	Total Score (Post-test)	3.64	22	2.871
10-Year-Old Group	Total Score (Pre-test)	1.23	22	1.660
	Total Score (Post-test)	1.77	22	2.181
11-Year-Old Group	Total Score (Pre-test)	0.77	22	1.152
	Total Score (Post-test)	1.18	22	1.053
Total Cumulative Score	Total Score (Pre-test)	14.23	22	5.952
	Total Score (Post-test)	17.77	22	6.369

Source: own processing in SPSS

From the group descriptive statistics table, it can be observed that there are differences in the mean scores for each age group between the pre-test and post-test. An exception to this pattern is the 8-year-old age group, with a mean score of 2.86 points at both testing moments (see Table VII.11).

Table VII.12. Dependent t-test for the Piaget-Head tool – pre-test versus post-test score.

Pre-Test Score – (minus) Post-Test Score	**Mean Difference**	**Calculated t-value**
6-Year-Old Group	-0.045	-0.568
7-Year-Old Group	-1.045**	-3.801
9-Year-Old Group	-1.273**	-3.309
10-Year-Old Group	-0.545	-1.916

11-Year-Old Group	-0.409*	-2.247
Total Cumulative Score	-3.545***	-6.647

***Sig (2-tailed) semnificativ la 0.1%; **Sig (2-tailed) semnificativ la 1%; *Sig (2-tailed) semnificativ la 5%

Source: own processing in SPSS

For the results reported above, the null hypothesis is rejected at a significance level between 0.1% (Sig. values < 0.001) and 5% (Sig. values < 0.05) for the 7-, 9-, and 11-year-old age groups, as well as for the total cumulative score. The statistically confirmed mean difference between pre-test and post-test scores ranges between 0.409 and 3.545 points, in favor of the final testing (see Table VII.12).

The second research hypothesis is fully validated. The use of the play-based psychopedagogical intervention program in young schoolchildren with mild and moderate ID contributes to the development of perceptual-motor behaviors and structures (orientation and spatial organization).

Research Hypothesis 3: **The implementation of the psychopedagogical intervention program based on didactic games in primary school children with mild and moderate intellectual disabilities will influence the quality of graphic behaviors involved in writing letters and numbers, specifically handwriting (letter, syllable, word, digit) in terms of form, size, and organization of writing space.**

The dependent t-test (pre-test versus post-test) was performed on the components of the writing tool. The set of statistical hypotheses formulated consists of the null hypothesis H0 "There is no statistically significant difference in the average scores of the analyzed variables between pre-test and post-test", with alternative H1 "There is a statistically significant difference in the average scores of the analyzed variables between pre-test and post-test".

From the group descriptive statistics table (Table VII.13), it can be observed that there are differences in the mean scores for each item included in the analysis between the pre-test and post-test, with higher values in the post-test.

Table VII.13. Group Statistics for the Writing Assessment Instrument – Total Score (Pre-test vs. Post-test)

		Mean	Target Group Size	Standard Deviation
Writing letters and numbers	Scor pre-test	12.86	22	4.074

	Scor post-test	14.82	22	3.375
Organization of the writing space	MD	7.36	22	1.706
	MI	8.14	22	1.670

Source: own processing in SPSS

For the results reported above, the null hypothesis is rejected at a significance level of 0.1% (Sig. values < 0.001). The statistically confirmed mean difference between IM and FM scores is 1.955 points for the item “Letter and Number Writing” and 0.773 points for the item “Organization of Writing Space” (see Table VII.14).

Table VII.14. T-test for the writing assessment tool – total score pre-test versus post-tes

Pre-Test Score – (minus) Post-Test Score	**Mean Difference**	**Calculated t-value**
Writing letters and numbers	-1.955***	-10.203
Organization of the writing space	-0.773***	-5.288

***Sig (2-tailed) semnificativ la 0.1%;

Source: own processing in SPSS

The tested hypothesis is fully validated. The application of PEIPDP contributes to the development of writing skills.

In conclusion, as a result of the complete validation of the specific research hypotheses, the application of the psychopedagogical intervention program based on the didactic game contributes to the development of psychomotor skills and writing skills. The general hypothesis of the research is validated, without hesitation.

