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The use of computers and augmentative and alternative communication devices by children and young with cerebral palsy

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Abstract

The purpose of the study was to determine the use of computers and assistive devices amongst children with cerebral palsy (CP) and establish the satisfaction level of both users and educational staff. The study was carried out with 30 children with cerebral palsy. A questionnaire was designed to characterize the use of new technologies and assistive devices. Some of the questions were reserved for the teachers. Even though 29 users show some type of communication difficulty, only 4 users dispose of a computer-aided communication device, with the static symbolic board being the most widely used device (4). More than half of the participants (17) regularly use a computer, 16 of them requiring some type of assistive device. The perception of the teachers with regard to the use of Information and Communications Technologies (ICTs) in the classrooms is positive in 5 out of 6 cases. ICTs only provide assistance if their application is accompanied by the involvement of professionals and the child's social environment. The low use of Augmentative and Alternative Communication techniques along with the absence of communication codes reveal the need to establish training protocols. The inclusion of social, physical, and personal factors is considered essential in order to evaluate the needs for assistive technology.

Keywords: assistive technology, cerebral palsy, Augmentative and Alternative Communication (AAC), computer access, special education

INTRODUCTION

Children with severe physical disabilities frequently require various assistive devices in order to perform activities of daily living related to mobility, communication, environment control, and accessing and using computers (Hawley, Cudd, & Cherry, 1994). Computers and information and communication technologies (ICTs) constitute basic tools in the emerging information society, characterized by the widespread use of informatics, telematics, and audiovisual communications methods. This article interprets ICTs as the use of information and tools in order to meet human needs or purposes, including the use of computers and contemporary devices such as the Internet. ICTs therefore constitute an important source of assistance for people with different types of disabilities. These technologies represent a major potential improvement in the lives of users and offer a wide range of uses that can help individuals overcome some of their limitations (Miranda de Larra, 2007).

However, there exists a risk in the use of ICTs, and that is the possibility that today's accelerated development of these technologies does not take into account the specific characteristics and needs of people with disabilities. This trend will likely contribute to social inequality and favor the appearance of new types of social exclusion. This phenomenon is known as the "digital divide," referring to the gap between, on one hand, those who either have easier access to the technologies or are able to make effective use of ICTs and, on the other hand, those who do not have such access or are unable to make effective use of the technologies (Pousada, Groba, Orozco, & Martínez, 2008).

Children with cerebral palsy (CP) have specific needs in terms of their interaction with ICTs. They suffer from alterations to their neuromuscular, musculoskeletal, and sensory systems, which limit their activity (Rosenbaum, 2003). The high frequency of communicative disorders in these individuals (Murphy, Marková, Moodie, Scott, & Boa, 1995) requires the use of computer-aided communication devices, defined as a communication supportthat is external to the individual, including communication boards and voice output devices (Rosenbaum, 2003). The prevalence of communication disorders in children with CP is above 60% (Murphy et al., 1995). They have different causes, such as mental delay, dysarthria, or psychosocial impairments. The difficulty in speaking usually is associated with the difficulty in swallowing and chewing. Most children will find a way to communicate, but the most affected children will need to find support through a computer-aided communication device (Rosenbaum, 2003).

Diminished physical abilities, together with the sensory, perceptive, behavioral, and/or epileptic disorders that usually occur (Chen et al., 2006), imply that children affected by CP require different types of assistive technology (AT) in order to make functional use of ICTs. These include head trackers to control interfaces (Harwins & Jackson, 1990; Chen, Chen, Kou, & Lai, 2003), eye control devices (Gravil, Griffiths, Potter, & Yates, 1985; Park & Lee, 1996), interfaces activated using switches (Berardinis, 1996; Gerpecheide, 1998), Web cams (Betke, Gips, & Fleming, 2002), and pointing devices (Chen et al., 2006; Turpin et al., 2005; Clayton, 1992). In this sense, assistive technologies can significantly improve the performance of daily activities, including the use of computers, communication acts (written and face-to-face communication), and social participation (Margolis & Goodman, 1999; Martine & Connolly, 2008). Even so, numerous studies have revealed low levels of use, restricted use due to contextual influences, or even complete abandonment (Pape, Kim, & Weiner, 2002; Philips & Zao, 1993; Riemer-Reiss & Wacker, 2000; Verza, Carvalho, Battagia, & Uccelli, 2006), which also affect the use of assistive devices for ICT access and communication facilitation.

The abandonment of assistive technologies is directly connected with the environment and the individual characteristics of each person (Martine & Connolly, 2008) and is influenced by the attitude and lack of knowledge of the educational team regarding the benefits of the application of the technologies (Huntinger, Johanson, & Stoneburner, 1996).

The introduction of ICTs in the educational environment for children with physical disabilities such as CP has the potential to contribute positively and significantly to the social and academic participation of these children. It is important to study how AT for communication support and computer access is currently being used by children and adolescents with CP in their classrooms (Cabrera, 2005; Huntinger et al., 1996; Vega, 2004).

