Chapter # 10

FUTURE EDUCATORS' PERCEPTIONS OF VICARIANCE AS A DESIGN TOOL IN EARLY CHILDHOOD EDUCATION SERVICES IN THE PRESENCE OF VISUALLY IMPAIRED CHILDREN

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ABSTRACT
Neuroscience highlights the body's central role in cognition, showing the close link between perception, action, and thought. Vicariance is a creative capacity of the brain that enables humans to devise alternative solutions to the complexity and unpredictability of reality. It thus represents an adaptive resource that fosters flexibility and responsiveness, both essential for survival. In the case of visual impairment, vicariance allows the body to compensate for the lack of sight by enhancing other senses and supporting movement. This concept is highly relevant to education, where biological and cultural dimensions intersect. In the learning processes of visually impaired children, vicariance can be understood in two ways. On the one hand, it reflects the child's ability to develop strategies that compensate for the absence of vision. On the other hand, it refers to the educator's role in designing flexible responses tailored to specific educational needs, within an Adaptive Decision-Making perspective. On these grounds, a questionnaire was administered to students in the Educational Sciences degree program at the University of Salerno during the course "Inclusive Design of Early Childhood Services." The aim was to explore future educators' perceptions of designing activities for early childhood contexts with children with visual impairments, and to assess how they envision using vicariance as a creative tool to foster inclusive education for all.

Keywords: visual impairment, early childhood education services, vicariance, educational design, inclusion.

1. INTRODUCTION

Pedagogical design in early childhood education services represents a fundamental element in constructing quality educational contexts, promoting the well-being, development and learning of children in the 0-3 age group (Bianquin & Bulgarelli, 2022). It is a reflexive, intentional and dynamic process that orients everyday educational practices and ensures consistency with a shared pedagogical vision. Far from being a mere programming of activities, pedagogical design takes on a deeper meaning, expressing a particular image of the child, education, and society. The idea behind the pedagogical work in the nurseries is that of considering the child as a competent person, active in the construction of his or her knowledge, the bearer of rights and the protagonist of his or her growth path, promoting constant exploration and social interaction and encouraging his or her full autonomy (Aiello, 2023). Therefore, the focus is on each child's specific characteristics to create an environment that promotes the well-being of the individual and the group (Montessori, 1999). The relationships with adults and peers are central to design, as learning and personal development are nurtured through interaction. For this reason, pedagogical design is an

essential tool for creating spaces that foster the development of meaningful relationships, which, in turn, encourage exchanges between peers in a climate of positive affectivity, thereby promoting social responsibility processes (Amadoro et al., 2024b). Furthermore, in the project action, great importance is given to constructing a stimulating environment that supports exploration, learning and growth through numerous activities and play opportunities. For this reason, it is necessary to devote particular care to the arrangement of spaces and furnishings, the selection of materials, the organisation of time, and the design of educational experiences that can effectively accommodate the various changes the child will undergo as he or she grows. According to Montessori, the richness of the environment, understood as the presence of stimuli organised according to reasoned educational reflection, is directly proportional to the child's cognitive development. The importance of perception within cognitive processes, now confirmed by neuroscience research, has long been emphasised in education. Indeed, sensory education represents a fundamental cognitive experience that precedes higher intellectual activities in children aged 0-6 (Montecchiani & Paolini, 2011). It appears to be further enhanced in the presence of visual disabilities, as in this case stimulation of the senses is necessary to compensate for the absence of sight, allowing the child with this type of disability to form mental images through which to construct their knowledge of the world.

The concept of vicariance, whose etymological origins refer to the Latin term *vicarius* – meaning "one who acts in place of another", "who takes the place of another" – has crossed a multitude of epistemic domains over time, gradually acquiring specific meanings and distinct connotations. Despite its semantic diversification, the conceptual core of vicariance remains constant: it denotes a substitutive, compensatory, and generative function that can activate alternative means of pursuing a goal in the presence of obstacles, constraints, or discontinuities (Di Gennaro et al., 2018).

