Monograph

Studies on the situation of deaf students in Spain

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Presentation

Carmen Jáudenes
Director of FIAPAS

The Education Challenge

The pages of this publication present the contents of the studies published at the Scientific Reflection Day on the most recent studies carried out by Spanish groups on the situation of deaf students in Spain. The day was organised by FIAPAS within the framework of the Collaboration Agreement signed with the Ministry of Education, Culture and Sport for 2016, with the aim of providing a joint forum for reflection to help highlight the new challenges demanded by the education and training of deaf people today, providing research data and proven evidence that should be reflected in the design of education policies in our country.

The Spanish Confederation of Families of Deaf People-FIAPAS is the largest platform for representing families of deaf people in Spain. We have worked for four decades to defend the rights and interests of people with hearing disabilities and their families.

We particularly work to improve the educational care that deaf students receive, because for us education, aside from having value in itself, is the most effective means of ensuring a fulfilling personal and professional future. Our aspiration is for children and young people with deafness to become autonomous and independent people, professionally equipped and integrated into working life, which means a change of status in personal and social life. We therefore understand that education is an investment that, when done well, generates a one hundred per cent return.

We are aware that despite the significant progress made in recent years in the fields of health, technology and methodology, improvements are still needed in educational practice addressing students with deafness, who in many cases do not attain a sufficient academic level to complete the professional training and/or access higher education, which would facilitate their integration in the world of work, and their full social inclusion.

With this conviction in mind, we addressed the need to organise a new, second, edition of a scientific day of educational reflection, that in this case offers the opportunity to present the current landmark studies into the situation of students with deafness in Spain, carried out by Spanish expert groups and researchers.

Pending challenges in the education of deaf students mean that the education system must be constantly renewed and adapted to respond to changes. In this regard, we would highlight as central issues to be taken into account: knowing how the use of the sensitive period of development influences the acquisition of language by a child with deafness, how this acquisition affects both early hearing restoration and early exposure to oral language, together with the role of the family. And hence how to guide specialist intervention and educational care, identifying and evaluating methodological advances, the best way to use the technology and accessibility measures adopted, and uncovering current failings.

In search of answers to the questions raised, we turn our spotlight on the chain of learning, in which one link leads to another in what should be a project of educational inclusion and independent life.

For all children–including children with deafness–this chain of learning takes place from sound to language. From language to reading and writing, the key to all learning and a necessary element for independent learning. And from this to the ultimate competency: learning to learn, generating and managing one's own knowledge.

It is true that there is still work to be done and progress to be made, but it is also clear that the situation of these children today is better than 30, 15 or 5 years ago... and Medicine and Technology have forged an alliance in contributing decisively to this, opening up new perspectives of all kinds in their education.

But although we expect a lot of science, we don't expect everything. Without an informed and involved family, professionals trained to respond to the emerging needs of these students and their families, and a public authorities committed to inclusion, the success factor is diluted.

In this regard, we hope that throughout these pages the keys to a quality educational response will be found, which must remain in step with the progress generated and the achievements already made in other areas, such as early diagnosis of child deafness or advanced audiology and prosthetic technology. A real challenge.

II Scientific Day of Reflection

Studies on the situation of deaf students in Spain

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Panel I

Influential variables in language acquisition and development

Importance of early stimulation of the auditory pathway in acquiring oral language

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Keywords:
Hearing loss, early stimulation, auditory plasticity.

WORKING HYPOTHESIS

Early stimulation of the auditory pathway is critical in obtaining development of the auditory areas involved in language. Therefore, the use of stimulation systems, such as cochlear implants, will be optimal to the extent that they are fitted within the period of greatest auditory sensitivity (first 2 years of life).

SAMPLE PROFILE

Subjects with congenital bilateral profound neurosensory hearing loss, treated unilaterally with cochlear implant, between 0 and 25 years of age, are studied. Patients with labyrinthine malformations or other conditions associated with hearing loss were excluded.

RESULTS

A sample of 367 shows that levels of perception of the spoken word (recognition of bisyllabic words, at 65 dB, in silence, in open context) have a significant negative correlation ($p<0.001$), with early stimulation of the auditory pathway *(Figure 1)*.

Figure 2 shows the result of another sample in 357 children implanted before 11 years of age. Results over time are shown by age group (0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 years). All these children were implanted and monitored at the same establishment, the University Clinic of Navarre, and the study conditions thus benefit from a high degree of homogeneity. Although all of them have excellent results after follow-up of at least 6 years, children who had received a cochlear implant before the age of 1 year had better levels in the recognition of bisyllabic words than other children implanted later. This group of children implanted before the age of one year obtained maximum results, close to 100%, after six years of development. These levels even exceed those recorded in children implanted at the age of one year, at that time of follow-up. Exploration of comprehensive and expressive language, using the Reynell scales, also shows that the best results are significantly related to the earliness of cochlear implant stimulation.

KEY FINDINGS

It is considered critical to implement means to detect, diagnose and treat children born with hearing impairment early.

Figure 1. Pre-lingual deaf population, age of implantation and word recognition

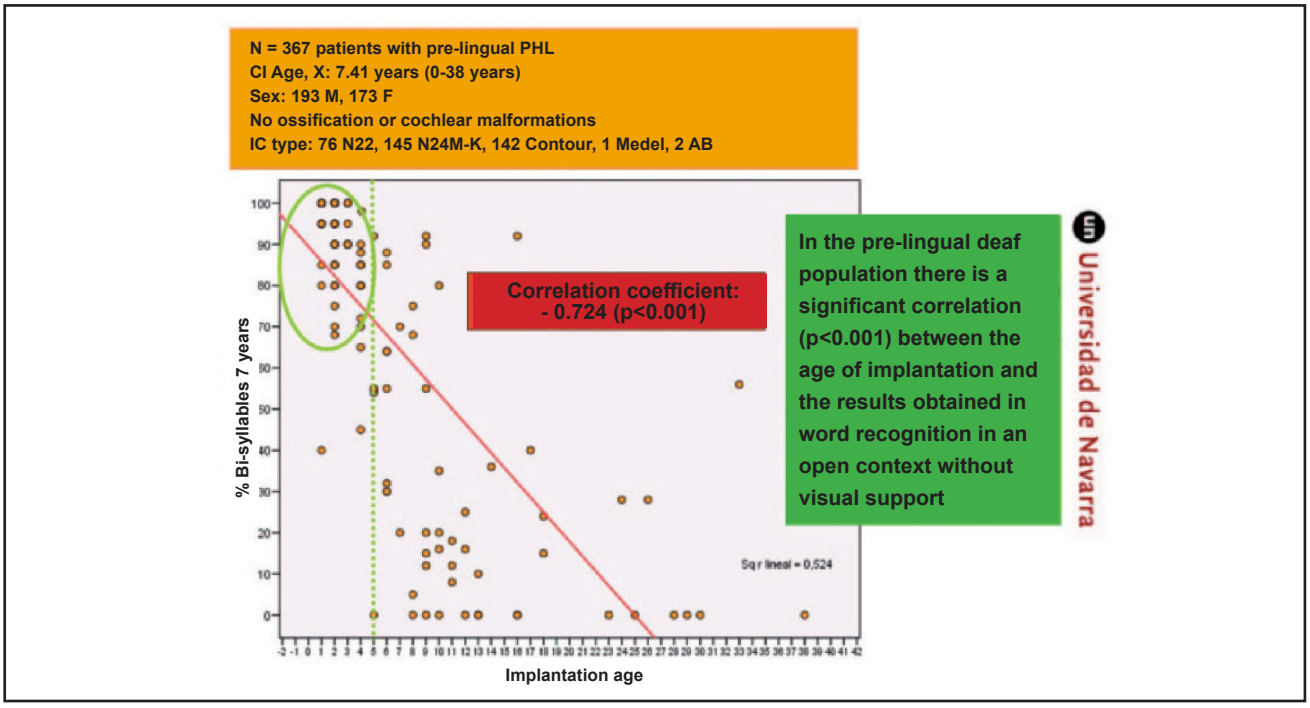
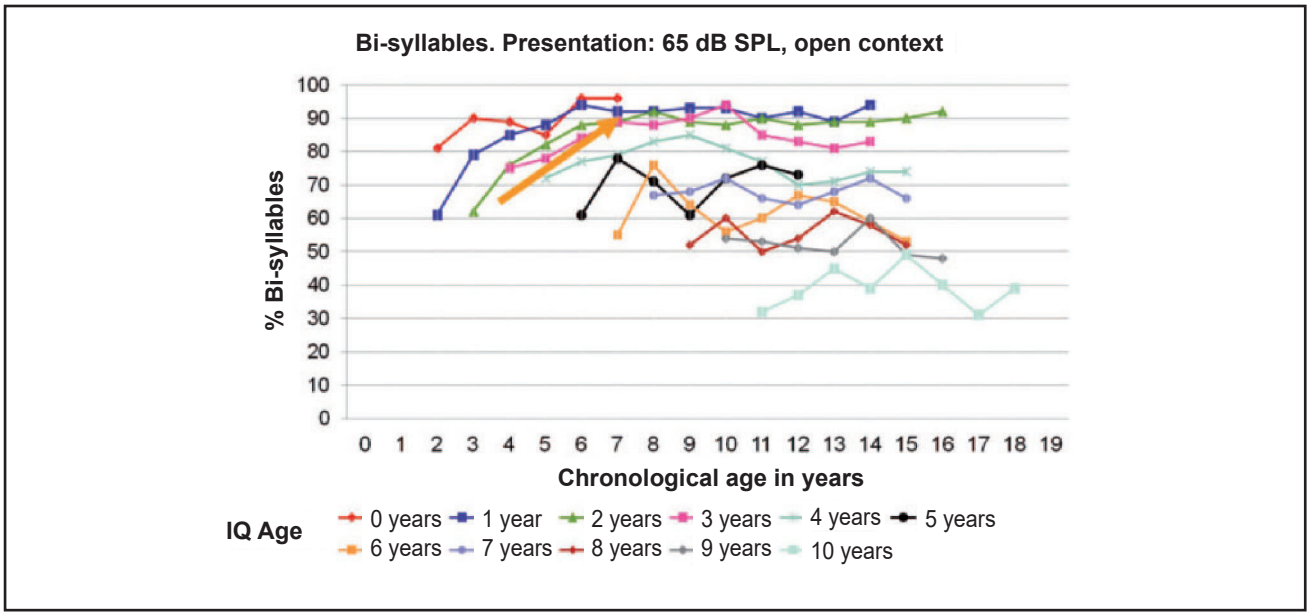


Figure 2. Pre-lingual and CI Age



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The neurological basis of Spanish sign language processing

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Keywords:
Brain, processing, fMRI, Spanish sign language.

WORKING HYPOTHESIS

This study examines the processing of Spanish sign language ('Lengua de Signos Española', or 'LSE') in the brain. Thanks to previous studies in other sign languages, such as the American, British and Japanese, we know that these visual and gestural languages are processed in the neurological regions associated with the processing of oral languages, i.e. with marked lateralisation in the left hemisphere and with prominent roles for the inferior frontal gyrus (known as the Broca area) and posterior and parietal temporal areas (Mac Sweeney *et al.*, 2008; Neville *et al.*, 1998; Sakai *et al.*, 2005). The first objective of this study is to confirm this neurological organisation for Spanish sign language through the first neuroimaging study in this language using the functional magnetic resonance imaging technique. The second objective is to investigate how the linguistic processing network is configured in the case of a visual and gestural language.

SAMPLE PROFILE

The sample consisted of a group of 23 adult early bilingual hearers of Spanish and LSE (the participants were the children of signing deaf families), and a control group of 23 adult early bilingual hearers in two oral languages. All participants were right-handed and without any disease or neurological disorder. Both groups showed similar values in various control indices (age, gender distribution, IQ). We presented linguistic stimuli to participants while measuring their brain activity with an MRI scanner. The stimuli were of two types: signs taken from our LSE database (Gutiérrez-Sigut *et al.*, 2016) in video format without sound; and Spanish words in audiovisual format, i.e. videos with the sound of a person pronouncing words.

RESULTS

The results show that the oral language is processed in the same way in both groups, while the processing of sign language differs between the two groups.