This article describes the work carried out in a special education center for children with CP and characterizes the use of computers in favor of written and face-to-face communication.

METHOD

The aim of this study is (a) to determine the use by children with CP of computers, of assistive technology to access computers, and of computer-aided communication devices and (b) to establish the satisfaction level on the part of these users, in order to support the development of a curricular program for pupils with CP.

Participants and Setting

The study was carried out at the educational center of the Association of Parents of Persons with Cerebral Palsy (ASPACE). This center has an agreement with the Department of Education of the Regional Government of Galicia to attend a total of 30 children with CP in a total of six classrooms. ASPACE is the only specialized assistance center focusing on persons with CP in the region of A Coruña, with 250,000 inhabitants.

Each of the six classrooms is coordinated by an educational psychologist (educator). The children also regularly attend treatment sessions in the center, such as physiotherapy, speech therapy, or occupational therapy. The center has a computer room and its own ICT resources, as well as assistive devices for computer access and communication.

The criteria for inclusion in the study were that the participants were diagnosed with CP or other similar pathologies (hydrocephalus, encephalopathy, or undefined diagnosis), were younger than 25, and that they attended a special education center (ASPACE) with ICT resources. The study was carried out with all pupils from the ASPACE-Coruña educational center who met these criteria (30 children). The participants were between 3 and 22 years of age, and all had been diagnosed with CP or similar pathologies.

Participants over the legal age gave their informed consent to take part in the study, according to the ethical protocol appointed by ASPACE. In the case of the minors taking part in the study, authorization was requested from their parents, who agreed on their participation in all cases.

Out of 30 children, 17 answered the questionnaire directly. The remaining 13 participants were interviewed with the help of their educator and speech therapist from the center, as they were unable to respond to all of the questions due to their age or cognitive abilities. The selection of these two professionals (educator and speech therapist) was based on the fact that they are the individuals who most often interact with the participants, who know their abilities to use the computer and to communicate, and who have a strong working knowledge of the assistive devices used.

Questionnaire for Children and Adolescents

In order to obtain the necessary data, a questionnaire was designed. The questions were of the closed type, presenting several options so that the participants could select the one that most closely fit their situation. The information included the following.

First, demographic and clinical data, including age, gender, and type of CP, were gathered. Second, data on communicative capacities and types of applied assistive devices were collected. The disorders specified were anarthria, dysarthria, alalia, dyslexia, delayed language development, autism, intellectual deficit, and "other." In terms of the communicative code used, the following options were proposed: ordinary language (if the participant used his or her mother tongue in communication, considering both the understanding of ordinary language and its verbal expression), representative drawings of objects (different symbolic codes such as SPC, Bliss, PIC, or Widgit), gestural codes (if the participant used different parts of his or her body to transmit messages), or none (if the participant did not use any type of code in the comprehension or expression of verbal and/or nonverbal messages). Finally, the proposed augmentative and alternative communication (AAC) options were the following: a static symbols board (on paper), a dynamic symbols board (using computer software or a PDA), a static syllabic board (on paper), a symbolic communicator, and an alphabetic communicator.

Third, data on computer use were collected. Access to the computer was analyzed by means of three questions: whether the access is normal (using an ordinary keyboard and mouse) or if one or more assistive devices are needed, if items are selected directly on the computer or by scanning, and what types of assistive devices are used to access the computer. In the case of the assistive devices used to access the computer, a series of options were offered such that the participant had to choose one or more answers that corresponded to his or her situation with regard to accessibility options included in the operating systems (in all cases, using Windows XP): specific keyboards (concept board, on-screen keyboard, keyboards with large keys, keyboard with keyguard, plastic keyboard, single-hand keyboard), touch screen/tablet PC, adapted mice and mice emulators (trackball, joystick, facial mouse, head tracker, tracker combined with mouse functions emulator, Iriscom®, virtual mouse), switches (touch and pressure switches, breath switches, tongue switches, pointing wands and sticks), computer access software (In-TIC, symbolic communication software, Saw®, text predictor, voice recognition), or other adaptations (lectern, supports, etc.). These assistive devices were proposed on the basis of those available in the ASPACE computer room and in the participants' homes. A multiple response was accepted for the question on the most widely used software applications, the options being the following: text editors, databases, Internet browsers, multimedia players, e-mail, and educational programs for accessing the curriculum or for entertainment.

Finally, data on individual perceptions and level of satisfaction with ICTs and the assistive devices used were gathered. A total of three questions were asked for this purpose: level of satisfaction with the use of AAC, level of satisfaction with the use of ICT, and level of satisfaction with the assistive technology device. In order to answer the questions, the participants had to choose one of the following options: very good, good, OK, bad, or very bad. In order to evaluate individual perceptions, each participant who regularly used a computer was asked what ICT means to him or her, choosing multiple responses from among the following options: learning, autonomy, information, communication, freedom, accessibility, unattainable, difficult to access, confusing, not at all useful, and other.