Research Hypothesis 4: **The implementation of the psychopedagogical intervention program based on didactic games in primary school children with mild and moderate intellectual disabilities is a significant predictor of the quality of graphic behaviors involved in writing letters and numbers.**

In order to accurately measure the effect of validating the main hypothesis on the level of writing skills, multiple linear regression equations were estimated between the independent variables represented by each applied game and the dependent variables "Writing letters and numbers" and "Organization of the writing space", respectively.

The validation tests of a regression equation include the analysis of error correlation (Durbin–Watson coefficient), the analysis of the representativeness of the regression model

(Table VII.15), the analysis of the significance of the estimated coefficients (Table VII.16), as well as the testing of multicollinearity among the independent variables for multiple linear models.

Regression Model with the Dependent Variable "Letter and Number Writing"

This model has as independent variables all the games applied within the intervention program, measured in the pre-test, without the components that evaluate the total scores.

The null hypothesis of the ANOVA analysis is rejected at a significance level of 0.1% (Sig. value < 0.001), indicating that the estimated model is statistically significant (see Table VII.15).

Table VII.15. Anova analysis of the multiple regression model, the first model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	288.340	4	72.085	20.339	0.000
	Residual	60.251	17	3.544		
	Total	348.591	21			
Variabilă dependentă: scrierea literelor şi a cifrelor						
Predictors: (Constant), games: Finger Puppets, Tricky Clips, Pyssla, In the Orchard						

Source: own processing in SPSS

The high value of the F statistic (F = 20.339) confirms that the model has significant explanatory power and that the relationship between the selected predictors and writing performance is not random. In practical terms, the combination of these games constitutes a set of activities that directly and consistently contributes to the development of graphic skills.

All estimated coefficients are statistically significant at a 5% significance level (Sig. value < 0.05), including the constant, thus preserving the linearity of the model. The estimated multiple model does not present multicollinearity issues, as the VIF coefficient falls within the reference range of 1–10, confirming this statement (see Table VII.16).

Table VII.16. Estimated coefficients of the multiple regression model, the first model

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Collinearity Statistics

		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-5.380	2.221		-2.423	.027		
	Pyssla	-0.911	0.339	-0.739	-2.686	.016	0.134	7.439
	In the orchard	0.759	0.312	0.541	2.431	.026	0.206	4.863
	Finger Puppets	1.068	0.433	0.410	2.466	0.025	0.369	2.713
	Tricky Clips	1.526	0.425	0.737	3.592	0.002	0.242	4.140

Source: own processing in SPSS

Table VII.16 shows how each game contributes, on average, to the variation in scores obtained for letter and number writing, while the other variables remain constant.

"Finger Puppets" has a positive coefficient (1.068), which means that an increase of one point in this game is associated with an increase of 1.068 points in writing performance. The game contributes to the development of fine motor skills and finger coordination, aspects that are essential for letter formation.

"Tricky Clips" has the strongest positive impact (1.526). Manipulating the clips requires strength, precision, and coordination, directly engaging the fine musculature of the hand necessary for writing, which explains its influence.„În livadă" are un coeficient pozitiv (0,759), arătând că și activitățile de orientare vizual–spațială, bazate pe plasarea și recunoașterea elementelor într-un context, susțin dezvoltarea comportamentelor grafice implicate în scris.

"Pyssla (Bead Art)" shows a negative coefficient (−0.911). Although the game develops fine motor skills and coordination, within this multiple model its effect appears statistically reversed, most likely due to overlap with similar variables (such as "Tricky Clips" and "Finger Puppets"). This does not mean that the game has a negative effect in practice, but rather that its specific impact is absorbed or counterbalanced by the other predictors.

From the perspective of this first model, Research Hypothesis 4 is validated.

Regression Model with the Dependent Variable "Organization of Writing Space"

The estimated regression model with the dependent variable "Organization of Writing Space" is a particular model, in the sense that the constant is absent from the final optimal model (regression through the origin). The significant predictors (independent variables) identified among all the games are "Pyssla", "In the Orchard", "Finger Puppets" and "Tracing Paths".

The null hypothesis of the ANOVA analysis is rejected at a significance level of 0.1% (Sig. value < 0.001), indicating that the estimated model is statistically significant (see Table VII.17).