In psychology, particularly in differential psychology, vicariance refers to the ability of different individuals to solve the same problem using heterogeneous intellectual and perceptual strategies (Lautrey, 2003). Cognitive performance is therefore not an expression of a single, standardised process, but rather the result of multiple mental pathways, adapted to individual profiles and contextual conditions (Gardner, 1983). From this perspective, vicariance highlights the irreducibility of the human mind to linear models, emphasising instead its flexible, situated and variable nature. In the field of biological sciences, the concept takes on further implications, linking to von Uexküll's (2010) theory of the *Umwelt*. According to this view, every living organism interacts with the environment through a subjective representation that selectively orients its possibilities for action and perception. Vicariance, in this sense, manifests itself as the ability of organisms to adapt their behaviour in diverse and creative ways, modulating the use of available resources according to their own perceptual and motor structure. It is, therefore, a form of functional plasticity, which expresses the possibility of redefining the relationship between organism and environment based on different perceptual configurations (Clark, 1997). In the medical and neurological fields, vicariance has been described as an expression of cerebral neuroplasticity, i.e., the ability of healthy brain regions to assume, in the event of damage, the functions previously performed by the damaged regions (Mounier, 1982). This phenomenon is particularly evident among individuals with sensory disabilities, who frequently develop complex and innovative neurocognitive adaptations to compensate for functional losses by reactivating other sensory or motor channels. In this sense, vicariance is an endogenous mechanism of biological resilience that can preserve or restructure functional balance under conditions of impairment (Bavelier & Neville, 2002).

A significant reworking in educational terms is offered by Lev S. Vygotskij, who, in his theory of compensation, states that every deficiency is accompanied by creative, infinitely varied and original forms of development (Vygotskij, 2007). According to this approach, the deficit is not conceived as a static limitation but as a dynamic, generative condition from which a reorganisation of functions and skills can arise. Vicariance, in this context, is a transformative process that allows the individual to develop new, creative and adaptive responses to a limitation, thus orienting their development towards non-predetermined trajectories. In line with this view, Alain Berthoz (2015) offered a refined neuroscientific and philosophical interpretation of the concept, arguing that vicariance is not limited to a simple capacity for functional substitution but manifests as a creative and anticipatory act grounded in the possibility of inventing possible worlds (*id.*). According to Berthoz, the human brain does not merely reproduce learned models; it selectively acts on incoming information, modifying its action patterns in relation to context to develop new strategies for achieving a goal. This conception emphasises the design dimension of vicariance, which is not limited to compensating for deficits, but activates processes of restructuring, discovery and construction of new possibilities of meaning.

The pedagogical outcome of these reflections is the formulation of a vicarious teaching approach aimed at overcoming the logic of ex post adaptation and promoting an idea of intrinsically differentiated educational planning (Sibilio, 2014). From this perspective, teaching does not aim to standardise pathways but to expand access, expression, and participation through multiple languages, devices, and environments. Vicariance thus emerges as the founding principle of an inclusive, dynamic and creative pedagogy, which recognises human variability not as an obstacle, but as an epistemological resource from which to rethink the forms of teaching and learning. In the context of visual impairment, vicariance refers to the extraordinary ability of the human brain to adapt and reorganise its functions when one sense is impaired or absent. When one sense, such as sight, is no longer available, the other senses (touch, hearing, smell, taste) play a more critical role in perceiving the environment and gathering information. The deprivation of sight necessarily entails a functional reorganisation expressed through the strategic use of the other senses and specific cognitive functions. Sensory vicariance determines how pupils with visual impairment interact with the world, learn and develop cognitively. Touch becomes the primary sense used to explore the environment and learn concepts (Caldin & Polato, 2023).

In educational contexts, particularly those involving children with visual impairments, vicariance has a dual meaning. On the one hand, it reflects the natural predisposition of the blind child's body to develop alternative mechanisms that compensate for the loss of visual function. On the other hand, it is reflected in the educational professional's ability to define solutions and design interventions tailored to the child's educational needs, implementing an *Adaptive Decision Making* strategy (Caldin & Polato, 2023). Through the activation of differentiated strategies and nonlinear paths, vicariance enables us to identify and legitimise the teaching strategies necessary to address the complexity of educational processes, particularly in contexts characterised by special educational needs. In such a theoretical framework, there is a need to configure educational environments with high perceptual density, in which cognitive experience can develop through sensory modalities alternative to vision, safeguarding the symbolic, relational and cognitive dimensions of the educational process. Adopting this approach helps avoid implicit exclusion or educational simplification, thereby restoring centrality to the subjective dimension of learning and the right to full participation in education. In this way, it allows the overcoming of methodological rigidity and the identification of educational deviations, thereby addressing the complexity of teaching and learning (Sibilio, 2017).