In the word condition of the oral language, all participants showed a similar activation: the classical perisylvian network of the left hemisphere (the orange zones in *Figure 1*). This result is expected since Spanish is the native language of both groups, and there are no significant differences between the two groups in this regard.

However, when participants perceive signs in LSE, brain activation changes according to the group. On the one hand, in the control group (those people who did not know LSE), activation is limited to occipital areas (the pink area

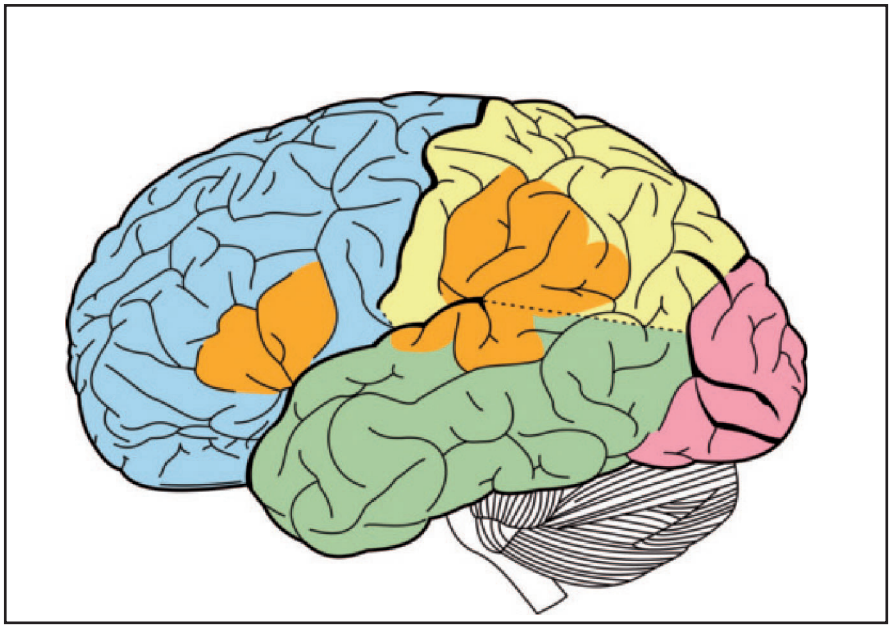
in *Figure 1*). This posterior region of the brain is related to visual processes. On the other hand, in the bimodal bilingual group (which did know LSE), sign-associated activation focuses on the areas of the left hemisphere related to linguistic processing: lower frontal, posterior temporal, and parietal (orange in *Figure 1*).

The results reveal a clear distinction according to linguistic knowledge: when the person does not know the language, the information becomes only a sensory stimulus (in this case visual). By contrast, those proficient in the language process it as linguistic information in the brain areas that handle this type of information. Despite being visual and gestural languages, sign language processing occurs in the same brain network used by oral languages.

KEY FINDINGS

This study provides new evidence for results from research in other sign languages. It thus shows that the brain treats Spanish sign language as just another language, and processes it in regions dedicated to the management of linguistic information. This result confirms that these areas of the brain have a functional amodal specialisation and are responsible for processing linguistic information whether it is an oral language or a signed language.

Figure 1. Left brain hemisphere



The left hemisphere of the brain with its different lobes: frontal (blue), temporal (green), parietal (yellow), and occipital (pink). The areas associated with linguistic processing are marked in orange.
Image adapted from Wikimedia Commons:
https://commons.wikimedia.org/wiki/File:Lobes_of_the_brain_NL.svg

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Impact of the sensitive period for language acquisition in children with cochlear implants

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Keywords:
Deafness, cochlear implant, Spanish language, phonology, speech

WORKING HYPOTHESIS

This work builds on the generally accepted assumption that linguistic and cognitive development is underpinned by a series of low-level cognitive skills that make it possible to acquire complex skills such as language. In addition, the following assumptions are made:

1) low-level skills (auditory perception, motor control, etc.) develop during the first years of life, i.e. are subject to a sensitive period;
2) complex skills can be developed over a longer period (less subject to a sensitive period);
3) the technical limitations of the current implants may limit the optimal development of perceptive-linguistic skills.

Based on all the above, we propose two hypotheses:

1) development of low level skills (articulation-perception) will depend on whether the cochlear implant (CI) is fitted within the sensitive period;
2) high-level skill development depends on factors such as family environment as well as the CI.

SAMPLE PROFILE

The sample included 14 children implanted between 12 and 24 months of age, with no deficiencies associated with deafness. The families of the participants are varied in terms of their socio-economic/educational level. The study period was from the time of receiving the CI until 48 months later. The children were tested for speech in interaction with their parents and/or researchers, and the children were tested for repetition and sympathetic language.

RESULTS

We present the data divided into three periods of CI use: year 1, year 2 and years 3 and 4.

Between 3 and 9 months after the activation of the CI, all children produced canonical babbling. These data indicate that the access to sound provided by the CI has an almost immediate impact on sound production (Moreno-Torres, 2014).

The first words appear 6 to 12 months after implant use. Studies with typical children have shown that they use

the same sounds in their canonical babbling and their first words. In order to check whether this was the case in our study participants, their babbling sounds and words were examined. The results showed that in all cases the most common sounds in babbling/words were the same. This confirms the positive impact of the CI on initial development. Meanwhile, it was observed that although the number of words was generally very high, there were large differences between the participants. Below we examine the origin of these differences.

Between 12 and 24 months, a clear improvement is seen in all children (although with large individual differences). Proof of progress is that all participants could be evaluated by a relatively complex test (pseudo-word repetition) after 24 months of implant use. In order to interpret this test, a group of 24-month-old normally hearing children was also evaluated. The comparison results showed interesting matches and differences between hearing and implanted subjects. Considering the total number of correct items, significant differences were observed between the two groups. However, 35% of children achieved scores at the same mean (or higher) as hearers. On examining the errors by type of phoneme and phonological trait, the implanted patients were found to have selective difficulties. Implanted subjects tended to have less difficulty with sounds with higher acoustic energy (vocals and fricative sibilants), suggesting that audibility had a greater impact on implanted than hearing subjects. Meanwhile, although the sonority and articulation mode errors were similar, the same did not occur with the articulation location errors, which were significantly more frequent in implanted subjects (Moreno-Torres and Moruno-López, 2014).

Between 36 and 48 months, clear advances in lexical and grammatical development were observed. Sentence repetition tests and spontaneous language samples were used to assess these advances. Both tests showed similar results, indicating that a group of children were close to the hearing subjects. The examination of grammatical errors did not allow significant differences to be observed between the two groups (Moreno-Torres, et al., 2013). Taken together, these data show that implanted children can follow a linguistic development process almost identical to that of a hearing child, while leaving unanswered why some children have particularly slow (or atypical) development.

In order to check the possible causes of these differences between children, the correlation between different measures of linguistic development after 12, 24 and 36 months of CI was analysed, and two extra-linguistic measures/factors (Moreno-Torres, et al., 2016): age at receiving CI and degree of family involvement in the adaptation of the CI child. The results showed that family involvement was significantly correlated with all lexical, phonological, and grammatical measures; only the percentage of articulation location errors did not correlate with family involvement. The age of implantation showed the opposite behaviour: it correlated with articulation location errors, but not with any general measure of linguistic development.

KEY FINDINGS

The age of implantation is decisive for developing low-level skills such as the ability to produce sounds naturally (without articulation location errors). While these low-level skills may have an impact on overall language development, their impact is relatively small. These skills are optimally developed even if the implant is late, provided there are adequate conditions in terms of family involvement.

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Reading comprehension in children implanted early

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Keywords:
Comprehension, reading, morphosyntax, cochlear implant, implantation age.

Ramón López-Higes (speaker)

WORKING HYPOTHESIS

In this study it was expected that children with early cochlear implantation (before 24 months of age; hereinafter 'early CI') would show a level of morphosyntactical comprehension in reading (use of keys, strategies, understanding of links) similar to that of children in a control group with normal hearing. Meanwhile, since evidence shows that early implantation has more positive effects on language development and reading than late implantation (after 24 months), children with late CI were expected to show significant differences in all aspects assessed, not only with their control group peers, but also with children with early CI.

SAMPLE PROFILE

The full protocol applied to a total of 103 primary school children aged 3 to 6, in different schools across Spain. The sample was divided into three groups, depending on whether or not CI was present and when it was performed. A total of 56 children belonged to the normally hearing group of children, 21 to the group of children with early CI, and 26 to the group of children with late CI. All children with CI had severe or profound pre-lingual deafness occurring between 0 and 2 years of age. From this total sample, a sub-sample of 57 cases was selected for the studies, who were assigned to one of three groups of equal size (n1,2,3 = 19): (1) early CI, (2) late CI, and (3) normal hearing. These groups were matched in age, educational level, and non-verbal intelligence (Wechsler, 2004).

Different tests were developed to assess morphosyntactical understanding in these children:

1) Morphological consciousness, which evaluates knowledge of nominal and verbal flexion and substantive and adjectival derivation, through a task that involved completing the missing element from among four alternative responses.
2) Comprehension of sentences (ECCO_Prima), is a reduced version of the ECCO battery comprehension of sentences test (López-Higes, *et al.*, 2005) that serves to explore grammatical comprehension, specifically the assignment of thematic roles to the constituents, through the simple verification of 36 sentence-drawing pairs.
3) Detection of semantic and syntactic strategies, is a test that aims to detect the use of semantic/syntactic strategies in reading through a set of 24 incomplete sentences, in which the final word has been omitted. Each must be completed by selecting one of four alternative responses, one correct and three distractor alternatives, two semantic and one syntactic. A more complete description of these tests can be found in (Lopez-Higes, *et al.*, 2015) and (Gallego, *et al.*, 2016).
4) Linkage test. A specific test was also developed to assess knowledge of the syntactic function of the main links in Spanish, including 36 incomplete sentences accompanied by a drawing that serves as context, which were missing the functional words (preposition, coordinated conjunction, or subordinate conjunction). Children had to choose from four alternative responses.

RESULTS

The most relevant results after analysing the data obtained with the first two tests, morphological awareness and comprehension of sentences (López-Higes *et al.*, 2015) are as follows:

- Comprehension improves with CI and is critically dependent on the timing of implantation.
- Children with early CI and normally hearing children do not differ significantly in morphosyntactical understanding.
- Children with early CI tend to match late implantations when the most complex sentences are considered, or those that deviate from the canonical word order (example: It is the child that the grandmother hugs) or with two propositions/verbs (example: The child the grandmother greets is blond.)
- Children with early CI show similar performance to normally hearing subjects in morphological awareness, and significantly different to that of the group of children with late CI, especially in verbal flexural morphology.

When considering strategy screening (Gallego *et al.*, 2016), the most important results would be:

- Children with early CI perform worse than normal hearers only under demanding conditions (long and infrequent sentences), while children with late CI perform below the norm in all types of sentences.
- Those with early implantation tend to match late implantation under more difficult conditions (long sentences).
- Results show that students with CI use global semantic strategies, but also show that early adopters use syntactic strategies (when they make mistakes, they choose a syntactic distractor more often than a semantic one, although the probability of randomly choosing a semantic distractor is twice as high as choosing a syntactic one).

Lastly, the main results obtained when considering linkage testing were those described below:

- The performance of children with early CI in the linkage test occupies an intermediate position between that of normal hearers and late CI subjects, generally very close to that of the former.
- The relationships expressed by subordinate conjunctions (so, although, as, while, so as to, because, that, if...) are acquired later, and can therefore be assumed to be of greater difficulty. This is where groups of children with CI show similar performance.
- Subordinate conjunctions express relationships between propositions (cause, condition, purpose); it may be asserted that children with CI do not reach the same level as their normally hearing peers in their use.

KEY FINDINGS

Early implantation has a positive effect on language development, and more specifically on literacy at the morphosyntactical level.

Children with early CI show similar performance to children with typical development and use morphosyntactical cues when these are critical for understanding. However, children with early CI experience some difficulties, especially in conditions that impose higher demands, such as when sentences are complex from a syntactical or semantic point of view, or when it comes to competently using the links that serve to relate propositions.

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Reading strategies in deaf people

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Keywords:
Reading strategies, deafness, cochlear implant, syntax, vocabulary.