Table VII.17. Anova analysis of the multiple regression model, the second model

Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	1241.553	4	310.388	448.873	0.000
	Residual	12.447	18	0.691		
	Total	1254.000	22			

Source: own processing in SPSS

All estimated coefficients in the final model are statistically significant at a 1% significance level (Sig. value < 0.01); however, the estimated multiple model presents multicollinearity issues, as the VIF coefficient falls outside the reference range of 1–10, confirming this statement (see Table VII.18). The independent variables are statistically significantly correlated with each other.

Table VII.18. Estimated coefficients of the multiple regression model, second model

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
2	Pyssla	-0.636	0.155	-1.144	-4.105	.001	0.007	140.717
	In the orchard	0.511	0.134	0.748	3.807	.001	0.014	70.045
	Finger Puppets	0.559	0.182	0.472	3.074	0.007	0.023	42.687

	Tracing Paths	0.954	0.166	0.922	5.742	0.000	0.021	46.755

*Linear Regression through the Origin. Dependent Variable: Organization of Writing Space

Source: own processing in SPSS

Given that in both estimated regression models have been identified games that statistically significantly predict the quality of the graphic behaviors involved in writing the letters and numbers evaluated, it can be said that hypothesis 4 formulated is validated.

VII.2. Case Studies

We have selected 3 case studies. For each class, a case study. The participants in the studies were named S.1.II. (abbreviation from case study number 1, grade II) for the first study, S.2.III. (abbreviation from case study number 2, grade III) second study and S.3.IV. (abbreviation from case study number 3, grade IV). Choice of participants S.1.II., S.2.III. and S.3.IV. of the students included in the research was carried out based on the relevance of their psychopedagogical profile for the objectives of the study and for the analysis of the effects of PEIPDP on psychomotor development and graphic behaviors involved in writing. For each participant, school documents were studied in detail, a process carried out in compliance with legal and ethical requirements. This analysis was carried out based on the written consent of the educational institution and the parent or legal guardian, in accordance with the GDPR regulations in force on the protection of personal data.

The three case studies were selected in order to conduct an in-depth analysis of the effects of the PEIPDP program on psychomotor development and on the quality of graphic behaviors involved in writing among primary school children with mild and moderate intellectual disabilities. This approach allowed for the observation of how the psychopedagogical intervention operates in relation to different levels of chronological age, school achievements, and psychomotor maturation.

Participant S.1.II. was selected because he represents the profile of a student at the early stage of consolidating instrumental writing skills, with pronounced difficulties in the sensorimotor and visuospatial domains. He presented difficulties in forming letters and numbers, as well as in graphic organization and orientation, including omissions, distortions, and mirror writing. These aspects made him particularly relevant for observing how

psychomotor intervention can support the development of graphic behaviors involved in writing. His selection allowed for the analysis of the effects of the PEIPDP program on a student with a low initial level of psychomotor acquisitions involved in writing.

Participant S.2.III. was selected because he illustrates an intermediate profile, specific to a student who has developed graphic behaviors, but these are not yet sufficiently stabilized. His difficulties were mainly related to fine motor control, organization of writing space, line alignment, letter size, and eye–hand coordination. By including this participant in the research, we were able to capture how the PEIPDP program contributes not only to the formation, but also to the consolidation and regulation of developing graphomotor skills.

Participant S.3.IV. It was chosen because it offers the image of a student at a more advanced school level, in which certain delays in psychomotor and graphomotor development persist, despite the accumulated school experience. Although he had more developed acquisitions in relation to the other participants, the analysis of the notebooks and the applied tests highlighted problems of spatial organization, upward trend of rows, oversized letters and difficulties in graphic control. Its choice allowed for the examination of the potential of PIDPE to correct and optimise already formed but insufficiently automated graphical behaviours.

Therefore, these three participants were selected because they provide a gradual picture of the psychomotor and graphomotor difficulties encountered in students with mild and moderate ID, from the level of initiation of writing skills, to the level of consolidation and then to the level of correction of persistent graphic behaviors.

Thus, the selection of these cases was not random, but based on pedagogical and methodological criteria: the relevance of the initial difficulties, the existence of complete evaluation and monitoring data, the constant participation in the intervention and the ability of each case to illustrate a certain level of psychomotor and graphomotor development. These three cases complement the group analysis carried out on the 22 participants, providing an individualised perspective on the formative effects of the PEIPDP programme.

Next, we will analyze for the three case studies the results obtained in the pre-test, post-test and BM, FM.