Only one answer was given for each question, except for those related to types of difficulties in communication, type of assistive device used in communication and computer access, most frequently used software, and what ICT meant for the user. Multiple responses were accepted for these questions.

Questionnaire for Educators

A series of questions was presented to the group of educators. The inclusion criteria were that they were responsible for one of the six classrooms attended by the 30 children and that they worked at the ASPACE center. All educators at the center filled out the questionnaire (six persons).

The questions were intended to unveil a professional opinion regarding the application of ICT to learning and education and regarding whether there had been evidence of any significant progress among the pupils in the use of these technologies. They also aimed to ascertain whether, at a local level, the use of ICT and assistive devices is important in the corresponding adaptations to the curriculum. This part of the questionnaire was completed directly by the six educators.

The full questionnaire is shown in Appendix A (users); Appendix B contains the special questionnaire for educators. These were prepared by the research team with the advice of the psychoeducational and speech therapy staff of ASPACE.

Development

Before applying the questionnaire, it was pilot tested by a person with CP and by an educator at ASPACE. These persons were selected at random as representatives of users in the sample. The pilot test was carried out in the same space as the survey itself. Only two modifications were implemented concerning the perception of ICT: The choice options were closed and a space for comments was established.

Once the questionnaire was prepared, agreement had been reached on its contents, and all of the participants and tutors had been informed about the details of the study, it was distributed to the participants.

The questionnaire was administered by the same person from the research team and filled out inside the center. In the case of the 17 participants who responded to the questionnaire directly, the process took place in the center's computer room, face to face, without any additional distractions. The other 13 participants who needed help from the professionals to complete the questionnaire filled out the questionnaire in the educator's classroom and in the speech therapist's office. The answers to the questionnaire were written on the form, and the data were subsequently treated using SPSS 16.0.

RESULTS

Demographic and Clinical Characteristics

The 30 participants in the study live in the metropolitan area of A Coruña (Galicia, Spain) and attend the educational center of ASPACE Coruña on a daily basis. All of them live at home and travel to the center using the specially adapted transport provided for them.

The participants were between 3 and 22 years of age; most ($n = 14$) ranged in age from 16 to 22. The average age was 13.3 years. In terms of gender, 19 participants (63.3%) were male and 11 (36.7%) were female.

All of the participants were diagnosed with cerebral palsy or a similar pathology. The most frequent type was spastic CP, affecting 19 participants (63.3%), followed by athetosic CP, affecting 4 participants (13.3%). Table 1 presents data on participants' general demographic and clinical characteristics.

TABLE 1. Demographic and clinical characteristics of the sample

Characteristic	No.	%
Age		
3–6	5	16.7
7–15	11	36.7
16–22	14	46.7
Sex		
Male	19	63.3
Female	11	36.7
Type of CP		
Spastic	19	63.3
Athetosic	4	13.3
Ataxic	1	3.3
Mixed	2	6.7
Similar pathology	4	13.3

Communicative Abilities and Computer-Aided Communication Devices

A total of 29 of 30 participants had some type of communication disorder associated with their diagnosis of CP, meaning that only 1 participant did not have any kind of associated disorder. Three of the 30 participants had at least three associated communication disorders, while 18 participants had two communication disorders and 8 participants had only one type of difficulty. The most frequent types of disorders were delayed language development and anarthria, present in 16 subjects (53.3%), followed by dysarthria (5 subjects, or 16.7%) and language disorders associated with intellectual deficit (5 subjects, or 16.7%).

With regard to the age at which associated communication disorders were diagnosed, 53.3% (16 participants) were identified in the first 2 years of life, followed by 33.3% (10 participants) diagnosed before the age of 10; in only 3 participants were the communication disorders detected after the age of 10.

The results based on the type of communicative code indicate that the most frequent response was “none,” with 40% (12 participants), followed by “gestural” with 26.7% and “ordinary language” and “representative drawings of objects” (symbols/pictograms), each with 16.7%.

The participants with associated communication disorders were asked if they used any type of AAC system. Only 6 of them (20%) use some type of assistive device to help with their communication disorder.

Out of the 6 participants who used some type of AAC, 4 used two AACs that are compatible with each other, as one is static and the other is dynamic. The most widely used type of AAC was the static symbolic board, used by 4 participants, coinciding with the number of participants who used the symbols code. None of the participants used an alphabetic communicator.

The access method for the AAC was pointing with a finger (for 2 participants) and eye movement (for another 2 participants) in the case of static symbolic boards. Three of the four participants who used a dynamic symbolic board needed a switch for indication purposes. The participants who used the symbolic communicator did so by direct selection.