WORKING HYPOTHESIS

- The language and reading levels achieved by deaf students depend on their ability to extract information from the oral language they are exposed to.
- The reading levels achieved by deaf students with early cochlear implantation (CI) do not differ significantly from those achieved by hearing students of the same age.
- Deaf students (with and without CI) use the keyword strategy (KWS) to read, which involves identifying the content words in a sentence and ignoring or not processing functional words.
- The use of KWS is related to syntactic skills, specifically the ability to process functional words.

SAMPLE PROFILE

The aim of the paper is to examine the reading strategies employed by deaf students with and without cochlear implants (CI), and the linguistic bases (vocabulary and syntax) underlying these reading strategies.

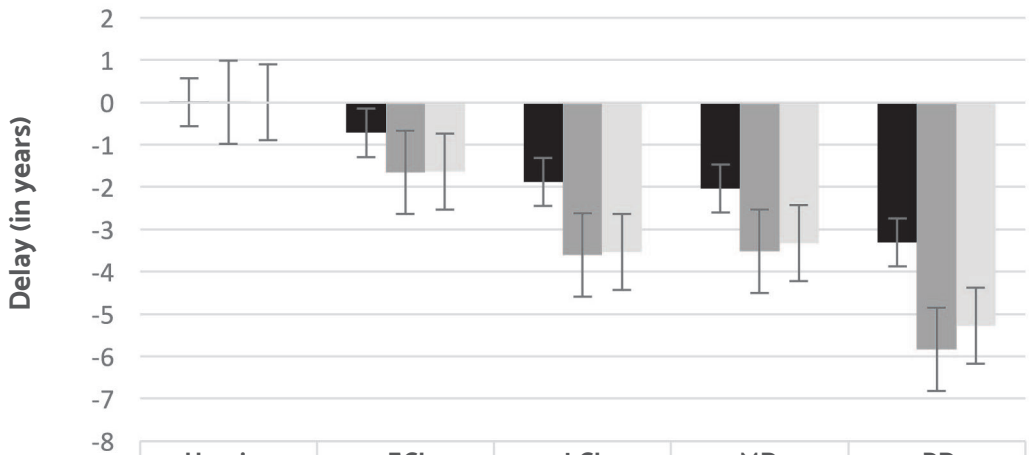
The participants were 172 deaf students aged between 6 and 18 from eleven provinces in Spain. Of these, 96 used CI (44 early and 52 late) and the rest did not use CI (47 had moderate and 29 profound deafness; BIAP, 1997). As a comparison group, a sample of 1000 primary and secondary hearing students from the Research Project EDU2014-52739-P was selected. All participants were evaluated with four tests: TECLE (Marin and Carrillo, 1999), which determines overall reading level; PEES, which evaluates the use of the Keyword Strategy (KWS); a syntax test; and finally a vocabulary test. All of them belong to the PEALE battery (Domínguez *et al.*, 2013); (Domínguez *et al.*, 2014) and (Domínguez *et al.*, 2016).

RESULTS

The results show that the reading levels of deaf students with early implantation are very similar to those of listeners of the same age, with no significant differences between the two groups (Figure 1). In addition, students with a late implant have reading delays similar to those without implants with moderate deafness (-2.14 years and -2.22 years respectively). Finally, the group of deep profoundly deaf students without implantation reveal an average reading delay of 3.5 years, generating significant differences with all groups.

These results confirm those obtained by other research showing the importance of early implantation for reading (Archbold *et al.*, 2008; (Domínguez,*et al.*, 2012), (Johnson and Goswami, 2010) and (Marschark, *et al.*, 2010).

Figure 1. Reading, Semantic and Syntactical Delays: Means in years by group



	Hearing	ECI	LCI	MD	PD
RL	0	-0,717	-1,878	-2,04	-3,31
R-SEM	0	-1,65	-3,6	-3,52	-5,84
R-STX	0	-1,63	-3,53	-3,33	-5,28

Means in years of Reading, Semantic and Syntactic Delays by group (hearing, deaf with early CI –ECI-, deaf with late CI –LCI-, deaf without CI and moderate deafness –MD-, and deaf without CI and profound deafness –PD)

However, analysing the reading strategies used to reach these levels, it is observed that all groups of deaf people, including early CI recipients, make use of the Keyword Strategy (KWS), which consists of identifying the words with the content of the phrase and not processing the functional words. Again, the profoundly deaf without implantation are the group that makes the most use of this strategy.

To try to understand why KWS was used, the Syntax test was used to assess participants' tendency to ignore functional words in reading sentences. The results show that all deaf groups have syntactic delays ranging from one and a half years in the early implantation group to five years in the profoundly deaf group without implantation. In other words, the use of KWS may be due to difficulties in detecting and using functional words in the reading of sentences.

Lastly, the results indicate difficulties in the vocabulary of all deaf groups, including the early CI group. Difficulties increase based on hearing loss and CI use, and the gap between deaf and control hearing subjects tends to increase with age. However, when groups are compared at a fixed reading level, all groups have similar vocabulary levels, which corresponds to a constant interval of about one and a half years with respect to the hearing group at the same reading level.

KEY FINDINGS

The findings of this study suggest that the language skills and reading levels achieved by deaf students depend on their ability to extract information from the oral language they are exposed to. CIs play a very important role, especially those performed early, as they generate better scores in the tests used. The results show that despite considerable progress in the education of the deaf, thanks to the use of CI, this technique still does not place deaf students in the same conditions as their hearing peers, especially in the processing of functional words and the establishment of semantic networks between content words.

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Panel II

School and learning

An inclusion experience for deaf students

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Keywords:
Inclusion, educational community, grouping, identification, strategies.

WORKING HYPOTHESIS

The schooling of deaf students in the Grouping mode within an ordinary school is a model of inclusion. In the 2001-02 year, this experience began, considered by CREDA to be a good model for students with deafness and oral language, starting out from the idea that they should have the opportunity to learn, play and grow in an environment as normalised as possible, if the necessary aids are offered and adaptations made.

The aim is to capture a state of opinion regarding the Grouping project from various points of view (professionals, families and students) and as a source of future internal debates and improvement contributions in daily practice.

After ten years of cumulative experience, the MALL team ('Maestras de Audición y Lenguaje', or 'Hearing and Language Teachers') and speech therapists of the school considered that it would be a good time to assess this form of inclusion and analyse the reality, the strengths and weaknesses of the Grouping, in order to continue improving this inclusive practice.

SAMPLE PROFILE

The phases followed to prepare this work are as follows:

- Preparation and administration of surveys of the entire educational community.
- Analysis, treatment and study of the information gathered.
- Preparation of the final report, expressing the results obtained and the conclusions reached and setting out proposals for improvement.

As an assessment activity, a questionnaire was administered to the various groups in the educational community that are part of the Grouping project: deaf students, hearing students, families of deaf students, families of hearing students, tutors and specialists, management team and educational services.

The general assessment is that the Grouping is an enriching experience for the entire educational community, both professionally and personally. At the professional level, because strategies used for deaf students have been incorporated into educational practice and have had an impact for the benefit of all students, encouraging teamwork and discussion. At a personal level, because of the contribution in terms of acceptance of difference (*Table 1*).

The evident satisfaction of being part of this school has led teachers to reflect on their daily practice and make adjustments to advance towards inclusive schooling. There is a shared demand as to the need for more spaces for

Table 1. Grouping project

Advantages	Disadvantages
• Systematic work and careful monitoring with families and students. • The quality support and reinforcement of hearing and language specialists, MALL and speech therapists. On the MALL side, it allows for more school-specific reinforcements and therefore more attention to deaf pupils. • The normalisation of the deficit. Deaf students are with other children with the same deficit (identity, feeling of equality...), while sharing their daily tasks with hearing students. • Families and students are made to feel welcome. They are provided with systematic work, very close follow-up. They are well integrated into the groups. • The Grouping promotes the mature development of students as it is enriching for other students and teachers. • Increased awareness of attention to diversity. • Day-to-day thinking about diversity. • It is another step towards inclusive schooling and is a very enriching reality for the entire educational community.	• Having deaf children in the classroom, even today, represents a problem when it should not. • They are just another student, and sometimes this may lead to confusion, because their needs are very specific. • One drawback may be that if there is more than one in a class, the tutor has much more work. • As a tutor, I would like the speech therapist/MALL to be the focal figure for the student and have more initiative with the tutors. • Not being schooled closer to home, not knowing the local children. • Be able to work more in a small group. Lack of attractive educational material.

coordination between tutors, MALL and speech therapists, and to be able to create spaces for discussion. The aim is to improve the inclusion of these students and involve the entire educational community more, as well as to optimise the organisation and management of the school to make the work already carried out more effective.

Another very important aspect is that teamwork is valued more, as there has been a need to learn how to share the classroom with other specialists. And to see that more time is devoted to pedagogical exchanges.

Students with deafness participate actively in the classroom, although they cannot always participate in the same activities, and need special attention in order to consolidate their learning. The learning of deaf students is also considered to be slower than that of the hearing students.

The relationship that deaf students have with their hearing peers is good and normalised, they interact in any situation, but relationships are affected when the code of communication code is not satisfactory on both sides. The relationship between peers involves a series of communicative and linguistic skills that the deaf child sometimes does not master.

The professional staff of the Grouping believe that one of the bases of its success is that the tutors take responsibility for these students, and this is essential for their inclusion. And we believe that from the results obtained, after 10 years of experience, a space for discussion now opens up again to continue improving the inclusion of these students. The educational community sees this work as a reason for internal reflection to advance this educational reality, and points it out as a discussion element to make a qualitative leap in this experience (*Table 2*).

RESULTS

The stability of the staff, especially MALL and speech therapists, has facilitated a more continuous and fluid relationship with the parents. Families thus appreciate that the relationship goes beyond the mere curriculum, feeling "accompanied" in the process of accepting the deafness of their children.

Families have the perception that their children relate well to the hearing pupils in the class and school, and that they have a good relationship with their deaf peers.

Students value teachers who help them, help them understand and speak slowly. They don't like to be in class for long oral explanations and group work because they are disturbed by ambient noise and other groups of children talking at the same time.

Table 2. Reflections

Working methodology	School Methodology	Specific changes
• Be more aware of advance planning of activities. • More visual resources. • Physical situation in the classroom (respecting the auditory bubble, close to the board, close to the teacher, eye contact for good lip reading) to favour listening and communication. • Shared view. • Adaptation of tasks. • Learn to communicate with deaf children. • Think more about how to say things, clear instructions. • Teach other children the best way to communicate with deaf children and their specific needs. • Perform more experiential and contextualised work. • The teacher must be more expressive. • Be flexible and adapt to the needs of the moment.	• Learn to share the same space, time and timetable with the MALL. • Coordination with speech therapists and MALL. • Flexible working hours and activities. In this school there is a lot of flexibility in changing time slots, but when you have MALL or speech therapist support, sometimes you cannot.	• Learn how to use technical aids (FM, hearing aids, implants...). • The widespread feeling of few methodological changes is a sign of the normalcy with which deaf students are being incorporated into classrooms.

These students recognise and value the work of the MALL and speech therapists as teachers who help them in their learning and possible daily difficulties: they help them write, talk, keep their prosthetics in order, listen and follow classes.

KEY FINDINGS

By way of conclusion, the expression is one of full satisfaction at having initiated and conducted this experience. The Grouping is considered a good model that can be exported to other groups through the Education Administration, and the conviction of the human and professional quality of the teaching team.

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Cochlear implants and the development of the Theory of Mind and oral language in Primary Education students

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Keywords:
Cochlear implants, theory of mind, language, auditory quality.

WORKING HYPOTHESIS

Cochlear implants (CI) promote the development of oral language in deaf students. Some dimensions of language might benefit more than others. Several factors influence the progress of oral language acquisition, including auditory quality. Some dimensions of oral language relate more clearly to skills in Theory of Mind (ToM).
Given the relationship established between ToM and oral language, CI has favourable effects on the development of ToM in deaf students.
The diversity of the population of students with deafness in their development will also be reflected in different profiles depending on the influence of different factors.

SAMPLE PROFILE

A sample of 30 participants (15 boys and 15 girls) aged 6 to 12 years was studied. All are at the Primary Education stage in inclusive schools and receive homogeneous speech therapy support from the Hearing-Impaired Educational Resource Centres ('Centres de Recursos Educatius per a Deficients Auditius', or 'CREDA').