In the pre-test, S.1.II. showed the most pronounced difficulties in the sensorimotor and visuospatial domains. The scores obtained on the NEPSY indicated significant delays in eye–hand coordination, fine motor skills, movement precision, and spatial organization. Crossed

laterality, evidenced by the DSD pattern in the Harris Test of Lateral Dominance, represented an additional vulnerability factor, with possible consequences for spatial orientation and eye–hand coordination. At the writing level, the student demonstrated difficulties in forming letters and numbers, including omissions, distortions, mirror writing, and poor organization of writing space.

S.2.III. presented in the pre-test a psychomotor profile characterized by unitary left laterality, stable, but with difficulties in sensory-motor coordination, fine motor control and automation of motor sequences. Compared to S.1.II., the visual-spatial domain was better defined, but the integration between visual analysis and motor execution was insufficiently consolidated. The writing was marked by uneven letters, ascending or descending rows, alignment difficulties, and inadequate letter and number sizes.

In the case of S.3.IV., the pre-test highlighted a unitary, fixed right laterality, but also persistent difficulties in fine motor control, organization of graphic space and transposition of visual models into motor execution. Although the student had better school achievements than the other two, the graphic behaviors involved in writing indicated an insufficient psychomotor maturation: oversized letters, uneven lines, upward trend of the writing line and difficulties in maintaining proportions in the graphic space.

The monitoring carried out during the intervention showed progress in all three participants, albeit at different levels. S.1.II. recorded an increase of 19 points in basic motor games and 28 points in perceptual-motor games. This progress is relevant because the student started from a low initial level, with significant deficits in both areas. Its evolution indicates an increased receptivity to structured playful activities, especially in the area of oculo-motor coordination, fine motor skills and spatial orientation.

S.2.III. obtained an increase of 10 points in basic motor games and 11 points in perceptual-motor games. Although the score obtained is lower, compared to S.1.II., it must be interpreted in relation to the student's initial better level. Its evolution reveals the consolidation of already partially formed skills, especially in terms of stability of movements, precision of execution, visual organization and respect for graphic space.

S.3.IV. recorded a progress of 20 points in the basic motor games and 22 points in the perceptual–motor games. These results indicate a significant improvement, especially considering the higher chronological age and the persistence of graphomotor difficulties at the

initial stage. The observed progress suggests that psychomotor intervention remains effective even at the fourth-grade level, particularly when activities are adapted to the student's functional needs.

The post-test results confirm the positive effect of the PEIPDP program on psychomotor development. In the NEPSY subtests, all three participants showed improvements in raw scores in both the sensorimotor and visuospatial domains. For S.1.II., progress was most evident in the "Design Copying" and "Visuomotor Precision" subtests. For S.2.III., a balanced development was observed between fine motor control and visuospatial processing, with improvements in "Finger Tapping," "Imitating Hand Positions," "Visuomotor Precision," "Design Copying," and "Arrows." For S.3.IV., progress was more pronounced in the visuospatial domain, particularly in "Design Copying" and "Arrows," indicating better visual analysis, spatial orientation, and graphic organization.

An important methodological aspect is that, after scaling the NEPSY scores relative to chronological age, the differences were not always significant. However, the analysis of the raw scores allowed the capture of relevant functional progress, especially in the case of students with ID, for whom the evolution can be slow, gradual and better observable through qualitative and quantitative indicators of individual progress.

The Piaget–Head Test also highlighted progress in right–left spatial orientation. S.1.II. improved from 9 to 12 points, successfully performing tasks that required verbal integration, lateral discrimination, and an appropriate motor response. S.2.III. increased from 17 to 21 points, showing improvements in movement imitation and reproduction based on visual material. S.3.IV. improved from 26 to 29 points, consolidating acquisitions specific to the 10-year-old age group. These developments confirm that the game-based activities within the PEIPDP program supported not only fine motor skills, but also the development of spatial representations and body orientation in space.

The results of the curricular writing test indicate the transfer of psychomotor acquisitions into graphic behaviors involved in writing. In S.1.II., a better use of graphic elements in the writing of letters and a more appropriate framing of the digits in the graphic space were observed. In S.2.III., the progress was made in the correct writing of the handwritten letters, the observance of the size of the lowercase letters, the organization of the horizontal rows and the writing of the numbers inside the marked space. In S.3.IV., improvements were

noted in the proportioning of upper and lower case letters, the maintenance of horizontal rows, the observance of the line and the general organization of the page.