The environment in which the participants used the AAC was similar for all 6 participants. They all used their main AAC in the educational center, at home, and when carrying out activities in the community. Their main interlocutors were the family (who knew how to use the AAC), the members of the team at the center, and other health professionals. There was no use of AAC by people in their social environment who did not know how the devices work. In the case of the 4 participants who used a second AAC, its use was limited to the educational center, as they did not have the necessary resources in their homes (computer, specific dynamic communication software, communicator). Table 2 provides further details on communication abilities and the devices used.

TABLE 2. Communication abilities and assistive devices

Characteristic	Response	Response frequency	% (of total sample)
Difficulties in communication	Yes	29	96.7
	No	1	3.3
Type of communication difficulties	Anarthria	16	53.3
	Dysarthria	5	16.7
	Alalia	4	13.3
	Delayed language development	16	53.3
	Autism	1	3.3
	Intellectual deficit	8	26.6
	None	12	40
Use of AAC	Yes	6	20
	No	24	80
Type of AAC	Static symbolic board	4	13.3
	Dynamic symbolic board	4	13.3
	Symbolic communicator	2	6.6
Environment for the use of AAC	Family	5	16.6
	Team from the center	5	16.6
	Other professionals	3	10

Computer Use

Taking into account that one of the aims of the study was to discover the level of computer use and the types of assistive access devices that were used, a series of related questions were included (see Appendix A). Out of the 30 participants in the study, 17 (57.6%) regularly use a computer in the center (in the computer room), whereas 13 (43.3%) do not. Nineteen participants (63.3%) have a computer at home, but only 4 of them use it at home (and also use a computer at the center).

For the remaining participants, the reason for not using the computer was a low level of cognitive ability in 10 out of 13 cases. These limitations prevent them from benefiting from a correct intervention using ICTs and from realizing their potential. The other 3 participants do not use a computer due to a lack of training or proficiency in using ordinary and assistive access devices for PCs.

For 9 of the 15 participants who have a computer at home but do not use it, the reason for this is a lack of material resources (they do not have the necessary assistive devices in their home, only at the center), and for the other 6 participants, their nonuse is due to their low (reduced) cognitive capacity. In the latter case, the participants form a part of the group who do not use the computer at the center for the same reason.

For the participants who do not use a computer, the questionnaire concluded with this question regarding nonusage. The rest of the participants were asked questions regarding type of access, level of satisfaction, and individual perspectives regarding their use of computers. The responses to the questions were only recorded for the 17 participants who use computers on a regular basis.

Out of the 17 participants who answered this part of the questionnaire, only 1 participant accesses the computer in a normal way, without using any type of adaptation or assistive device, whereas the other 16 participants require some type of assistive technology. Eleven of the 17 computer users select items directly, whereas 6 users (20% of the total sample) prefer a scanning system.

Among the assistive technology suggested, the most widely used technology is a touch or pressure switch (7 participants), alone or in combination with a scanning system, followed by a trackball (4) and touch screen (3). Table 3 shows the type of access method and the AT used by the 17 participants who use computers on a regular basis.

TABLE 3 Computer access and assistive technologies

Characteristic	Response options	Response frequency	% of participants who use the computer	% of total sample
Type of access	Normal	1	5.9	3.3
	Assistive device	16	94.4	53.3
Type of selection	Direct	11	64.9	36.7
	Scanning system	6	35.4	20
Type of assistive technology (multiple response)	Accessibility options	1	5.9	3.3
	Keyboards:	1	5.9	3.3
	On-screen keyboard			
	Touch screen/tablet PC	3	17.7	10
	Mice:			
	Trackball	4	23.6	13.3
	Joystick	2	11.8	6.6
	Head tracker	1	5.9	3.3
	Tracker + emulator	1	5.9	3.3
	Iriscom	2	11.8	6.6
	Switches:			
	Touch operated	7	41.3	23.3
	Access software:	2	11.8	6.6
	In-TICBoardmaker	2	11.8	6.6
	Other adaptations	1	5.9	3.3

Note. Data are from 17 participants from the total sample.

The 16 participants who need some type of assistive device to use a computer were asked which professional recommended that they should use this device, where they trained to use it, and where they use such devices. For 15 of the 16 participants who use one or more assistive devices, the devices were prescribed by the ASPACE speech therapist, who is responsible for the ICT section at the center. Also, in all cases, before starting to train the participants for future device use, the occupational therapist was consulted on the adequacy of the method with regard to the psychomotor abilities of each user (fine and gross motor skills). In these 15 cases, training in the use of assistive devices had been or was going to be carried out at the center itself by speech therapists, occupational therapists, and trainee occupational therapists. In the remaining case, the assessment and subsequent training had been carried out by professionals at an educational center before the participant entered the ASPACE center.

The 17 participants who regularly use computers were questioned about how often they used them and the most frequently used software applications. Only 1 of the participants uses a computer several times a day, whereas 3 use them several times a week. The number of participants in this subgroup (4) coincides with the number of individuals who own and use a computer at home. The highest frequency of use of a computer is several times a month, by 13 participants. This frequency coincides with the participants attending sessions in the computer room at the center once a week.