Participants have pre-lingual profound sensorineural deafness and have a cochlear implant fitted, activated no later than 5 years (14 of them before 24 months). None of them has other deficiencies.

RESULTS

The results obtained show that overall, in terms of oral language, the sample studied is above the 50th percentile in the BLOC-SR test, measured against a population with typical development of the same community in which the study was performed. However, as hypothesised, this result is not the same in all linguistic dimensions. In fact, in semantics and pragmatics the scores correspond to percentiles above 50%, and conversely are lower in morphology and syntax. Auditory quality, along with implant activation age, are influential factors in the language development of students with cochlear implants.

Regarding the development of ToM in this study, the scores are very similar to those of the hearing students (Peterson, 2012). However, the results do not reflect the same acquisition sequence of ToM as typical students, as they master the item of Diverse Information before that of Divergent Beliefs. This may be interpreted in line with the linguistic component demanded by the tasks. In fact, in this study, the item of the Diverse Information is not related to any of the linguistic dimensions, unlike Divergent Beliefs, which are related to all the linguistic dimensions.

The development of ToM is positively related to that of language, both in the overall scores and in the total score of ToM with each of the linguistic dimensions except for syntax, the relationship of which is not statistically significant.

Lastly, to explore in greater depth the differences that, despite the conditions established for a homogeneous sample, are presented in the population studied, the analysis of clusters shows the existence of 3 groups differentiated by levels of oral language skills, following the same pattern except in the syntax dimension, in which the intermediate group presents comparatively more difficulties (Figure 1).

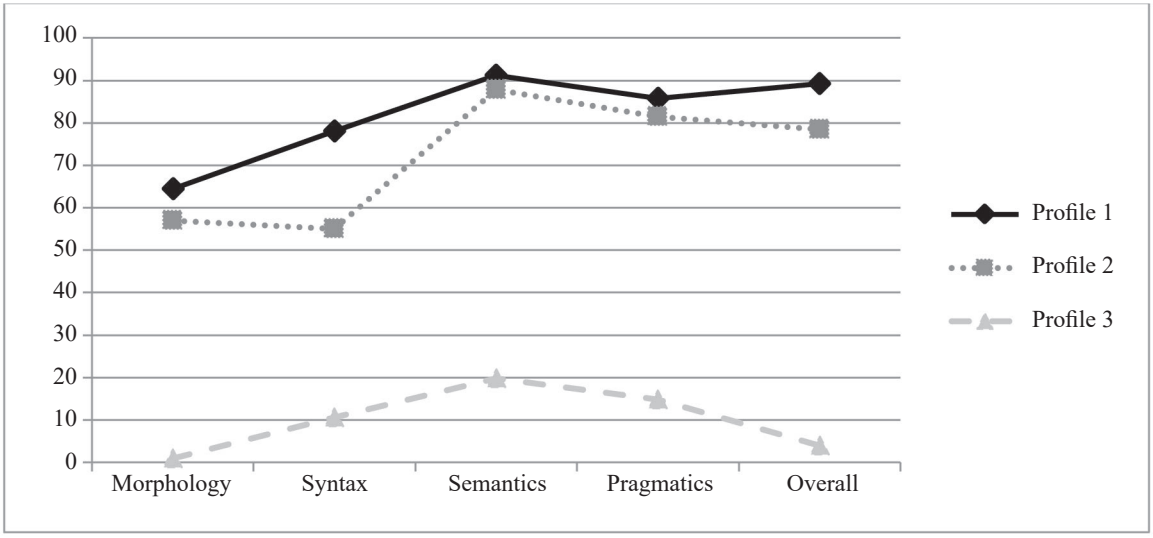
KEY FINDINGS

There are three main conclusions to this study. The first is that although speech therapy programmes at this stage seem to have a particular impact on acquisitions in morphology and syntax, students with CI gain great benefits in oral language overall, but continue to experience greater difficulties in these dimensions in relation to semantics and pragmatics.

Secondly, the implementation of the CI does not represent homogenisation among users in terms of their progress in oral language, but rather there are still differences between them that need to be taken very much into account in intervention programmes. The results of this study already indicate some differences, but mainly alert us to the need to advance knowledge of the different patterns in the acquisition of oral language presented by the implanted students.

Lastly, this study confirms previous studies on the relationship between ToM development and oral language, and provides new elements as to the relationship between oral language and different ToM tasks that have implications for speech therapy intervention.

Figure 1. Reading, Semantic and Syntactical Delays: Means in years by group



The average percentile of each participant group in each language dimension and in the overall oral language is indicated.

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Intervention protocols for syllabus adaptations in deaf students

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Keywords:
Inclusion, educational community, grouping, identification, strategies.

WORKING HYPOTHESIS

Most schools have concerns about developing an Individualised Plan (IP) for deaf pupils. In order to resolve them, the Hearing-Impaired Educational Resource Centre (CREDAC Pere Barnils) created a guide document for teachers and professionals involved in the educational process of deaf students enrolled in ordinary schools to prepare the IP (Article 6.3 of ORDEN/EDU/295/2008 *determining the procedure and formal documents and requirements of the evaluation process in compulsory secondary education* and the Document *"From inclusive school to inclusive system"*, published by the Department of Education of the Generalitat of Catalonia. (December 2015). While all deaf students need individualised plans, even if only for timetable modification, the type of speech therapy intervention and auditory education during the first few years of life and the way in which systematic work addresses the different textual structures will enable good levels of language. The procedure for making adaptations will promote reading comprehension.

PRIMARY EDUCATION

The experience with deaf primary school students from the city of Barcelona attended by the CREDAC Pere Barnils is here presented, and especially the grouping centres Escola Taber and Escola Proa.

The learning of the different textual structures, which begins as early as experimentation of narrative discourse in the first cycle of the Infant Education enables the mastery of textual understanding, and hence access to the curriculum. Under these conditions, adaptations made for students, whose language is not the language corresponding to their age, become mostly linguistic only, and where there are other additional difficulties, curricular adaptations are required.

Linguistic adaptations are made by modifying the text, taking care to include all spatial and textual markers, such as connectors, or by specifying essential information, such as narrative text, intentions and emotional states. The aim is to demonstrate and enhance the textual structure, and thus the type of text that the deaf student is faced with.
The adapted texts belong to the subjects with the high-

est linguistic content, such as: Catalan and Spanish, social studies and mathematics.

We take into account other primary conditions such as early prosthesis and oral speech therapy intervention, and family involvement and collaboration in order to achieve the acquisition of good levels of language.

SECONDARY EDUCATION AND VOCATIONAL TRAINING

The Guidance Document is presented as a tool for teachers and professionals involved in the educational process of deaf students enrolled in ordinary schools at the Secondary and Vocational Training stages.

The document, based on the current educational legislative framework and information from educational services (CREDA, Psycho-pedagogical Counselling Team...) sets out operational approaches, the tools and the supports that should be used to facilitate the learning of deaf students, and that should be part of the IPs.

Adaptations to be included in IPs could be:

- Methodological Adaptations. Those with no changes in the objectives and no changes in the evaluation criteria. They refer to methodology, school environment organisation and language adaptations.
  Adaptations regarding methodology and school environment include those prescriptive measures to be adopted in any classroom where a deaf student is enrolled, regardless of the degree of hearing loss and the prosthesis or implant used.
- Curricular adaptations with modification of objectives and contents. These may involve the reduction or elimination of objectives and/or content, lower level objectives, prioritisation of some over others... These are carried out by the class tutor and teachers of each subject, advised by the educational services.
- Evaluation. They include rules on how to act when conducting exams, how to assess and what to facilitate. This refers to aspects such as: the wording of the statements, avoiding the oral dictation of questions during the tests...

The Guidance Document has been presented and used at secondary schools with hearing-impaired groupings in the city of Barcelona. Most have seen better development of IPs following the recommendations, and increasing numbers of students with IPs, as recommended by the rules of the education system in force in Catalonia.

Figure 1. Deaf students with Individualised Plan (IP) in grouping centres

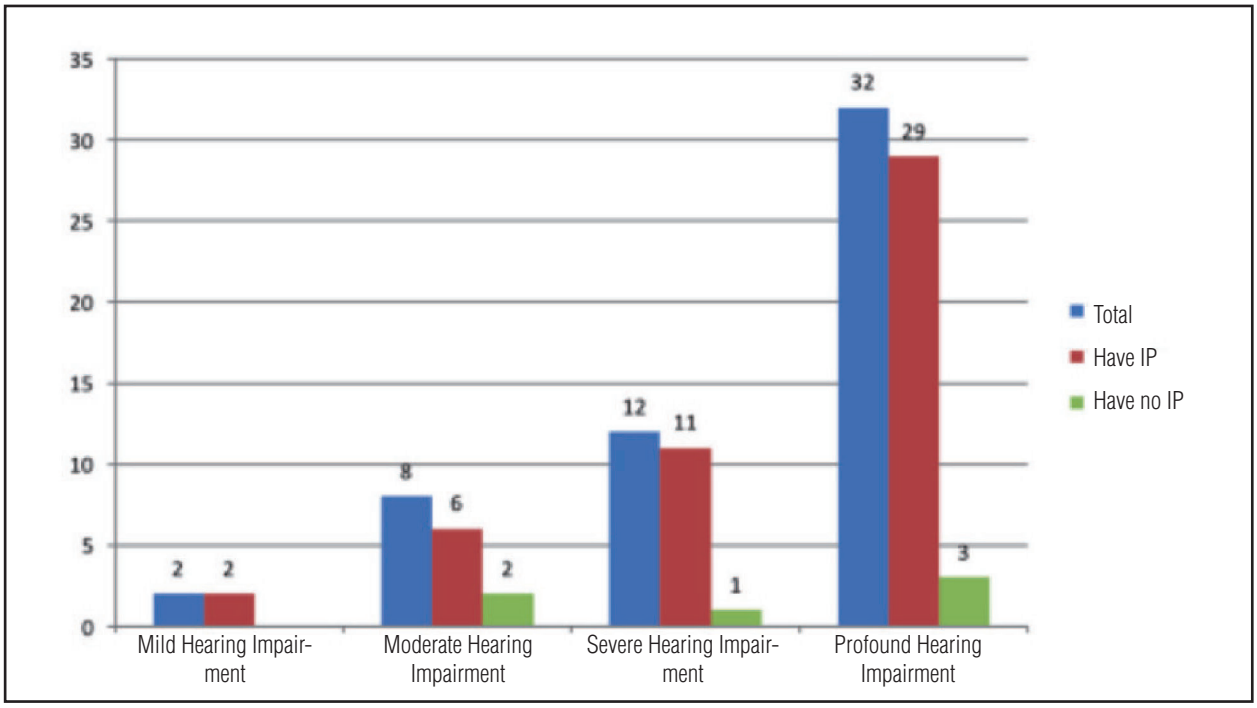
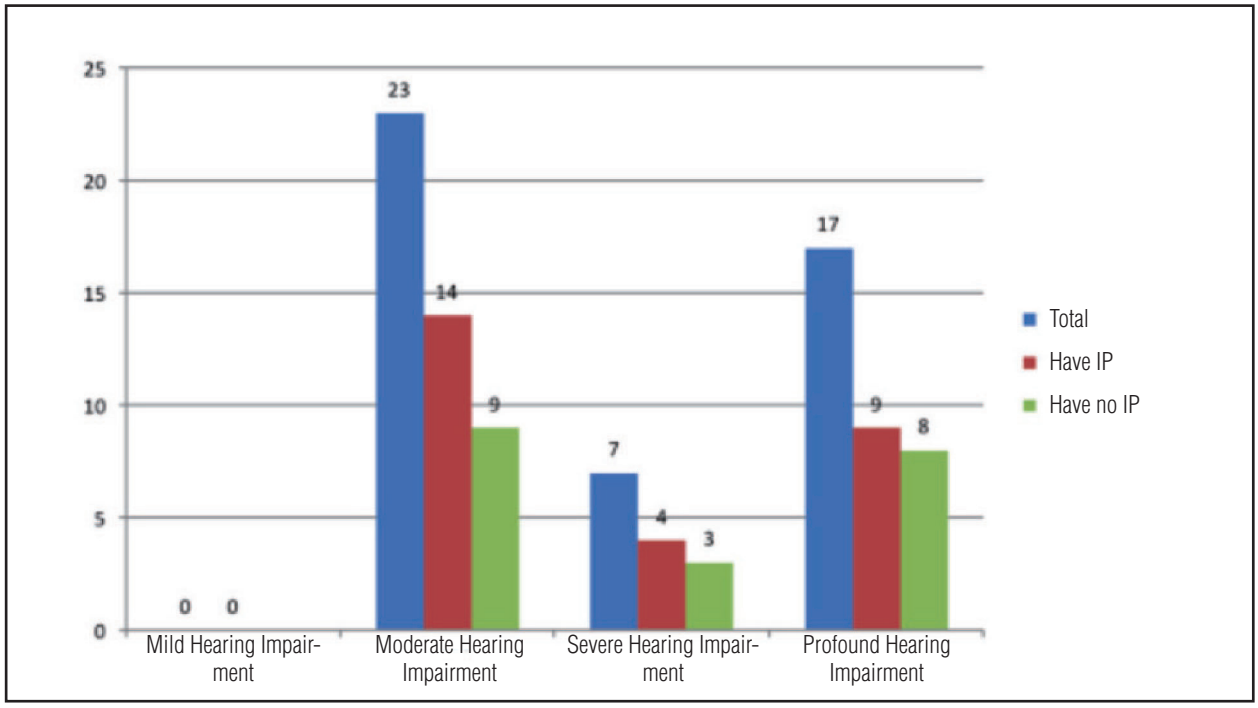


