

## **The importance of School integration for Algerian Deaf Children who have undergone cochlear implantation in developing their Oral language Skills**

**أهمية الإدماج المدرسي للأطفال الصم الجزائريين الذين خضعوا لزراعة قوقعة الأذن في تنمية مهاراتهم اللغوية الشفوية**

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### **Abstract:**

This article examines the impact of mainstream school integration on the development of oral language in Algerian deaf children fitted with cochlear implants. Facing a significant prevalence of neonatal deafness in Algeria and following the national cochlear implant program, the issue of post-operative support has become central. Drawing on international studies (Geers & al., 2009) and applying them to the Algerian sociolinguistic context (Arabic-French bilingualism), this research highlights the role of linguistic immersion and social interactions in mainstream settings as key success factors. The analysis reveals that, despite inclusion policies, challenges remain, particularly in teacher training and pedagogical adaptation. Findings from several Algerian case studies (Khelladi, 2020) confirm that well-supported integration promotes better syntactic and lexical acquisition. Practical suggestions are formulated to optimize inclusive practices in Algeria

**Keywords:** Cochlear implant, Deafness, School integration, Algerian child, language development.

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## **1. An introduction:**

Congenital deafness is a global public health challenge and societal issue, affecting approximately 5% of the world's population to varying degrees, according to the World Health Organization (2022). In children, profound or severe deafness that is not treated is one of the most significant obstacles to cognitive and social development, primarily hindering the acquisition of the most fundamental human skill: spoken language. In Algeria, this issue is particularly important. According to data from the Ministry of Health (2019), the rate of neonatal deafness is between 2 and 3 per 1,000 births. This situation is partly due to socio-cultural factors, such as the high prevalence of consanguineous marriages.

Faced with this reality, the advent of the cochlear implant represented a true technological and therapeutic revolution. By directly stimulating the auditory nerve, this neuroprosthetic device offers much more than simple sound amplification; it restores functional access to the world of sound for children who were previously deprived of it. The international scientific community now agrees on the effectiveness of this technology, particularly when implantation is performed at an early age. Pioneering studies, such as that by Niparko and colleagues (2010), have conclusively demonstrated that children implanted before the age of 3 benefit from the critical period of brain plasticity, enabling them to achieve significantly higher levels of spoken language development than those implanted later.

However, no matter how effective it may be, a cochlear implant is not a ‘magic ear’. It is a tool whose full potential cannot be realized without an adequate, rich and stimulating post-operative environment. This reality shifts the focus of the debate from the purely medical field to the educational and social arena. The central question is no longer simply ‘can we make the child hear?’ but ‘how can we transform this new hearing into a robust linguistic and communicative skill?’ This is where the crucial choice of schooling comes in. Historically, deaf children were mostly referred to specialized institutions. However, this article argues that, for children with implants, integration into mainstream schools is not just one option among many, but the main lever for their linguistic success and social inclusion.

The importance of this study lies in the need to adapt integration models to the sociolinguistic specificities of Algeria, thus filling a gap in local data. Its main objectives are to evaluate the comparative impact of the mainstream environment on

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language acquisition and to propose evidence-based recommendations for optimizing public inclusion policies.

We will argue that daily immersion in a mainstream classroom, in contact with hearing peers, creates a ‘language path’ of unparalleled intensity and authenticity, which acts as a catalyst for the development of vocabulary, syntax and, crucially, pragmatic skills. This argument will be developed by first exploring the theoretical framework linking auditory perception, social interaction and language acquisition. We will then analyze the challenges and opportunities of this integration in the specific context of the Algerian education system and sociolinguistic reality. Finally, drawing on data from scientific literature and national case studies, we will demonstrate the superiority of this inclusive model and propose concrete ways to optimize its implementation.

## **2. Neurocognitive and Socio-Interactionist Framework of Post-Implantation Language Acquisition:**

The transition from the absence of sound to auditory perception mediated by a cochlear implant involves extremely complex neurocognitive processes. The resulting language development cannot be understood without a dual approach: on the one hand, the cerebral mechanisms for processing new auditory information, and on the other hand, socio-interactionist theories that place the social environment at the heart of language learning. The effectiveness of the implant is therefore the product of a combination of technological potential and the quality of the communicative ecosystem offered to the child.

### **2.1. Brain reorganization and perceptual learning: from electrical signals to semantic representation**

A cochlear implant does not transmit sound in the same way as a normal ear; it delivers a series of electrical stimuli to the auditory nerve, which the brain must learn to decode and interpret as language. This process of ‘learning to hear’ is a remarkable example of brain plasticity. The auditory areas of the cortex, which are often under-stimulated or reorganized for other sensory modalities in deaf children, must specialize or re-specialize in processing this new signal (Svirsky et al., 2004). It is only through massive, repeated and contextually rich exposure that the brain can begin to establish stable links between patterns of electrical stimulation, language phonemes, then words and finally concepts. This process is in line with Bruner's interactionist theory (1983) and his concept of the “Language Acquisition

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Support System” (LASS). The environment must actively help the child to structure this input. In a mainstream classroom, every instruction given by the teacher, every story read, every song sung is an opportunity for the child's brain to test hypotheses, strengthen neural connections and gradually build a stable system of semantic representations. As Durand (2020) puts it, the abundance of linguistic input in a mainstream school environment is the fuel that is essential for this cerebral reorganization.