With respect to the most commonly used software application, the highest frequency corresponded to the use of educational programs (16 participants), followed by the use of a multimedia player (7) and Internet Explorer (5). The results for the prescription of assistive devices for accessing the computer, the frequency of use, and the most widely used applications are shown in Table 4

TABLE 4. Prescription of assistive devices for accessing the computer, frequency of use, and most widely used applications

Question	Response	No.	% of participants who use computers	% of total sample
Prescription of assistive device to access computer	ASPACE center	15/17	88.5	50
	Educational center	1/17	5.9	3.3
	Assistive device not used	1/17	5.9	3.3
Training in the use of the assistive device	ASPACE center	15/17	88.5	50
	Educational center	1/17	5.9	3.3
	Assistive device not used	1/17	5.9	3.3
Frequency of computer use (includes the entire sample)	Several times a day	1/30		3.3
	Several times a week	3/30		9.9
	Several times a month	13/30		43.3
	Never	13/30		43.3

Note. Data are from 17 participants from the total sample.

Individual Perceptions and Level of Satisfaction

Another fundamental part of our study consisted of asking the participants about their level of satisfaction with regard to the use of AAC (6 participants), ICT (17 participants), and access devices for the computer (16 participants). The questions were asked in order to evaluate how appropriate the assistive technology was for each participant's needs. The responses to these questions were positive in all cases. The results are shown in Table 5.

TABLE 5. Satisfaction with ICT, AAC, and assistive devices

Question	Response	No. (answers/participants)	Score (sum of obtained score/total possible score)
Level of satisfaction with use of AAC (6 participants from the entire sample)	Very good (5)	3/6	26/30
	Good (4)	2/6	
	OK (3)	1/6	
Level of satisfaction with use of ICT (17 participants from the entire sample)	Very good (5)	15/17	83/85
	Good (4)	2/17	
Level of satisfaction with assistive devices (16 participants from the entire sample)	Very good (5)	8/16	75/85
	Good (4)	8/16	
	OK (3)	1/16	

Finally, we evaluated each subject's perception about new technologies (Table 6). Also, at the end of the questionnaire, the participants had time to add comments about their adaptation to the use of ICT, their AAC (if used), and their access method. Apart from asking the participants directly, the information was contrasted with the speech therapy, occupational therapy, and educational department staff.

TABLE 6. Response frequency for personal perceptions about new technologies

Ranking according to number of choices		Ranking according to first preference	
Learning	14	Learning	10
Communication	10	Communication	3
Information	8	Other: stimulation	2
Accessibility	4	Other:	2
Freedom	3	entertainment	1
Autonomy	2	Information	
Other: stimulation	2	Autonomy	
Other:	2	Freedom	
entertainment		Accessibility	
Unattainable	0	Inaccessible	
Difficult to access	0	Difficult to access	
Confusing	0	Confusing	
Not at all useful	0	Not at all useful	

Note. Data are from 17 participants from the total sample.

The most frequent response in terms of personal perception was “learning” (14), followed by “communication” (10) and “information” (8). In the section “other,” two participants wrote that ICT represents “stimulation,” and another two wrote “entertainment.”

At the end of the questionnaire, each participant had the opportunity to write a sentence describing what ICT meant to them. The responses had a similar profile. The majority of participants declared that they were happy to take part in ICT sessions in the computer room. Some of the most interesting and useful comments were as follows: “I really like coming to play on the computer”; “This is really fun”; “I prefer coming here to being in class”; and “I always look forward to when they come and get me to go up to the computer room.”

Also, some of the participants' care providers referred to their perception of the AAC: “It's important to communicate with their parents and teachers, but when they want to talk to their classmates, they don't understand the symbols board,” and “The board is useful, but someone has to pick it up and hold it for them while they communicate, and they don't like it.”

Perception of the Educators

The perception of the educators is an important factor to be taken into account, since the application of ICT in the educational process and learning can have positive effects on completing the pupils' curricular program.

Here it should be noted that the 17 participants who regularly use a computer at the ASPACE center do not do so in their classrooms. The intervention session with ICT was directed by the computer technician, the occupational therapist, and/or the speech therapist, depending on the objectives of the session in question.

In order to obtain the opinions of the educators, four questions were included that, in a similar way to the questionnaire for the users, only permitted a single response to the different options (see Appendix B). With regard to whether the use of ICT was viewed as important in the educational environment, the most frequent response was “very” (4), followed by “quite” (2). In order to determine the benefits of the sessions with new technologies in adapting the curriculum to each pupil, the classroom tutors were consulted directly. Four out of six considered that attending these sessions has been very beneficial for the development of their curriculum; one considered it to be quite beneficial, and the rest felt that ICTs have a limited influence on complying with the objectives of the curriculum.