Figure 2. Deaf pupils with Individualised Plan (IP) in other schools



KEY FINDINGS

The benefits of using speech therapy intervention procedures that promote knowledge of oral narrative discourse at an early age, together with the textual work, which takes into account emphasis to assimilate the structures of the different textual typologies, make it possible to reach good levels of reading comprehension and therefore reduce the need for both curricular and linguistic adaptations in the school learning process of our deaf students, regardless of the degree of their hearing loss.

Analysis of the data presented (Figures 1 and 2) shows that deaf pupils in grouping schools benefit from IPs to a greater extent than those in other schools.

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Oral bilingualism and acquisition of a second language

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Keywords:
Bilingualism, cochlear implant, early intervention, hearing impairment, deafness.

WORKING HYPOTHESIS

Early cochlear implantation provides adequate auditory input for the acquisition and development of oral language. In the first year of a child's life, the foundations are laid for the perception of speech sounds; children are born with a capacity of universal perception of sounds, at the end of these first twelve months there is a reduction of this capacity, being more selective to the sounds of the mother tongue. A child exposed to more than one language early on thus has the right conditions for acquisition and development. Thus, children with hearing impairment who receive adequate stimulation, through hearing aids or implants, who are raised in a bilingual environment (e.g. each parent with one language) are able to acquire more than one language, which contributes to their social and educational inclusion.

SAMPLE PROFILE

The sample consists of 13 children (5 girls and 8 boys) with bilateral profound deafness palliated with cochlear implant, the minimum implant age being 7 months and the maximum age being 20 months (mean 13 months). They come from the Balearic Islands and speak Spanish and Catalan.

In relation to the language spoken by families, the distribution is as follows:

- Maternal Language: Catalan 54%, Spanish 31% and 15% others.
- Paternal Language: Catalan 69%, Spanish 16% and 15% others.

In relation to the aetiology of deafness in this population, the distribution is: in six cases unknown, in six cases genetic, and in one case cytomegalovirus (CMV). Four of them have associated disorders.

RESULTS

We studied the process of acquiring phonemes from both languages through phonological inventories: Registro fonológico inducido para la lengua Castellana (Monfort, M. & Juárez, A, 1990) and Els sons de la parla para la lengua catalana (Secall, M.V. & Crespi, F., 1987).

Language development was evaluated with the Reynell Scales III in Spanish and the version translated and adapted to Catalan by Eulalia Juan and Elisenda Roig (non-validated version).

And speech perception was evaluated through logo-audiometry with the lists of bi-syllables for children of the evaluation protocol for cochlear implantation of the University Clinic of Navarrae and the linguistic material in Catalan for logoaudiometry examinations (F. Tolosa et al., 2000).

The situation of oral bilingualism is an increasingly present reality, sometimes because in the family environment different languages are spoken by the parents, in others due to occupational mobility, immigration. The perception of bilingualism seems positive overall, but there is still some resistance. For example, in children with disabilities, the situation of bilingualism may seem disadvantageous, and especially for those children born with a hearing impairment where, a priori, the acquisition and development of language poses a challenge for the parents and professionals involved.

Based on programmes for the early detection of deafness and technological advances (hearing aids and implants), access to the world of sound, and in particular to the perception of speech, occurs in most cases from 6 months of age, an initial intervention through hearing aids and, in those cases where this stimulation is not sufficient, they will receive a unilateral or bilateral cochlear implant, as the case may be.

The role of the family in the process of acquiring oral language in the child is fundamental, and trust in the auditory responses of the baby who reacts adequately to auditory stimulation is a positive feedback process in the communicative bond between parents and children. Thus, parents who observe how their children respond to sound stimuli, and especially voice, feel more comfortable in verbal communication with them, make use of the so-called motherese or baby talk, natural adaptations of adult language to encourage communication with the baby.

Use of motherese is closely related to the use of the mother tongue. It is very difficult, if not impossible, to effect changes in intonation, rhythm, vocabulary, use of redundancy, etc. in a language we do not know perfectly. In this process of training in communication between parents and children, a very important role is played by the songs, rhymes, vocal games that are transmitted orally from parents to children and that are also linked to the mother tongue. It is therefore advisable for parents to use the language they know or master best in communicating with their children, with the idea of providing a suitable model for learning. Unfortunately, this recommendation is not always taken into account when it comes to immigrant families who speak a different language from the host country or between parents who may use two languages, when they are told to use only one of them as a supposed benefit for the child, because in many cases there is a collective belief, also among professionals, that if we use one language it will be more favourable for the child. There is currently a wealth of scientific literature on the beneficial aspects of mother tongue use and on the zero benefit of subtractive bilingualism. In other words, encouraging parents to use a majority language, even if they do not know it properly, with the idea of promoting social inclusion.

With these premises, a small group of families, parents of deaf children who were detected through the Hearing Impairment Early Detection Programme in the neonatal period (Decree 48/2003, 9 May, Balearic Government, Department of Health) and who were implanted early, made the decision to raise their children in a bilingual situation. In 10 of the 13 cases, the parents could each use one language in the parental home, and in 3 families one language was spoken at home, while contact with the second language took place in the social and/or educational environment.

The results are very positive, for example in the phonological aspect, acquisition of speech sounds, in all cases, and at the age of 6 years show functional acquisition of the phonetic repertoire of both languages, Catalan and Spanish. It should be noted that the intelligibility of speech at the age of 3 is perceived by parents as "better in Spanish than in Catalan". We note that the phonetic repertoire in Catalan at that age is lower, with many phonemes yet to appear, so more adaptive phonological processes occur especially in phonemes such as /z*/, /ʒ/, /ds/, /tʃ /, /dz*/, /dʒ*/, which apparently compromises the child's intelligibility when parents compare competency in both languages. In all cases the parents report during this period the use of code switching when alternating words from both languages in a sentence, and in most cases report the feeling that they do not use both languages equally, for example, when the child does not yet distinguish which of them (Dad or Mum) uses one language or another. In terms of language understanding, qualitative perception by families is positively valued in all cases, even in children with associated disorders, and parents feel that they understand both languages.

Two families found it difficult to maintain consistency in language use (this occurs when parents are highly competent in both). They tend to change languages based on the child's responses or the subjective perception of "ease" of one language over another.

Monolingual families who had to foster favourable environments for the child to have exposure to the second language report that it was an effort to maintain a balance between exposure to the language received at home and the language of the social and educational environment. In all cases the use of television, videos, music, apps, was positively valued as passive exposure, but it was considered necessary that the child spend time with friends with whom to use the language not spoken at home.

In the assessment of language (comprehension and expression) through normative testing (RDLSIII), results of competency in both areas are shown at the age of 6 years. In children with associated difficulties, the gap between chronological and linguistic age is maintained. The same test translated and adapted to Catalan shows a similar profile, although we cannot establish a relationship between chronological age and linguistic age as it is not a validated test. It should be noted that in cases with associated disorders and with delayed language acquisition, there are no differences in the use of both languages.

As for speech perception through logoaudiometry, discrimination rates are 100% in 9 out of 13 cases.

KEY FINDINGS

The situation of oral bilingualism in children who have adequate access to auditory stimulation and oral language at an early age is a reality, provided that these premises are maintained, in addition to adequate exposure, adequate linguistic pattern by the family and the social and educational environment, as well as adequate and balanced exposure of both languages.

Hence the importance of family counselling and accompaniment in the most challenging situations, for example when the rate of language acquisition is different, not necessarily pathological, but which may lead the family to give up and decide to use only one of the languages with the intention of assisting, in the case of children who experience difficulties in their language acquisition process, e.g. delayed acquisition and, as we see in our small sample, the language acquisition disorder becomes evident in both languages.

We would like to stress the importance of having equivalent validated tests in both languages that allow us to assess results with the same guarantees.

And lastly, to confirm the will and motivation of these families in the belief that they can raise their children in a bilingual linguistic environment despite receiving contradictory information, negative opinions that at some point will have made them doubt or wonder whether they were on the right path. We thank all of them for the trust they have placed in this process.

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Panel III

Training and employment

University education of hearing-impaired graduates: acquisition of professional skills

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Keywords:
Higher education, practical placements in university education, professional skills, university graduates with hearing impairment, occupational inclusion.

WORKING HYPOTHESIS

The general objective of this study is to understand the perception of Spanish university graduates with hearing impairment regarding their university education.
The specific objectives are:

- Understand the experience of university graduates with hearing impairment regarding the support received during their university education to develop professional skills.
- Find out, based on the experience of university graduates with hearing impairment, what professional skills employers value the most.
- Identify the value of practical placements during the development of university education based on the acquisition of professional skills.
- Detect aspects that could contribute to improving the university education of students with hearing impairment.

SAMPLE PROFILE

The participating sample comprises 84 university graduates with hearing impairment, who have completed their university studies and have two years of professional experience; 32 men and 52 women. Mean age: 35.63 years. The courses studied by these students include in particular social and legal sciences (60.71%).

RESULTS

63.10% of graduates believe that having a university education will make it easier for them to enter the job market. They believe that universities provided them with the support to acquire the following skills: motivation (52.38%) and concern for quality (51.19%). They state that the university did not sufficiently provide them with the necessary

support to acquire the following skills: English proficiency (89.21%), negotiation skills (71.43%), leadership (70.23%), interpersonal skills (60.72%), communication skills (60.71%), initiative (60.71%), generating new ideas (59.52%), computer management (58.33%), adaptability (53.57%), training search and management (53.57%) and organisation and planning (51.19%).

66.67% consider that the practical studies carried out during their university studies have adequately contributed to their professional development, compared to 33.33% who do not view this positively. This group noted a lack of connection between university and company, provision of specific support adapted to their needs, and sensitivity from the work environment.

Qualitative analysis shows that there is a significant lack of knowledge at university as to the needs and difficulties of people with hearing impairment. It also allows us to present those aspects that they believe would have contributed to a better development of their university studies. These aspects are as follows: Respect and appreciation of diversity in the classroom. Teacher training as to the classroom needs and difficulties of these students. Knowledge and mastery by teaching staff of tools to develop their classes in an inclusive manner. Specifically: provide tailored class material (audiovisual, notes, bibliography, etc.); offer assessments in different formats; transmit oral information in a way adapted to each need of students with hearing impairment; enhance communication and joint interaction among students with and without hearing impairment.

KEY FINDINGS

The students surveyed say that having a university education facilitates access to the world of work. They state that the university does not provide sufficient support to acquire most professional skills. There is a need for university teachers to be trained in universal accessibility and inclusive methodologies. The work experience of these graduates reasserts the need to develop the professional skills valued by employers. Practical placements at companies are highly valued by the majority of these students. A percentage of these graduates with less positive experiences were found to note insufficient connection between university and business, a lack of specific support and low sensitivity of the work environment to their needs. The functions of specific pre-university and university guidance services for students with disabilities should encourage the choice of courses of study suited to the reality of each student, accompany them, and provide them with the resources to facilitate their employability. Universities should have response, guidance and employment services ready to meet the specific needs of hearing impaired university graduates.