On this basis, the study aimed to explore future educators' perceptions of educational design in early childhood contexts that include children with visual impairments. In particular, a questionnaire including open-ended and closed-ended questions was administered to a group of students enrolled in the third year of the degree course in Educational Sciences, specialising in "Educators in early childhood services", at the University of Salerno (Italy), who attended the course "Inclusive design of early childhood services". The sample was asked to imagine designing an educational activity in a context in which at least one child with a visual impairment was present. The study aimed to identify recurring elements of educational design by analyzing participants' responses. Specifically, the research investigated how future educators imagine and conceptualise the design of educational activities when visual impairment is present, and whether the elements emerging from their representations are consistent with the scientific literature on vicariance as a central biological and pedagogical principle in inclusive education. Within this framework, vicariance is understood in its dual meaning: on the one hand, as an intentional design competence of the educator, and on the other, as a biologically inherent capacity of every child that supports development through adaptive and alternative pathways.

2. METHODOLOGY

2.1. Objective

The present study aimed to analyse the perceptions of future educators in early childhood services regarding the design of educational activities in contexts that include children with visual impairments. In particular, it sought to identify recurring elements of educational design emerging from participants' representations and to examine their consistency with the scientific literature on vicariance as a key principle in inclusive educational design.

2.2. Sample

The sample analysed consisted of 43 students enrolled in the third year of the degree course in Educational Sciences, specialising in 'Educators in Early Childhood Services', at the University of Salerno (Italy). They attended the course 'Inclusive Design of Early Childhood Services' during the first semester of the 2024-2025 academic year.

2.3. Survey Tool and Process

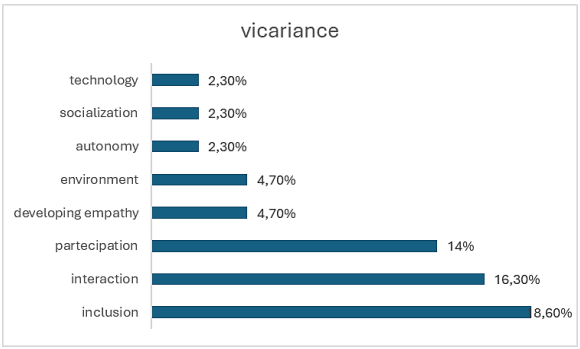
The survey instrument was a qualitative-quantitative questionnaire comprising eighteen questions, divided into three sections. Section no. 1 (items 1 - 7) was dedicated to gathering socio-demographic information, relating to age, gender, place of origin and course of study. Section 2 (items 8-16) collected information on traineeship experience (an activity included in the study pathway). They were asked to indicate the type of facility dedicated to early childhood services where the experience took place (item 9), whether there were children with disabilities (item 12) and, if so, to specify the type of disability (item 13). Item 12 ("Were there children with disabilities in the educational setting?") refers exclusively to participants' previous traineeship experience, and not to the imagined scenario proposed in item 18. This distinction was intentional, as the study sought to differentiate representations grounded in direct educational experience from those grounded in hypothetical design reasoning. The imagined presence of a visually impaired child was therefore introduced only in the final section of the questionnaire. Finally, it was asked whether the activities designed in contexts where children with disabilities were present had favoured the process of their inclusion in

the educational context (item 15). Section no. 3 (items 17 - 18) aimed at gathering information on the perceptions of future educators regarding the design of activities in educational contexts where there were children with disabilities (item 17) and with visual disabilities (item 18). More specifically, they were asked to imagine and describe the educational activities designed in the specific contexts outlined above. The questionnaire was administered during the first lesson, so the sample's answers were not influenced by the knowledge gained from attending the course. Still, it expressed personal impressions derived from direct field experience and sensitivity. The objective of the research was to answer the question. 18 ("If in the imagined educational context there was the presence of one or more visually impaired children, what activities would you plan to respond to their specific educational needs and favour their inclusion process within the educational context?"), for which a thematic type of analysis was chosen. It involved highlighting the key terms, which were then subdivided by frequency index and, finally, grouped into macro-categories. Although the core of the study is qualitative, a limited quantitative component was included by calculating frequency indices for recurring terms and thematic categories. These frequencies were not intended for inferential purposes; instead, they were used descriptively to support the qualitative thematic analysis and to highlight the relative salience of emerging design elements.