In order to ascertain their perception of the use of ICTs in the classroom itself, tutors were asked if this would be beneficial for the pupils' learning process. In this case, the most frequent response was also “very” (3), although one tutor answered “little.” Also, they were asked if they would be prepared to learn about different ICT resources and apply them in the classroom. While three educators had a very positive response to this question (“very”), one responded “quite” and two were more reticent toward this proposal (“little”). Table 7 shows the educators' responses to the questions.

TABLE 7. Perceptions of the educators in charge of the classrooms

Questions	Response options	No.	%	Score
Importance of ICT as a resource in the educational environment	Very (4)	4	66.6	22/24
	Quite (3)	2	33.3	
Progress with the curriculum for pupils who have computer sessions	Very	4	66.6	21/24
	Quite	1	16.6	
	Little	1	16.6	
Benefits of ICT in the learning process	Very	3	50	20/24
	Quite	2	33.3	
	Little	1	16.6	
Interest in learning about ICT resources and their application in the classroom	Very	3	50	18/24
	Quite	1	16.6	
	Little	2	33.3	

DISCUSSION

This study, carried out by applying a simple questionnaire, was aimed at discovering the specific characteristics of the use of ICTs and assistive technology in accessing computers and communicating among a sample of children affected by CP. The 30 pupils and the 6 educators constitute the entire possible sample, as ASPACE has 30 children in its educative center and 6 professors. Moreover, ASPACE is the only resource for people with cerebral palsy in the region of A Coruña.

Assistive Communication Devices

During the planning stage of this study, it became clear that it was important to consider the specific communication needs of children and young adults with CP. In this case, and as was observed during the survey, the use of assistive devices in communication is still scarce, despite the fact that they are well known and offer a great potential for the development of this community.

A high percentage of the users who took part in the study do not use any type of code in communication, which leads us to consider the need for speech therapy support in the early stages of the development of these pupils in special classrooms. The symbolic code used by 16.7% of the participants can be an adequate augmentative method for communication when the user is not able to read or write and/or has difficulties in language production. As a result, it is important to encourage learning, training, and using this code, but not only among the users. As mentioned before, children with CP use their aided communication devices in the educational center and with their families, which means that they remain limited for other people. Therefore, training ought to consider performance in the context of a wider social environment.

The lack of use of an alphabetic communicator as aided communication indicates the absence of reading and writing abilities among the participants. They have still not acquired the necessary skills to effectively carry out this type of communication, and protocols must be developed for training in these skills. Moreover, their application would make it possible to increase communicative possibilities.

It is also necessary to analyze the low level of use of aided communication: Despite the fact that most participants have communication difficulties, there is little evidence of the use of AAC. Different studies have evaluated the low level of use and the high level of abandonment of aided communication and assistive technology (Martine & Connolly, 2008; Pape et al., 2002; Philips & Zao, 1993; Riemer-Reiss & Wacker, 2000; Verza et al., 2006). As Martine and Connolly (2008) showed, the reasons are many and complex, depending on the environment, the device, the interlocutors, and personal factors. Researchers in Spain must also take into account the high cost of these devices and the absence of uniformity among the health policies adopted by the different regional governments.

As a result, in order for their use to become effective, assistive devices must be developed while addressing the real needs of end users and while taking into account their cost. At present, such usage remains restricted to families with more disposable income, in contradiction with the concept of equal opportunities.

Use of Computers, Individual Perceptions, and Level of Satisfaction

All of the users at the educational center with sufficient cognitive capacity regularly visit the computer room, where they are trained in the use of assistive technologies. These sessions complement their particular curricular program. However, only 4 out of the 17 participants who attend computer class actually use a computer at home. This is due to the fact that many of them do not have the necessary assistive devices to correctly operate the computer at home. Also, it should be noted that this study only considered the assistive technology available at the ASPACE center, and as a result the application and knowledge of these devices was restricted to this availability. The results obtained in this survey are similar to those of other studies (Harwins & Jackson, 1990; Huntinger et al., 1996; Margolis & Goodman, 1999; Miranda de Larra, 2007): Low use rates are due to the lack of the appropriate assistive technology for each user (Cabrera, 2005; Copley & Ziviani, 2005).

It is also important to consider the users' perception of the prescription of aided communication and computer access, which is made directly by the occupational therapist and speech therapist at the center. In this case, the responses were positive in all cases, revealing that the correct connection had been made between the user and the applied assistive technology. This is a fundamental factor in achieving the main objective, which is to make the activity easier for the user. An exhaustive evaluation is required of the capacities and needs of end users, including a dialogue with a multidisciplinary team and the impressions of the family (Copley & Ziviani, 2005).

The responses regarding the level of satisfaction with the use of computers were positive in all cases (very good or good), demonstrating the growing interest in new technologies and their possibilities as educational resources (Pousada et al., 2008). In order to increase the level of computer use among these potential users in their homes, they will need to have the necessary assistive devices available, and training will have to be provided to their parents. Only then will they be able to continue with the techniques and exercises presented in the computer room and improve their learning levels.