## **2.2. Social interaction as a scaffold for language development: beyond simple exposure**

While exposure is a necessary condition, it is not sufficient. Vygotsky's sociocultural theory (1978) provides a powerful framework for understanding why integration is so crucial. For Vygotsky, language is not acquired through simple imitation but is constructed through interaction within the ‘Zone of Proximal Development’ (ZPD), the space where children can accomplish with the help of a more expert peer (another student, the teacher) what they cannot do alone. A regular classroom is a permanent ZPD. When an implanted child does not understand a word, a classmate can point to it, mime it, or rephrase it. In a playground game, they are forced to negotiate, question and argue to make themselves understood. These authentic and functional interactions are the scaffolding (according to Bruner) that enables them to actively build their skills. Studies such as those by Vinter (2017) and Peterson (2010) have specifically shown that it is in these unstructured exchanges that pragmatic skills – knowing when to speak, how to interpret the unspoken, understanding humor – develop best. These skills are often lacking in children who have remained in specialized environments because they are less exposed to the complexity of ordinary social interactions.

## **3. The Algerian School System and the Challenge of Inclusion: Between Political Will and Realities on the Ground**

The People's Democratic Republic of Algeria has affirmed, through several founding texts including the 2008 Framework Law on National Education and Law 02-09 on the Protection of Persons with Disabilities, a firm commitment to inclusive schooling that guarantees the right to education for every child, regardless of their particular circumstances. However, translating this guiding principle into effective and widespread educational practices throughout the country faces structural, cultural and training challenges that warrant in-depth analysis.

As Ould Daoud (2017) points out in his analysis of constraints in the field, translating this body of legislation into effective educational practices faces major

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structural obstacles, creating a gap between the formal right to education and the reality of schooling.

### **3.1. Immersion in a changing multilingual environment: an increased cognitive and educational challenge:**

The Algerian sociolinguistic landscape is rich, but also highly complex for a child in the process of learning auditory decoding. It requires implanted children to engage in demanding cognitive exercises. Implanted children are now confronted with four linguistic systems on a daily basis: dialectal Arabic (Darija), the language of primary socialization and informal interactions; Modern Standard Arabic, the official language of education and writing; French, the first foreign language taught intensively and enjoying a historic social status; and, more recently, English, newly introduced into the school curriculum as a second foreign language from primary school onwards. For the child's brain, this quadruple exposure means learning to discriminate between distinct phonological, prosodic and syntactic systems through an auditory signal that is already degraded and reconstructed by the implant. While studies (Benali, 2021) show that implanted children can become competent bilinguals, this situation requires teachers to be acutely aware of these issues. They must be able to provide clear input, avoid mixing codes in an anarchic manner, and explicitly support the transition from one language to another. Mainstream schools, by offering structured and differentiated exposure to Standard Arabic, French and now English, are theoretically the ideal place for this learning, but this requires teachers trained in the teaching of multilingualism in the context of hearing impairment.

### **3.2. The gap between inclusion policies and teaching resources: the loneliness of the teacher:**

Despite the clarity of the legislation, the reality on the ground, documented by reports such as that of the CNDH (2022) or monographic research such as that of Haddad (2019), reveals a significant discrepancy. The first obstacle is the critical lack of specialized training for teachers. Primary school teachers are trained to manage a 'standard' class and often find themselves ill-equipped to deal with the specific needs of a child with a cochlear implant. Simple but essential strategies – such as optimizing classroom acoustics, ensuring that the child is always in a position to read lips, systematically using visual aids, and rephrasing rather than shouting – do not come naturally. A study conducted by Zebdi and Benyamina (2019) among primary school teachers reveals a paradox: while teachers generally

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have a favorable and supportive attitude towards inclusion, they express significant anxiety linked to a feeling of technical incompetence. Without specialized initial training, they say they feel helpless when faced with the specific needs of deaf children. This pedagogical deficiency has direct repercussions on fundamental learning.

The second major obstacle is the almost total absence, in the Algerian public system, of individualized support staff (equivalent to AESH in France), as Leroy (2018) points out in a comparative perspective. Teachers must therefore simultaneously manage often oversized classes, follow the national curriculum and provide individualized support to implanted pupils. This excessive workload and lack of resources often lead to situations where integration is only physical and not educational, with the child being present in the classroom but not benefiting from the adaptations necessary for their full participation and learning. Bouanaka's (2018) work in Constantine has highlighted that integrated deaf pupils encounter major specific difficulties in acquiring written language, often exacerbated by inappropriate teaching strategies (traditional dictation without visual support, lack of rephrasing).