2.4. Data Analysis and Discussion

The presentation of findings is organised in relation to the research objective, focusing on how future educators conceptualise inclusive educational design through vicariance. In particular, the analysis highlights recurring design elements and examines how these align with existing theoretical and empirical literature. Regarding the first section of the questionnaire on socio-demographic data, the analysis of the collected data shows that the entire sample originates from Campania, the region in southern Italy where the university is located. Most of the sample (72%) comes from Salerno and its province. In comparison, a fair percentage (16%) comes from the city of Naples, the regional capital, and its province. Finally, the remainder of the sample came from the other provinces of the region and their respective provinces (5% from Avellino and Benevento, and 2% from the city of Caserta and its province). Most of the sample (98%) is female, while 2% identify as male. Most of the sample (92%) were between 21 and 25 years old; 6% were under 20, and only 2% were over 25. The second section of the questionnaire, which referred to the training experience carried out (as provided for in the study plan), most of the sample (91%) stated that it took place in nurseries, 7% in pre-schools and 2% in other facilities. To the question concerning the presence of children with disabilities in the facilities where this activity is carried out (item 12), only 16% of the sample answered in the affirmative, and, from the answers given to the next question (item 13), this presence is concentrated exclusively in nurseries. In the third section, which investigates how future educators envision designing activities in early childhood contexts for children with visual disabilities, the sample identifies vicariance as a key element of the design process. The term "vicariance" is associated with "inclusion" (18.6%), "interaction" (16.3%), "participation" (14%), and "motor, cognitive, and social development" (9.3%). Further associations emerge with the terms “development of empathy” and “environment” (both 4.7%); “socialisation”, “autonomy” and “technology” (2.3%) (Figure 1).

Figure 1.



Through thematic analysis of the responses, it emerged that the entire sample envisions designing educational activities in early childhood contexts for children with visual impairments, using vicariance through sensory education. However, most of the sample treats touch and hearing as vicarious senses of sight, and only a minority explicitly identifies taste and smell as well. No one, on the other hand, takes haptic perception, considered the sixth sense and fundamental for people with visual disabilities, into account. A further interesting observation concerns the percentage of the sample that is convinced that educational design centred on vicariance promotes the development of empathy. This idea seems justified by the fact that the vicarious use of the other senses in place of sight would allow children without visual impairment to experience a "change of perspective," bringing them closer to the condition of their peers with this type of disability. Therefore, sharing the same condition would be beneficial to understanding it, thus facilitating the deconstruction of prejudice against the different. Moreover, sharing the same condition would seem to favour recognition of and attention to the other's needs. In this sense, this would favour collaboration among peers and the active participation of the visually impaired child, thereby improving the general class's inclusion. According to the sample's responses, sensory education would also benefit the child's motor, social, and cognitive development. This finding is noteworthy because it reveals a holistic approach to a dimension of the person that aligns closely with the biopsychosocial perspective on which the ICF-CY is based. Still, it identifies its justification in the embodied dimension of knowledge. It would be sensory education realised through the senses, thereby favouring the contextual development of the three dimensions of the person: physical, relational, and intellectual. This would confirm the recognition of the centrality of the body (albeit deprived of a sense and the so-called 'sense of distance' in favor of the senses considered 'of proximity' - touch, hearing, taste, and smell) within the person's development process. Part of the sample also recognizes a central role for the environment, understood as a multifaceted element comprising both physical and relational aspects, and considers it fundamental to the realization of a design aimed at enhancing sensory education by effectively responding to the educational needs of children and children with visual disabilities. Finally, the data on the use of technology as a tool for designing educational activities, which focuses on the functional use of sensory vicariance, leaves one somewhat perplexed. The low percentage shown in the figure appears inconsistent with the sample's average age, which places it in the digital-native generation. This contradiction could be justified by a lack of knowledge about the educational potential of technologies, which, by contrast, according to evidence in the scientific literature, constitute concrete tools for designing personalized educational paths. For this reason, they would be well-positioned to

address everyone's educational needs and, therefore, highly inclusive. Considering these results, it is possible to affirm that the participants' responses reflect a basic awareness of the value of vicariance in inclusive educational design, although some conceptual limitations remain. None of the participants explicitly referred to haptic perception, defined as active tactile exploration that integrates sensory and motor processes. This omission may reflect a tendency to subsume haptics under the broader category of touch. In line with Lederman and Klatzky (2009), haptic perception is not conceived here as an additional sense, but as a functional perceptual system resulting from the integration of tactile input and purposeful movement.