Overall, the three case studies highlight that the PEIPDP program had a positive impact on psychomotor development regardless of the student's grade level; however, the pattern of progress differs depending on the initial level of development. The student with the greatest initial difficulties, S.1.II., showed more substantial progress in perceptual–motor activities, suggesting that the intervention has significant compensatory potential in the early stages of schooling. S.2.III. demonstrated consolidation of already acquired skills, with evident effects on graphic organization and writing accuracy. S.3.IV. confirmed the effectiveness of the intervention in improving persistent difficulties, particularly in the areas of visuospatial organization and graphic control.

Overall, the three cases support the research hypotheses. Writing cannot be reduced to a simple academic acquisition, but must be understood as a result of the interaction between cognitive and sensory-motor functions. Therefore, the graphic difficulties observed in students with ID must be addressed through integrated interventions, aimed at psychomotor skills and graphic acting.

The general conclusion drawn from the analysis of the three case studies is that PEIPDP is an effective educational tool for stimulating psychomotor development in young schoolchildren with mild and moderate ID. Through structure, adaptation to the particularities of the students, the program contributed to the development of hand-eye coordination, to the development of fine motor skills, to the increase of the precision of movements, to the consolidation of spatial orientation and to the improvement of graphic organization. The effects observed in the writing activities confirm the formative value of the intervention and the relevance of including psychomotor programs in the educational approach for students with special educational needs.

Thus, the three case studies emphasize the fact that the psychomotor intervention carried out through didactic play in addition to the compensatory role also has a preventive and formative role, facilitating the student's participation in school activities and supporting the development of functional autonomy. The results obtained recommend the use of PEIPDP as a complementary educational practice in special education, especially for students with graphomotor difficulties, delays in the development of fine motor skills and deficits in visual-spatial organization.

FINAL CONCLUSIONS

Conclusions of the theoretical foundation of the doctoral thesis

This paper draws attention to the importance of psychomotor development in young schoolchildren with ID. The whole approach was built around the idea that psychomotor skills are a fundamental dimension of the child's development, with a direct impact on the learning process, especially on the acquisition of writing.

The first chapter laid the conceptual foundations, clarifying the role of psychomotor skills and its relationship with psychic functions. Movement is not just a physical act, but a complex expression of the interaction between perception, cognition, and emotion. The delay in psychomotor development is immediately reflected in difficulties in school and social adaptation, demonstrating the integrative character of this dimension.

Furthermore, the second chapter showed that psychomotor disorders frequently occur in children with intellectual disabilities. Delays in movement coordination, perceptual–motor deficits, and neuromotor problems hinder school activities, especially the process of acquiring writing skills. The definition and classification of these disorders provide a clear framework for diagnosis and intervention.

The third chapter introduced the psychopedagogical perspective, analyzing ID from an etiological, cognitive, emotional and psychomotor point of view. Here the link between psychomotor skills and writing skills was explicitly demonstrated: children with ID have major difficulties in spatial organization, hand-eye coordination and fine motor control, which leads to disorganized writing. The graphic act thus becomes not only a school skill, but a barometer of the psychomotor level, which confirms that psychopedagogical intervention is necessary.

The fourth chapter brought the research into the sphere of educational practice, looking at how the national curriculum and existing strategies can be adapted to the needs of children with ID. The didactic game was presented as a method of educating psychomotricity, as it responds to the child's developmental particularities and facilitates active and pleasant learning. In this regard, the personalization of activities and the flexibility of strategies have been identified as decisive factors in the success of intervention programs.

Viewed as a whole, the chapters of the paper are connected through a logical progression: from the definition and theoretical grounding of psychomotricity, to the description of disorders and their implications, followed by their theoretical integration into psychopedagogy, and finally their application through educational methods and practices. The main conclusion emerging from this progression is that the development of psychomotricity

represents an essential prerequisite for the acquisition of writing skills in children with intellectual disabilities and, consequently, for their academic progress and social integration.

The research shows that a structured psychopedagogical intervention, focused on didactic games and adapted strategies, can reduce psychomotor gaps and significantly contribute to increasing children's autonomy, self-confidence, and quality of life. Beyond its theoretical value, the thesis provides practical solutions applicable in special education, emphasizing the personalization of education and the need for a multidimensional approach to child development.