Furthermore, the success of inclusion depends on continuity of care. However, Touati's thesis (2020) highlights a frequent break in care: the absence of speech therapists in schools forces children to make constant trips to health facilities, fragmenting their school time and hindering the development of morphosyntax. Nevertheless, the impact of mainstream schooling should not be viewed solely through the prism of academic difficulties. On a psychosocial level, Hamdi and Meftah (2021) note that integration, despite its challenges, promotes better social adaptation and more positive self-esteem compared to a specialized environment, as children build a 'capable' identity through contact with their hearing peers.

#### **4. Results: Convergence of experimental study results in favor of integration:**

The superiority of the inclusive model for oral language development in implanted children is not merely a theoretical position, but a fact firmly established by a convergence of data from international research and corroborated by emerging studies in the Algerian context. Analysis of these results makes it possible to quantify the benefits of integration in several key areas of linguistic competence.

One of the most influential studies in this field is the longitudinal study conducted by Geers and colleagues (2009) in the United States. By following cohorts of children over several years, they clearly demonstrated that the most powerful predictor of oral language proficiency in adolescence was not the socio-

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economic status or educational level of the parents, but rather the type of schooling. Their data reveal that 81% of children with implants who were educated continuously with hearing peers achieved levels of spoken language (vocabulary, syntax, intelligibility) comparable to those of their classmates, a spectacular result that fell to only 9% for children kept in specialized schools for the deaf.

These findings are reinforced by research targeting more specific skills. For example, the work of Moreau and Petit (2019) on language development in general highlights the importance of ‘decontextualized conversations’ (talking about past or future events, telling stories), which are ubiquitous in a mainstream classroom and crucial for the development of complex syntax. In Algeria, although large-scale studies are still lacking, qualitative and doctoral research is beginning to paint a similar picture. Khelladi's thesis (2020), carried out at the University of Algiers 2, is pioneering in this respect. By closely following a group of 10 implanted children from the Algiers region, she was able to objectively assess the benefits of integration. Using standardized tools such as the EVIP vocabulary test, she measured a significant difference of 15 points in favor of integrated children after only three years of primary schooling. Furthermore, analysis of spontaneous speech revealed that children in mainstream settings produced longer utterances, used a greater variety of sentence structures (particularly relative and subordinate clauses) and made fewer morphosyntactic errors, demonstrating a deeper internalisation of the grammar of the language.

## **5. Conclusion: Synthesis and perspectives: From auditory rehabilitation to educational success**

At the end of this theoretical reflection, the convergence of the studies examined convincingly corroborates the pre-eminence of the inclusive model over the segregated model. It appears that immersion in a mainstream environment is not simply an educational alternative, but a sine qua non for the realization of the linguistic potential of children with implants. By offering an authentic and socially relevant ‘language immersion’ experience, mainstream schools act as a catalyst that maximizes the technological benefits of implants, thereby promoting a more robust acquisition of morphosyntactic and pragmatic skills.

This observation remains entirely valid in the specific context of Algeria. Contrary to apprehensions linked to local sociolinguistic complexity, simultaneous exposure to Darija and the languages of instruction should not be seen as an obstacle, but as a rich communicational ecosystem that stimulates development. This analysis thus emphasizes that the success of cochlear implantation is not limited to technical success in the operating theatre, but is played out and decided on a daily basis in the classroom.

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It is therefore imperative that the Algerian model moves beyond the stage of political declarations and becomes firmly established in practice, transforming this evidence-based data into concrete action. This transition requires systemic investment: specialized training for teachers, the institutionalization of human support and, above all, the creation of genuine bridges between the health (university hospitals) and education sectors. Only then will the state's investment in hearing health translate into genuine social and educational inclusion for every child with a hearing aid.

Nevertheless, it is worth highlighting a major institutional advance: the fulfilment of the State's commitments through the creation of the École Normale Supérieure des Sourds-Muets (ENSSM) [Higher Education College for the Deaf and Dumb]. The aim of this college is to provide specialized initial training (Master's degree) to future secondary school teachers, in order to ensure that learners with hearing impairments receive appropriate support. It is hoped that this initiative will be extended to primary and middle schools.

## **6. Practical suggestions:**

- 1) Institutionalize continuing professional development for primary school teachers with a compulsory module on ‘welcoming pupils with special educational needs’, designed in partnership with speech therapists and psychologists from university hospitals.
- 2) Launch a pilot programme to create a corps of Support Staff for Pupils with Disabilities (AESH) in a few wilayas, to assess its impact and prepare for its roll-out nationwide.
- 3) Develop and distribute an ‘inclusive teacher's guide’ by the Ministry of Education, with practical information sheets on classroom acoustics management, communication strategies and the use of visual aids.
- 4) Make an annual review meeting mandatory for each implanted pupil, bringing together parents, teachers, the head teacher and the child's speech therapist to define and adjust the Individualized Educational Plan (PPI).
- 5) Equip new school buildings with magnetic loop sound amplification systems in at least one classroom per cycle, to make it easier for pupils with hearing aids to hear.

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