Likewise, the reduced emphasis on olfactory and gustatory senses indicates a partial view of multisensory learning. Educational literature increasingly highlights the benefits of integrating all senses in early childhood education to foster deeper cognitive and emotional engagement (Shams & Seitz, 2008).

Furthermore, the low level of awareness regarding the potential of digital tools for inclusive sensory-based education suggests the need to strengthen technological literacy among future educators. Digital applications, such as tactile tablets, sound-based learning tools, and virtual simulations designed for visually impaired learners, have shown promising results in enhancing access to multisensory experiences (Al-Azawei et al., 2016; Amadoro & Di Gennaro, 2024a). Therefore, targeted training in inclusive technologies could be a strategic lever for advancing educational design toward greater equity and creativity.

Another critical aspect concerns the respondents' intuitive reference to empathy as a by-product of vicariant activities. This insight aligns with current research in affective neuroscience, which shows that shared sensorimotor experiences can foster interpersonal understanding and emotional resonance (Gallese, 2007). The idea of using vicariant educational strategies to promote empathy and peer cooperation could thus represent a valuable direction for inclusive pedagogy. A deeper theoretical integration with existing inclusive education models, such as the Universal Design for Learning (UDL), could further strengthen future educators' capacity to structure learning environments that are accessible, flexible and emotionally responsive (CAST, 2018).

3. CONCLUSIONS

The research data appear to corroborate the scientific literature on the centrality of vicariance as an indispensable tool for designing educational activities in early childhood contexts that include children with visual disabilities. The most frequent terminological connection is precisely "vicariance-inclusion". However, the concept of vicariance can be understood in ambivalent terms, concerning both the child's organic faculty and educators' capacity to identify solutions that meet children's specific educational needs (Caldin & Polato, 2023). In the first case, designing educational activities that stimulate the development of vicariance, understood as the biological faculty of the human being, would foster divergent thinking and creativity in children (Zollo et al., 2015). This would also be consistent with what is indicated by recent European legislation on the subject and, in particular, the *Council Conclusions on the role of early childhood education and primary education in promoting creativity, innovation and digital competence*, which established the importance of fostering creativity from early childhood onwards by making explicit reference to the need for 'modernisation of pedagogical approaches, teaching resources and the learning environment' (2015/C 172/05). In the educational sphere, the acquisition of creative thinking skills can be a valid strategy for promoting educational interventions that decipher complexity and address its pitfalls (Zollo et al., 2015; Amadoro et al., 2024b). In the specific

case of children with visual disabilities, the design of educational activities that tend to enhance this ability would have the twofold objective of responding to a particular need of the child with this type of disability, since he or she needs to *train* the other senses to compensate for the absence of sight and, at the same time, would respond to the need shared with his or her peers to foster the development of creative ability. Furthermore, designing educational activities centered on vicariance would more generally respond to the common need of children in the 0-6 age group to use sensorial exploration as the primary vehicle for knowledge of reality, as affirmed by Montessori's pedagogy (Montessori, 1938).

In conclusion, vicariance, understood as a central component of educational design in early childhood services, particularly in contexts where children with visual impairments are present, is doubly linked to the theme of inclusion. Responding to needs shared by all and specific to some, vicariant-based educational experiences enable the development of skills that are fundamental in early childhood. From a pedagogical point of view, these results highlight the importance of rethinking training pathways for future educators, ensuring they are equipped with interdisciplinary knowledge that connects neuroscience, special pedagogy and didactic innovation. Integrating theoretical models, such as "embodied cognition" and "multisensory learning," into university curricula could enhance professional practices grounded in awareness and scientific rigor (Wilson, 2002). Moreover, it is essential to consolidate reflective practice within educational contexts, fostering a design mindset that is not only responsive but also anticipatory of children's diverse needs. As suggested by Sibilio (2017), embracing vicariance as a pedagogical tool means adopting a dynamic approach to teaching, one that values flexibility, creativity, and situated decision-making.

Finally, further research should explore the long-term effects of vicariant-based educational interventions on the development of autonomy, self-regulation and social integration among children with visual impairments. Building evidence-based models to guide inclusive design strategies could significantly enhance educational quality and equity from the earliest years of life.

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