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University students with deafness: Employability and training needs for quality employment

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Keywords:
Disability, employment, university, deafness.

WORKING HYPOTHESIS

This study was conducted with the aim of exploring in greater depth the reality of university students with disabilities, the current labour market and its alignment with the training provided by universities, with a view to improving the employability of people with disabilities and offering a series of proposals that have an impact on the increased employability of this group in skilled jobs and the development of their professional careers.

SAMPLE PROFILE

The study was conducted according to the following phases and with the following sample profile:

- Analysis of the training and competency demands called for by the business sector, for which a review of secondary sources was performed, interviews were conducted with relevant agents, and a preliminary quantitative study was undertaken as to the occupational inclusion of university students with disability (graduates and students on practical placements), with a sample of 32 companies.
- Analysis of the resources available to a sample of 29 universities in relation to the employability of their students and graduates. The 29 universities that participated in this study were attended by a total of 17,445 students with disabilities, representing 80.85% of students with disabilities enrolled at Spanish universities.
- Qualitative study (in-depth interviews with 26 university students and 7 graduates with disabilities).
- Quantitative study with a sample of 983 university students with disabilities to ascertain their perception of different aspects such as expected professional development, employment expectations, geographical mobility, skills acquired, etc.

KEY FINDINGS

The higher the level of education, the lower the unemployment rate. Having a university degree is a facilitator in finding a job, but it is not enough. Some degrees have better employability prospects, mainly those related to the Health Sciences and Engineering branches.

It is important to improve academic guidance for students with disabilities by different agents: high school counsellors, university counselling services and disability-related organisations.

Most of the universities interviewed do not have specific employment and practical placement structures to meet the demands of students and graduates with disabilities.

In many cases, the companies surveyed do not know where to recruit workers/students with disabilities or how to conduct selection processes.

There is a perceived mismatch between the skills that students believe they need to develop in order to improve their employability, and what companies would actually be demanding; languages and international mobility remain unaddressed by many students, but are nonetheless linked to greater employability; knowledge of the job market and labour intermediation mechanisms help employability.

Employment can be boosted by universities and other institutions through talks and workshops, but students must also be proactive.

The difficulty of accessing homogeneous data and statistics on disability at universities, or on offers and vacancies filled by students and graduates with disabilities, makes it impossible to establish a global picture of disability at university. This lack of information has an impact on the inability to monitor over time or assess the impact of different measures and programmes.

Furthermore, various obstacles and facilitators for occupational inclusion of students and graduates with disabilities have been identified. These factors relate to enterprises, students themselves, universities and other factors, which are described below (Table 1).

Table 1. Barriers and facilitators for occupational inclusion

Agent	Facilitator	Obstacle
Companies	Economic incentives, tax advantages, benefits, aid. Information and awareness-raising (by universities and other agents). Compliance with legislation and quotas. Training of recruiters. Previous experience with students / workers with disabilities (or examples from other companies).	Lack of information and lack of knowledge of skills. Lack of knowledge of existing support and resources. Prejudice. Accessibility.
Students themselves	Qualification and specific training. Horizontal skills and competencies. Further training (especially in languages and ICT area). Continuous recycling. Prior practical placement at the company. Completed international/national mobility programmes.	Pensions and benefits: lack of knowledge of compatibility with practical placements, lower remuneration, fear of having to give up and then be dismissed. Lack of prior experience. Lack of social skills and horizontal competencies. Type and degree of disability. Lack of language training and/or technology skills. Family overprotection.
Universities	University job inclusion programmes (awareness-raising and contact with companies, student focus).	Incompatibility of working/placement and study times.
Other factors	Mediation of Employment Services and/or Foundations working in favour of the occupational integration of certain groups. Job portals and specific programmes for people with disabilities.	Economic crisis. Alignment between the skills of the person and the job. Architectural barriers or the combination of transport and timetables.

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Removal of communication barriers in classrooms

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Keywords:
FM systems, classroom acoustics, suppression of communication barriers, accessibility.

WORKING HYPOTHESIS

The auditory capacities of students and the acoustic conditions of the classroom determine accessibility to oral communication in auditory-verbal learning environments. Optimal acoustics for hearing students may be insufficient for students with hearing loss. This study analyses the acoustic suitability of 23 ordinary classrooms for the inclusion of students with hearing loss who wear hearing aids (HA) or cochlear implants (CI). Based on measurements of background noise (BN), reverberation (TR60) and classroom size, a simulation was conducted of the speech recognition ability of hearing-impaired and hearing students. The benefit of the use of Frequency Modulated (FM) systems as a technical aid in the removal of oral communication barriers was studied. Selected students with hearing loss took part in a speech recognition test, in silence and with BN for lists of words of high and low lexical frequency, with and without the FM system.

SAMPLE PROFILE

This study involved 23 pupils with hearing impairment from different Primary schools. The ages ranged from 8 to 16 years. The inclusion criterion established a Maximum Verbal Discrimination in free field greater than 80%. Of these 23 hearing-impaired students, 15 were finally selected: 8 girls and 7 boys. Of these 15 students, 7 had unilateral CI and 9 had HA, 2 were unilateral adaptations and 7 bilateral.

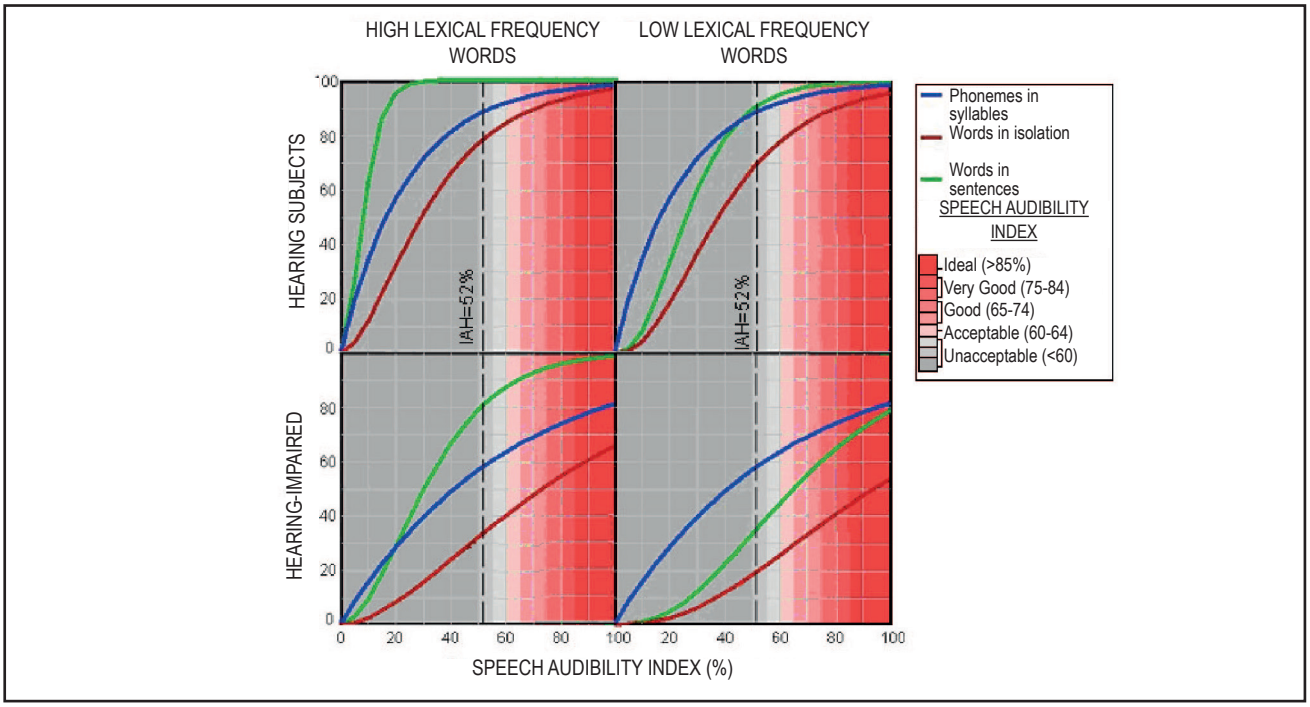
RESULTS

A Speech Audibility Index (SAI) of 52% was obtained for the acoustic conditions of the classrooms studied (Figure 1). With this index, hearing students are able to recognise 87% isolated words of high familiarity while hearing impaired students reach 58%.

With the use of FM systems, better scores were observed in subjects with HA than in subjects with CI. In the FM condition, subjects score better than in the non-FM condition. Words with high lexical frequency are more easily recognized by all participants than words with low lexical frequency.

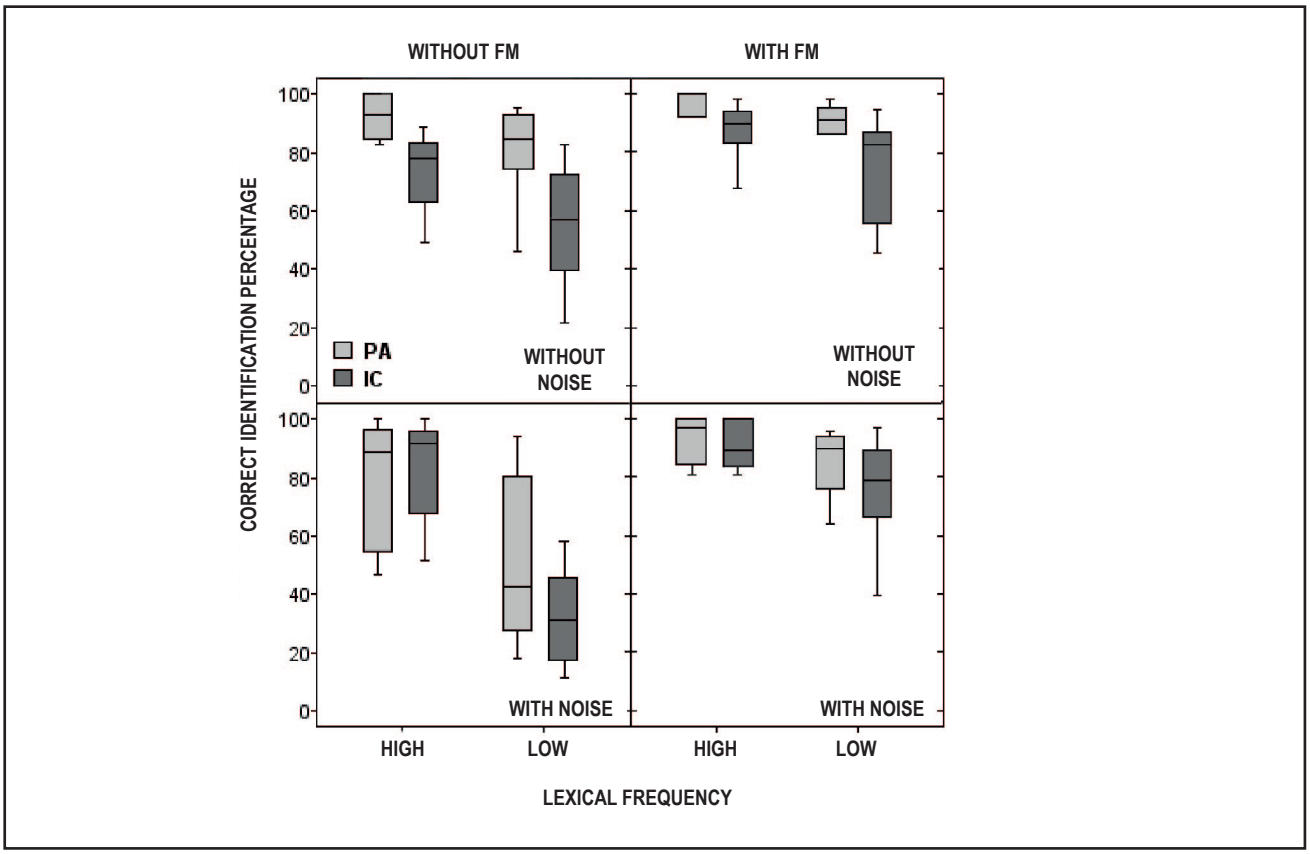
Participants scored higher on recognition of phonemes in the presence of BN when using FM Systems. A significant interaction was found between lexical frequency and FM. The use of FM favoured the perception of words with low lexical frequency (Figure 2).