Thus, the connection between the chapters reflects the unity of the scientific approach: theory underpins practice, and practice confirms theory, both converging towards the same conclusion: the development of psychomotor skills is not an end in itself, but a fundamental condition for the formation of basic school skills and for the integration of the child with ID in school and in society.

Conclusions of the research

Nepsy Test

In relation to the mean value calculated from raw scores, with the exception of the "Finger Tapping" subtest, all other subtests record higher scores in the post-experimental stage (post-test) compared to the pre-experimental stage (pre-test). In terms of the mean value calculated from scaled scores, all administered subtests show relatively similar scores in the post-experimental stage compared to the pre-experimental stage. A notable difference is observed in the scaled median value for the "Design Copying" subtest between the two testing moments, suggesting that this subtest shows the most visible improvement compared to all other evaluated subtests.

Piaget–Head Spatial Orientation Test (right–left)

Considering the values reported for the median and mode, both in the pre-test and post-test, which remain below the standard reference value of 27 points, it can be inferred that the vast majority of participants in the study present difficulties in spatial orientation. In the pre-test, not a single participant in the target group achieved a total cumulative score of 27 points, the highest score recorded being 26 points, obtained by only one participant.

Fifty percent of the participants showed an improvement in their scores following the implementation of the intervention program, at least within the 7-, 9-, and 11-year-old age groups. The highest values of the 75th percentile are reported for the 7-year-old and 9-year-old groups.

PEIPDP. For the first 8 analyzed games, the highest mean scores were recorded, both in BM and FM, for the “Bead Game,” with a mean of 22.64 points in FM compared to 18.23 points in IM. The “Finger Puppets” game records the lowest mean scores, with values ranging from 6.18 points in IM to 8.23 points in FM.

Regarding the median value, half of the respondents recorded lower scores in BM compared to FM, indicating progress as a result of the implementation of games aimed at developing motor coordination.

The three most frequent scores recorded in FM, in descending order, are 20 points for the “Pyssla” game, 15 points for “Friends in the Forest,” and 14 points for “Tangram.”

Curricular Writing Test

The items of the writing assessment instrument were operationalized into two specific variables: “Letter and Number Writing” and “Organization of Writing Space.”

For both analyzed variables, the performance recorded by the study participants was higher in the post-test compared to the pre-test for the majority of the reported statistical indicators.

For the variable "Writing letters and numbers", regarding the median value, there is a difference of 1.5 points between pre-test and post-test, in favor of the latter, which shows an improvement of this analyzed variable for at least 50% of the study participants, as a result of the application of the intervention program. On the post-test scores, it is observed that 75% of the research participants recorded a maximum of 18 points in the items of writing letters and numbers, the remaining 25% obtaining higher scores.

For the variable “Organization of Writing Space,” the range has an identical value in both the pre-test and post-test (6 points). The most frequent score recorded in the pre-test is 8 points, while in the post-test it is 9 points.

Statistically significant Pearson correlation coefficients, for which the associated Sig. values are below the 5% threshold, are identified for all analyzed pairs of games. Positive coefficient values are observed, indicating direct relationships between the two variables in each tested pair, of moderate intensity (values within the 0.3–0.7 range), both for “Letter and Number Writing” and for “Organization of Writing Space.”

For the first 8 analyzed games, the strongest direct relationships with the variable “Letter and Number Writing” were identified for the games “Tricky Clips” (correlation coefficient = 0.841), “Letters and Numbers from Modeling Clay” (correlation coefficient = 0.774), and “Finger Puppets” (correlation coefficient = 0.745). The strongest direct relationships with the variable “Organization of Writing Space” were identified for the games

"Tracing Paths" (correlation coefficient = 0.724), "Tricky Clips" (correlation coefficient = 0.689), and "Letters and Numbers from Modeling Clay" (correlation coefficient = 0.684).

For the last 8 analyzed games, the strongest direct relationships with the variable "Letter and Number Writing" were identified for the games "Tangram" (correlation coefficient = 0.829), "The Little Detective" (correlation coefficient = 0.845), and "Friends in the Forest" (correlation coefficient = 0.800) (see Table 9). The strongest direct relationships with the variable "Organization of Writing Space" were identified for the same games as in the case of "Letter and Number Writing," but with different correlation coefficient values.