Perception of the Educators

Although the main objective of this study was not to obtain the perception of the educational psychologists, the questionnaire did include a number of questions aimed at these professionals in order to reveal their opinions about the suitability of ICT sessions in the computer room at the ASPACE center. Despite the fact that these practitioners perceive new technologies as a highly appropriate resource for complementing the curricula of pupils with special educational needs, one third of the educational psychologists would be relatively unwilling to receive training in ICTs and use them in their classes (Table 7). Taking into account the small sample of educators, the results should be considered carefully.

Educators should see the inclusion of these resources in the classroom as an aid to their educational goals: as a way of supporting the curriculum and a way of introducing innovation and change that seek to improve learning and educational possibilities. For this reason, it would be important to guarantee the training of these types of educators in the use of ICTs applied to inclusive education in order to improve the academic performance of pupils with special educational needs (Davies, Mudge, Ameratunga, & Stott, 2010). As a result, we would suggest a comparative study that analyzes the benefits, difficulties, and prejudices regarding the application of new technologies in special education centers, and a comparison by educators with more traditional teaching methods.

Limitations of the Study

The survey was conducted in a specific educational center with a particular population base, and is thus presented in this context. Therefore, similar surveys in other centers with similar characteristics would expand the results of this study. Other assistive technologies for computer access should also be included to expand the results and transfer them to other contexts.

In order to complete and carry out a more exhaustive analysis of the selection of assistive technology and to quantify the results of its use, a full study must be conducted using validated and standardized tools such as Matching Person and Technology, the Assessment of Computer Task Performance, or the Psychosocial Impact of Assistive Devices (Díez, 2006). Only then will it be possible to obtain a complete and accurate overview of the adequacy of assistive technology in meeting the real needs of people with functional diversity, improving the effectiveness of interventions, and reducing the level of abandonment with regard to these devices. In this case, the surveys should be performed according to rigorous research methods that take into account possible factors that may interact with AT outcomes.

On the other hand, and to guide future surveys, it could be interesting to categorize the results according to age span, severity of disability, or developmental level of the children, since the needs for AAC and computers can vary considerably depending on those factors. Moreover, since the data in this study are only quantitative, it would be interesting to include some open questions that allow students and educators to elaborate and explain their responses, thereby adding a qualitative component.

Finally, it should be remembered that the interview with the educators was a complementary part of the study, not an integral part. Future research should focus on the work carried out with the 30 participants in the sample. The responses of the educational psychologists served to guide the research team in reaching their conclusions. We therefore propose for future surveys the following: (a) to increase the number of questions directed to educators, (b) to include an in-depth qualitative study with open-ended questions, and (c) to perform a statistical analysis to obtain results between qualitative and quantitative questions. It is difficult to give a general overview of the use of assistive technology in people affected by CP since so many factors are involved: social factors, financial considerations, and/or physical context considerations. Also, demographic and

clinical characteristics are highly heterogeneous. According to Davies et al. (2010), given the individual modifications or innovations required, single case studies may be the only method to analyze success in individuals with CP.

CONCLUSIONS

The children with cerebral palsy who participated in this study are pupils with special educational needs, who require specific educational support and attention as a function of their disabilities or serious behavioral disorders (Ministry of Education, 2006). This study has shown that ICTs can only provide continuous support if their application is accompanied by the full involvement of professionals, in this case the team of educators. Only then can pupils actively participate in communicating and in learning under conditions of cooperative interaction; in this broader context these technologies might offer the type of suitable support that can be usefully integrated within the academic environment (Rodríguez, Sánchez, & Soto, 2006). The reduced use of AAC and communication codes reveals that a training protocol is needed.

The study also showed that the environment constitutes an essential factor, especially with regard to the communications aspects of the participants. The interlocutors' lack of knowledge of the specific code often restricts their level of use. This situation is an obstacle to social integration and participation, thus reducing the functionality of assistive devices and possibly even leading to their abandonment. Therefore, as Copley and Ziviani (2005) have observed, the inclusion of all of the individuals involved in the daily and academic life of the child is considered essential to evaluate the need for assistive technology.

The limited use of computers (17 of 30 participants) may be due to a lack of personalized assessment and training at home and insufficient economic means. Parents must become aware of the benefits of computers and assistive technologies, such that their children can benefit from these resources and continue a learning process at home that started in the classroom. It may be interesting to carry out a study on the factors that affect the use of assistive technology and aided communication devices by these pupils.

Despite the positive results in the perception of new technologies and their contribution to the learning process, the pupils who use the computer room do not use ICTs in their classrooms. This is due to lack of knowledge on the part of the educators. Achieving greater support among the professional groups involved will also be crucial in order to work toward a common goal: the usage of ICTs as an educational resource for strengthening the skills of children with disabilities, thereby helping to achieve a more equitable set of circumstances wherein everyone can aspire to have equal opportunity in the educational process. Finally, we refer to the suggestions of the European Agency for Development in Special Needs Education (2001) in its report on the application of new technologies in education for pupils with special needs regarding the future development of ICTs, since these suggestions further support the conclusions reached in this study.