Figure 1. Speech recognition



Estimated speech recognition rate for hearing subjects in the top row and hearing-impaired in the bottom row for words of high familiarity, left column and low familiarity, right column. The dotted line indicates the SAI calculated for the average of the 15 classrooms studied which was 52%.

Figure 2. Correct identification of phonemes



Box and whisker plot of correct phoneme identification percentages according to lexical frequency, auditory correction system and presence or absence of BN with and without FM.

KEY FINDINGS

The inclusion of students with auditory correction systems in an ordinary classroom requires optimal acoustic conditions in order to ensure accessibility to verbal information. This study found an average BN of 55 dB for the 15 classrooms studied. Taking into account that the values recommended by the ASHA as optimal for the inclusion of students with hearing impairment are set at 35 dB, we find that the classrooms analysed have BN levels above the recommended value. The TR60 of the classrooms studied was 1.4 msec above the 0.6 msec recommended for the inclusion of hearing-impaired students.

BN and TR60 are determining values in the calculation of the SAI Index. The average value found in this study is 52%. This value is inappropriate according to the standards established by the Boothroyd model for the inclusion of students with hearing loss in the classroom. Simulations carried out using this index have shown how hearing subjects have no difficulty in accessing even isolated words of low familiarity, reaching intelligibility values close to 70%. However, this SAI is unacceptable for hearing-impaired students. Estimates for students with HA or CI reach values of less than 20% under the same acoustic and linguistic conditions, where average students reach 70%.

FM systems facilitate the accessibility of oral language in acoustically poor situations without the need for structural modifications or building works, as the equipment is portable. BN has an adverse effect on scores obtained by hearing-impaired students especially when using HA or CI without the FM system. In this study, the benefit of this technical aid was clearly observed when analysing speech recognition scores in the presence of BN. Overall, the FM system benefit averaged 42% for both groups of students in the most difficult condition (with and without FM in BN and low lexical frequency words).

This study monitored linguistic difficulty in oral communication through the lexical frequency of the words presented. This task was more complicated as words were unfamiliar to HA or CI users. Particularly difficulty was presented by the condition of recognition of low lexical frequency words in the presence of BN. In this condition, again the use of FM proved to be clearly beneficial for accessibility in student communication. The main conclusions of this study are as follows:

1. The acoustic conditions of the classrooms studied are acceptable for normally hearing students, but are not suitable for the inclusion of hearing-impaired students.
2. These conditions create a barrier to communication for hearing-impaired students that significantly impedes access to verbal information.
3. The acoustic conditions of the classroom, the difficulty of verbal language and the presence of hearing loss interact to determine access to communication for students with hearing impairment.
4. The use of FM systems facilitates access to verbal information in the presence of adverse acoustic conditions, especially words with low lexical frequency in students with hearing impairment.
5. The use of FM serves to remove barriers to communication in classrooms with inappropriate acoustics.

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STARTIT Audio streaming for hearing-impaired students

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Keywords:
STARTIT, accessibility, education, streaming, mobile devices.

WORKING HYPOTHESIS

FM systems used in classrooms can sometimes present problems such as interference with other radio signals, depending on the equipment and frequency selection. Likewise, installations of perimeter magnetic loops in adjacent classrooms or on different floors may cause interference if an adequate installation is not performed in accordance with the regulations. Two other important factors add to these problems: the high cost and the inability to store audio for later use by students. STARTIT is a support system, under validation, for communication, understanding and study within and outside classes, the use of which is proposed as an alternative future choice for accessibility in educational environments.

SAMPLE PROFILE

STARTIT is a system that can capture the sound of a teacher's voice and send it, via audio streaming, directly to students who need it. STARTIT consists of two elements:

- PC desktop app that captures sound.
- Mobile app that plays captured sound.

The application was first validated in a real academic environment for a week with the participation of the Colegio Tres Olivos school in Madrid and the Vodafone España Foundation. A total of 12 students aged nine to sixteen took part in the tests. If the hearing impairment level is considered, all students have severe or profound deafness and need their devices for oral and/or aural communication. In addition, the vast majority of them use lip reading as support in communication and some use or know sign language.

Evaluation of the system was undertaken in different selected classes:

- In Primary it was used during English classes. These classes are characterised by the use of multimedia content from the computer and the broad participation of students in the classes.
- In Secondary, it was used during classes such as geography, history and mathematics.

KEY FINDINGS

The assessment was conducted through interviews and questionnaires based on five questions with subjective answers:

- Delay: time elapsed from the teacher moving their lips to the student hearing them.
- Quality: intelligibility and quality of the teacher's voice.
- Following: ability to follow and understand the teacher's explanations.
- Interaction: Student's ability to communicate with classmates while using the app.
- Usability: ease of use.

The rating scale for each question consists of four values: very bad (1), bad (2), good (3) and very good (4).

Table 1 provides a summary of the main statistics obtained for the different parameters. On a complementary basis, as shown in Figure 1, the subjective impression for most parameters is good. However, the mean delay value is around 350 ms and the subjective impression is bad or very bad. This lack of synchrony between the teacher's lips and voice becomes more relevant when the student activates the M position of their hearing aid, as they simultaneously hear the ambient sound and audio streaming signal through the magnetic loop.

After this first experience, the line of future work focuses on improving voice signal processing to reduce delay.

Figure 1. Distribution of evaluations

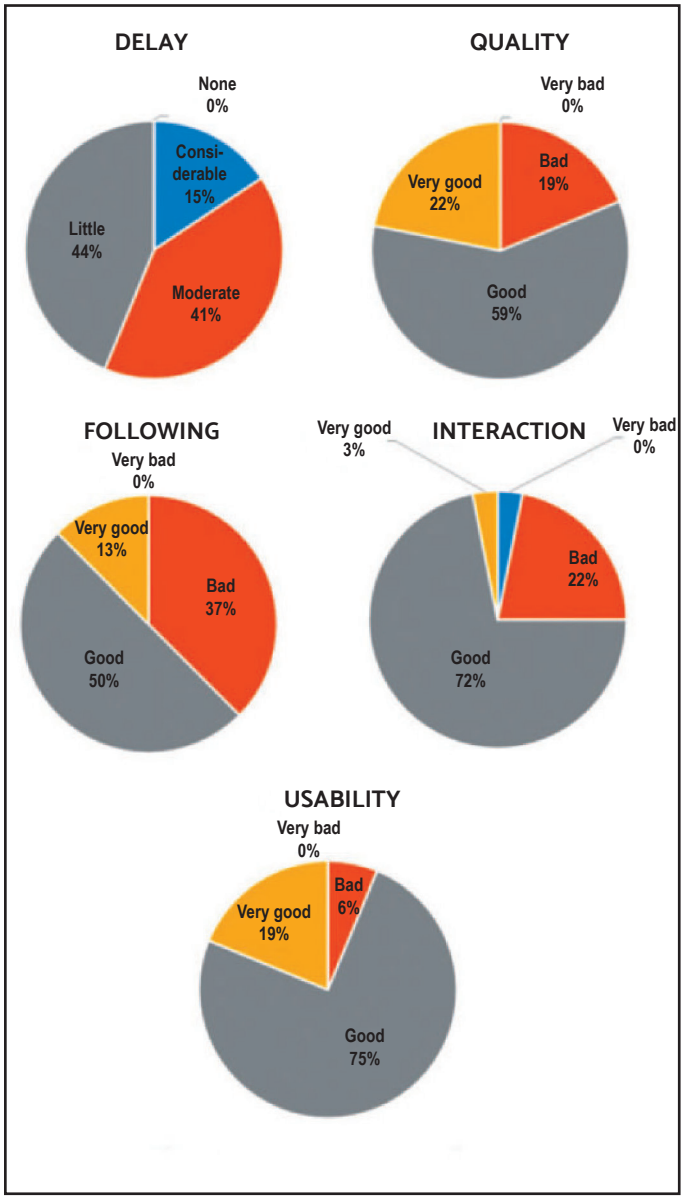

Table 1. Statistical analysis of parameters

	Delay	Quality	Following	Interaction	Usability
Mean	2.281	3.031	2.75	2.75	3.125
Median	2	3	3	3	3
Deviation	0.728	0.647	0.672	0.568	0.492
Impression	Moderate	Good	Good	Good	Good

University Inclusion Support Programmes

Hearing-impaired students

Complutense University

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Keywords:
Education, university, social, student, deafness.

Spain is, like other European countries, currently undergoing a process of transformation in the social, political and economic spheres. This process is being reflected in many spheres of society. Likewise, changes are seen in the institutional context, the university being a knowledge transfer generating institution, a centre of innovation and research committed to transformation. Higher Education is no stranger to these changes, and is becoming a space driving the inclusion of students with diversity. In recent years, there has been a change in the profile of students (Barañano and Finkel, 2014) and new challenges therefore arise in equal opportunities, as this is where students encounter a greater number of obstacles (Peralta, 2007). The aim of this paper is to analyse the social and educational resources demanded by students with hearing disabilities at Complutense University.

STUDENT PROFILE AND RESOURCES

The profile most commonly observed in these students is derived from sensory hearing, visual and physical impairments and also those derived from long-term diseases and/or special treatments (Alcatud, *et al.*, 2000).

The population registered in the UCMd+I Office for the Inclusion of Persons with Diversity in the 2015/2016 academic year corresponds to a total of 447 students, of whom 237 are women and 191 are men.

The profile of the sample in this academic year was 45 students with hearing impairment. The number of women stands at 25 compared to 20 men enrolled. It should be noted that there is a greater presence of female university students of this profile of students with disabilities.

In addition, 40 students were enrolled in the 2012/2013 academic year, and in the data from the first census, corresponding to the 2004/2005 academic year, 27 students with hearing impairment were enrolled. As may be seen, the number of students has increased progressively.

The demand for resources from hearing-impaired students has mainly focused on note-taking aids as well as basic instructions to teachers.

In relation to demand in technical aids to support oral communication, these were: FM devices, magnetic loops and recorders.

Lastly, with reference to the demand for Spanish sign language interpreters ('ILSE'), 11 students applied for this service. There is thus an increased presence of students using oral language.

KEY FINDINGS

The UCMd+I Office for the Inclusion of Persons with Diversity ('OIPD') at Complutense University provides personalised attention to all members of the university community with disabilities, specific and personal needs. It recognises the recipient as an active subject of the intervention process, taking into account their abilities, respecting the principle of equal opportunities and committing to an inclusive university, recognising human and social rights, betting on self-determination, autonomy and co-responsibility.

With regard to the purpose of this paper, we found that, on the one hand, more students with hearing disabilities are enrolled each year and, on the other, that the office has adequate resources and programmes to meet the demands requested by students, for their social and educational inclusion in the university context.

In conclusion, the Complutense University promotes excellence for students with disabilities, transnational mobility, skilled employment, sport, associations, leisure and free time. As well as diversity management that promotes research, innovation, development and sustainability. In this regard, the Action Plan of the Spanish Disability Strategy 2014-2020 aims to reduce the school drop-out rate and increase the number of students with disabilities in higher education.

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University Inclusion Support Programmes

Hearing-impaired students

University of Burgos

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Keywords:
Management, quality, support, sign language interpreter (SLI), adaptations.

This work presents the support given to a student with deafness, based on her needs, for her academic success.

CASE DESCRIPTION

M. is a pupil with pre-lingual profound deafness, bilingual in sign language and Spanish, and her mother tongue is sign language. She has a good level of reading comprehension and oral expression and is proficient in lip reading. During her previous educational career she had the support of the sign language interpreter (SLI) and is supported by her family environment and the ARANSBUR-BURGOS Association.

To facilitate the inclusion of the student M. at the university, work was carried out in two areas of intervention:

The first was the provision of the Sign Language Interpreter Service (SLIS) for the elimination of student communication barriers, accessing all classroom information. In the management of the SLIS, an external company was hired in the first year but neither the quality of the interpreting nor the number of hours was sufficient. In the second year, the number of hours of interpreting was increased and an experienced interpreter was selected. However, attendance at class was inadequate and the expected academic results were not achieved.