Answers to research questions

It has been statistically demonstrated that the application of the psycho-pedagogical intervention program based on the didactic game to young schoolchildren with mild and moderate ID, contributes significantly to the development of psychomotor skills and the level of writing skills. More precisely, the quality of the graphic behaviors involved in writing letters and numbers shows positive developments, concrete improvements, measured in the post-test.

The general hypothesis of the work is statistically confirmed. For most of the t-tests applied, there was a statistically significant difference in the mean scores of the variables depending on the time of testing.

The games applied within the intervention program are significant predictors for the quality of the graphic behaviors involved in writing letters and numbers.

The development of the game-based psycho-pedagogical intervention program achieved the objectives pursued. There are differences between pre-test and post-test. Also, during the course of the program, it was possible to follow the evolution of the students during one module and from one module to another. The data obtained in the MD were analyzed and then compared with those in the IM. The data obtained from the observation tables were structured starting from the component elements of psychomotricity comprising the objectives pursued by the intervention program.

Original research contributions

It brings to the fore the PEIPDP carried out and implemented within this research. It represents an original contribution through the design and application of games structured according to the model of the didactic game, each with a clear purpose and carefully formulated objectives for the development of the component elements of psychomotricity. Based on the needs identified in children with mild and moderate ID, 16 games were selected and created, integrated into 8 modules, carried out over 16 weeks.

The originality of the approach consists, on the one hand, in the classification and explicit correlation of the psychomotor elements concerned (oculo-motor coordination, fine motor skills, precision of movement, spatial orientation and organization, visual-spatial perception) with the educational objectives pursued, and on the other hand in the methodological integration of the games: each game has clear rules, training for teachers, accessible and attractive materials, as well as an observation table intended for monitoring of students' individual progress.

The structuring of the games into two main categories—games for the development of basic motor behaviors and games for the development of perceptual–motor structures—ensures coherence and progression, while respecting the age-specific characteristics and developmental level of the children. The modular design of the program, with a frequency of 3 hours per week and a gradual progression from simple to complex activities, provides both continuity and adaptability to the classroom context.

An innovative aspect is the integration of the EIPP into the current teaching activity, which allows teachers to use it not as a separate intervention, but as a natural component of the educational process. This integration is supported by the auxiliary materials prepared for teachers and the playfulness of the games, which facilitate children's motivation and active participation.

Thus, PEIPDP is also a strategy for reconstructing the educational experience through playful and interactive means, aimed at recovering the gaps and strengthening the psychomotor skills for the primary cycle.

Limits of research

One of the limitations of this research is the fact that the application of the psycho-pedagogical intervention program was carried out by the classroom teachers. Even if they benefited from prior training and structured work materials, their level of involvement and implementation mode could vary depending on experience, availability and teaching style. This aspect can be considered a source of variability in the application of the program, influencing the uniformity of the activities and, implicitly, the results obtained. In addition, as it is a program that involves the observance of clear rules and the systematic observation of students' behaviors, any differences in the application of the methodology may affect the degree of comparability between classes.

Another limitation of the research is given by the relatively short period of the intervention – only 16 weeks, organized on 8 modules. Although this duration has allowed the observation of visible progress in the development of psychomotor skills, it is not enough to capture the lasting impact of the program or to follow the stability and generalization of acquisitions in various educational contexts. In a longer period of application, it would have been possible to consolidate the psychomotor skills, observe their transfer to other school activities and assess the persistence of the results after the completion of the program.

Future research directions

Taking into account the above and taking into account the identified limitations of the present research, a series of directions for deepening and expanding the scientific approach can be formulated.

A first direction aims to optimize the implementation of the PEIPDP through the direct involvement of researchers or specialists trained in a unitary way, so that the application of the methodology is as consistent as possible and the variability determined by the individual teaching styles of teachers is reduced. Such an approach would allow for a more rigorous control of the intervention variables and a more precise assessment of its effectiveness.

The second development perspective highlights the need to extend the duration of the intervention program, meant to allow the analysis of the effects of consolidation and stability over time of psychomotor acquisitions. Longitudinal studies, carried out over longer intervals (e.g. over a full school year), could highlight the persistence of results and the transfer of competences to other areas of school work.

At the same time, future research could aim to compare the application of the program in different educational contexts, for example, in schools in urban and rural areas, or in groups of students with distinct levels of initial development in order to assess the degree of generalization and adaptability of the intervention, students with special educational needs in integrated education.

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