This is when the Diversity Response Unit assessed the continuity of the SLIS, although the total number of class hours had not been covered, the student's use was insufficient and she began to consider dropping out. Several circumstances were linked to the decline in her academic motivation and self-esteem: first of all, the implementation of the European Higher Education Area (EHEA) forced her to change from the plan of study she had started, and secondly, the problems of the SLIS for her whole timetable.

This was the turning point of the whole experience and where all those involved, student M. and the University of Burgos, managed to transform the situation that led to academic success and graduation, raising the need for a commitment from the student to take advantage of and attend class, linked to the provision of the SLIS that the ARANSBUR Association was to handle from that point onwards.

Some of the key elements behind the change:

- The commitment of the student and her change of attitude
- The high level of professionalism of the SLI, overcoming all difficulties such as the complexity of the subject content with a specific and technical vocabulary, the long duration of the classes, the speed of the lecturers' speech, the poor acoustics of the classrooms.
- SLIS quality management by ARANSBUR, which made it possible to hire two sign language interpreters (between 5 and 6 hours of interpreting per day) and to organise and coordinate the interpreters.

The second was teaching staff awareness, through training courses on "educational support for deaf students at university" or sign language, organised with the Teacher Training Institute of the University of Burgos (IFIE) and taught by ARANSBUR. And information for teaching staff about the needs of the student and guidelines to facilitate the interpreting of classes by the SLIs.

Informative group talks were also given to the class, and sign language courses were facilitated among peers, who volunteered as note takers.

KEY FINDINGS

In our case, proper management of the SLIS improved the motivation and academic outcomes of the student, although the key to her academic success was commitment and involvement in the entire learning process and responsibility for the use of the support made available to her.

The attitude of the teaching staff is another key aspect, with this changing throughout the process, especially in the acceptance of the interpreters, proving increasingly open to collaboration, speaking more slowly, using visual elements in their presentations, posting notes...

Finally, this experience has generated synergies between ARANSBUR and the University of Burgos, facilitating the use of resources and advice throughout the process.

University Inclusion Support Programmes

Hearing-impaired students

University of Valencia

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Keywords:
Deafness, university students, cochlear implant, hearing aids.

Following the adoption of Law 13/1982, of 7 April 1982, on the social integration of disabled people, people with disabilities began arriving at Spanish universities.
The resources available at Spanish universities have helped increase the number of students with some form of disability.

INTRODUCTION OF SUPPORT SERVICES AT UNIVERSITIES

The difficulties encountered by people with disabilities when they arrived at university were very diverse, depending on their personal characteristics. These situations led to the creation of support services or programmes intended to implement actions aimed at achieving the principle of equal opportunities almost three decades ago.

Over time, these services grew with the priority of "normalising the university life of these students" up until 2007, when the regulations made them mandatory.

DEAF STUDENTS AND ACTION NEEDS

The great heterogeneity of these care services was reflected in a lack of uniformity, but regardless of this, the fundamental goal was to normalise the university life of students with disabilities, seeking to comply with the principles of integration and equal opportunities.

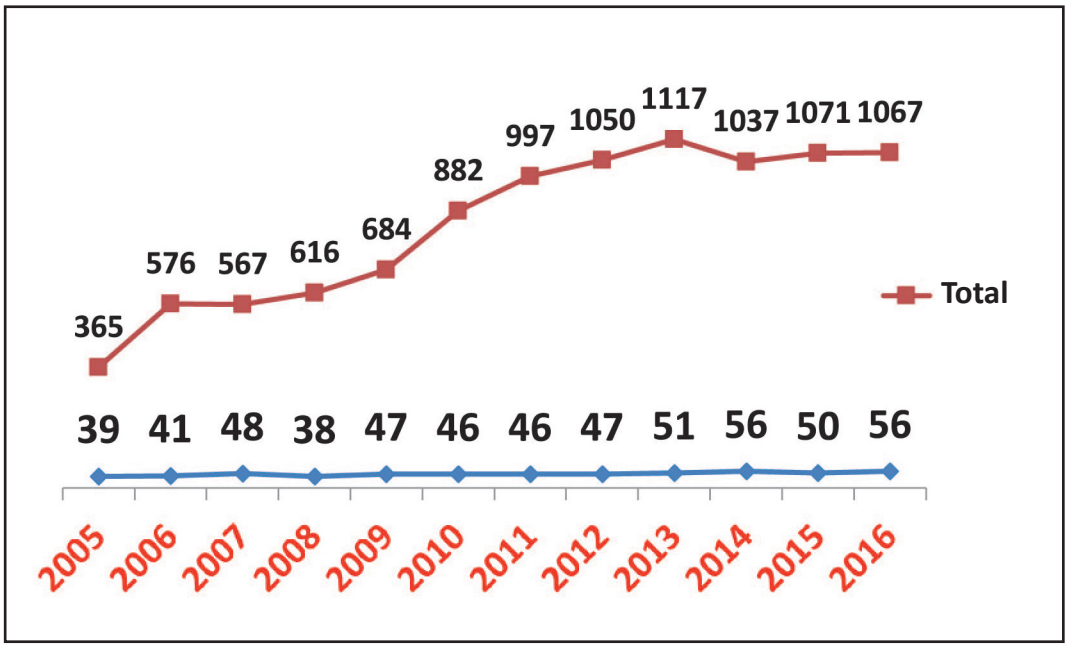
According to the White Paper, Álvarez-Pérez (2012) documented that only 1% of university students were registered as having a disability, and that only 3% of people with disabilities had a university degree. Focusing on people with deafness, we found that they were the group with the least increase in their presence in higher education. However, the advancement of cases with monaural implants at an early age since the late 90s and early 2000s suggests that they will be an emerging group at university in the near future.

Currently only 1% of deaf youngsters access university, possibly because their greater difficulty in integrating into the university environment are limitations in accessing verbal information, and poor reading skills (Figure 1).

Difficulties in accessing information are alleviated to a greater or lesser extent through lip reading and the use of support products intended to take advantage of possible residual hearing available to the person in order to try to approach oral language.

In other cases, it is the use of sign language that enables good communication in the university environment. For this reason, some universities provide sign language interpreting in all subjects throughout the university pathway, and other universities in those subjects with a greater verbal load.

Figure 1. Evolution of tuition fees for students with disabilities and deaf students in the last 10 years



People with residual hearing are often provided with frequency modulated transmitters and portable magnetic loops as a support product. In both cases fellow student volunteers act as note takers, using carbon copy notebooks or digital pens. In addition, volunteers are often trained to adapt material such as the subtitling of videos to be used in classes.

Planning and provision of support and actions are needed to make "equal opportunities" a reality. The scope of action will thus be environment:

- The student is provided with: reserved place on front rows, carbon copy notebooks and/or pens, FM emitters, note-taking and volunteering.
- For teachers and administration and service staff: guidance and recommendations for teaching, reports on Non-Significant curriculum adaptation, material adaptation and training courses.
- For classmates and students in general: awareness and training courses.

Within the university environment, we currently have legal standards covering people with educational support needs arising from a disability. However, the level of demand in the educational context has increased, so students will need to show sufficient acquisition of professional skills. As professionals, technicians and mentors we will therefore have to give even greater consideration to our responsibility in guiding and/or advising a student with disabilities regarding their access to training courses, to university: to degrees, to master's courses... Good advice helps to adjust the expectations of the student so that they are realistic about their abilities and limitations, thereby ensuring academic success.

CONCLUSIONS

In addition, universities must aim to ensure that the support offered to each student, with specific needs, constitutes a well-structured process, responding to all the specific needs presented by diversity, always bearing in mind development and progress; without neglecting any of the areas that may, within the university, lead to factors of discrimination against other students.

University Inclusion Support Programmes

Hearing-impaired students

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Keywords:
Deafness, levels of support, specific support, general support, universal support.

Comillas launched the Unit for the Support of Students with Disabilities in 1998. Through the experience it has built up, the work proposal currently developed by this University is presented below.

DESCRIPTION OF A LEARNING EXPERIENCE

After so many years and so many students, working together and coordinating with teachers and specialist bodies, we have concluded that caring for people with disabilities requires a three-tier system.

The first level refers to the "specific", or in other words to the particular needs derived from their disability status, whatever that may be. By this I mean the provision of the resources, supports and services needed to ensure the full participation of the person in conditions of normality and equal opportunities. A wheelchair, FM equipment, a magnetic loop, a social and healthcare assistant, curriculum adaptations, elimination of barriers, etc. In the framework of Higher Education, we have regulations in place that dictate that universities must provide the means, supports and resources to ensure real and effective equality of opportunities in relation to the other components of the university community, and this is a guarantee.

The second level to be considered within the system of support for people with disabilities is "general or community". This level develops actions to generate structures and provide resources, including all the specific conditions indicated at the previous level. This is made possible through the establishment of policies, regulations, strategic plans, protocols, budgets, etc., which work for and towards guarantees as to the conditions of participation and coexistence and to generate a social culture, in our case recognising diversity as an essential value of human nature. At universities, we provide support, provide resources and set up services to meet the different conditions that arrive. But we also generate internal regulations, action protocols, we are present in the strategic plans, services are consolidated, so that diversity is recognised and is a natural part of the university dynamics.

The third level, which we consider important and which goes a step further, covers the "universal", in which we are all equal, whether or not we have a condition of disability. If we look at the different conditions that a person presents, such as physical condition, economic condition, sexual condition, religious condition, etc., we will see a difference. Different conditions make us look different. But

there are personal skills, there are qualities that are innate and universal. It seems worthwhile to make this distinction because although the Disability Support Units at universities work at the specific and general levels, it is increasingly necessary to work on the personal skills and qualities that accompany each person. One example clarifying this would be a student with a motor limitation who may need walking sticks or frame, a wheelchair, etc.: different resources depending on the needs derived from their disability (specific level). The student will turn to a service or unit that will have a protocol, a budget, internal regulations, a structure, etc. (general level). However, all of us, with or without disabilities, share a competency that in this case is "personal autonomy". We work on autonomy, learning, motivation, acceptance, emotional independence, decision-making, and they are all universal.

Within these personal competencies of a universal nature I would like to highlight Listening. Listening as a basis for learning, for creating bonds founded in equality, also listening to who we are, what we want, what we need.

In the case of Comillas University, our students with hearing impairment have implants or have hearing loss. In any event, these are people with a physical deficit in receiving information, to a greater or lesser extent. When recently working with an engineering student with a cochlear implant, I asked him, "What keeps you from listening?" His immediate response was "the noise!" Clearly a physical impediment. It is common for these students, when they have not heard or understood part of the explanation, not to ask. And when they don't ask, that information becomes a loophole, and that loophole becomes disconnection, and that disconnection leads to demotivation that means they drop out or give up.

And what makes you stop listening? "when I think I can't hear everything" "when I think I can't do it". When the person gets into their head the thought of "I can't", they immediately stop focusing on and addressing the data, the information, and external listening. As soon as we reach this point, as individuals our listening shuts down, enters a disconnect and initiates an inner dialogue that leads to isolation.

And what else makes you not listen? "when I get bored" "when it's not interesting". Issues such as lack of interest, criticism of what is listened to, rejection, disorder or if the speaker makes no sense cause us to stop listening immediately. But it doesn't just happen to him. It happens to us all. When we criticise something, we stop listening to develop an inner discourse, which strikes us as more interesting. That is where we cut the connection with the information and with the other. Our student, as soon as he feels that what he hears is not of a sufficiently intellectual level, in terms of content, structure, logic and meaning, simply disconnects.

This example serves to illustrate that beyond serving and improving the auditory quality of deaf people, which is essential, personal skills must be worked on. In the case of listening, we need to know that it is a matter of focus. Where you place your focus, you place your intent. Where you place your intent, you place your learning. We need to know what causes each of us to lose focus and disrupts our listening. And so for the engineering student, we will be able to distinguish what is part of the hearing deficit and what is part of his own nature that we need to develop.

CONCLUSIONS

When we finished our follow-up session, I said "I hear you." And after a long pause to reflect and order his thoughts, he replied: "I'm in shock." And that's fantastic, because it's not the same to live with a physical limitation that gives you the status of "deaf," as to live with the experience that "I can manage my own listening". It's not the same.

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