In conclusion, and in agreement with Davies et al. (2010), “more comprehensive studies should be undertaken in this area of research such that the research results can be grouped on the basis of functional ability as well as environmental and personal factors.”

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APPENDIX A: QUESTIONNAIRE FOR CHILDREN

Classroom:

Code (Initials):

Age:

Sex: □ Male /□ Female

Diagnosis:

□ Spastic CP

□ Athetoid CP

□ Ataxic CP

□ Mixed CP

□ CP-like pathology

COMMUNICATION AND ASSISTIVE DEVICES

Does the user have communication difficulties? □ Yes / □ No

Diagnostic age in communication disorders:

□ Before 2

□ Between 3 and 10

□ More than 10

Type of communication difficulties:

□ Anarthria

□ Dysarthria

□ Alalia

□ Agraphia

□ Dyslexia

□ Delayed language development

□ Autism

□ Intellectual deficit

□ Others

□ None

Does the user use some type of AAC system? □ Yes / □ No

Type of communicative code:

□ Ordinary language

□ Drawings representing objects (SPC, Bliss, PIC …)

□ Gestural

□ None

Type of AAC system used:

□ Symbols on paper (static)

□ Symbolic software (dynamic)

□ Syllabic chart on paper (static)

□ Symbolic communicator

□ Alphabetic communicator

□ Others:

□ None

Type of access to AAC system:

□ Pointing with finger

□ Eye pointing

□ Switch

□ Without indication

Environment where AAC system is used:

□ Home and family environment

□ Educational centre

□ Community

□ Others:

Participants in the use of the AAC device:

□ Family members

□ Friends

□ Professionals from the centre

□ Other healthcare professionals

□ Others:

USE OF COMPUTERS, ASSISTIVE AND INDIVIDUAL PERCEPTION DEVICES

Do they normally use a computer in the centre? □ Yes / □ No

Do they have a computer at home? □ Yes / □ No

Do they use a computer at home? □ Yes / □ No

If they do not use a computer in the centre or at home, why not?

□ Lack of motivation

□ Lack of means

□ Lack of training / habituation

□ Cognitive abilities

Fill in only if the user uses the computer:

Type of access: □ Normal (without AT) □ With some type of adaptation

Input method used: □ Direct □ By scanning

Assistive devices for accessing the computer *(if used):*

□ Accessibility options in Windows XP

Keyboards:

□ Concept board

□ On-screen keypad

□ Keyboard with extra large keys

□ Keyboard with keyguard

□ Plastic keypad

□ Single hand keypad

□ Touch screen / Tablet PC

Mice:

□ Joystick

□ Trackball

□ Facial mouse

□ Individual head tracker

□ Head tracker combined with software to emulate mouse functions

□ Iriscom®

□ Virtual mouse

Switches:

□ Touch or pressure switch

□ Breath switch

□ Tongue switch

□ Wand/stick

Access software:

□ InTIC (software author)

□ Boardmaker Dynamically®

□ Saw®

□ Text prediction

□ Voice recognition

□ Other adaptations (holders, supports, etc.):

Prescription of assistive devices:

Professional:

□ Occupational therapist

□ Speech therapist

□ Teacher

□ Social worker

□ Other:

Prescription location:

□ ASPACE Centre

□ Early Attention Unit

□ Other educational centre

□ Others:

Training:

□ ASPACE Centre

□ Early Attention Unit

□ Other educational centre

□ Home

Most frequently used computer applications:

□ Text editors

□ Spreadsheets

□ Databases

□ Internet Explorer

□ Multimedia players

□ E-mail

□ Educational programmes to access curriculum / entertainment

Frequency of use:

□ Several times a day

□ Several times a week

□ Several times a month

□ Never

Level of satisfaction with current type of access to computer:

□ Very good

□ Good

□ OK

□ Poor

□ Very poor

Level of satisfaction with use of computer:

□ Very good

□ Good

□ OK

□ Poor

□ Very poor

What do technologies (computer, assistive technologies to access it and assistive devices to communication) mean to you?

□ Learning

□ Independence

□ Information

□ Communication

□ Freedom

□ Accessibility

□ Inaccessible

□ Difficult to access

□ Confusing

□ Not at all useful

□ Others:

Comments / Observations:

APPENDIX B: QUESTIONNAIRE FOR EDUCATORS

Code:

Classroom:

Do you consider the use of Information and Communications Technologies to be important as an educational resource?

□ Very much

□ Quite

□ A little

□ Not at all

Have you noticed any type of progress in the curriculum of students attending computer sessions?

□ Very much

□ Quite

□ A little

□ Not at all

Do you think the use of Information and Communications Technologies is beneficial for your pupils in the learning process?

□ Very much

□ Quite

□ A little

□ Not at all

If you had the opportunity, would you be interested in learning about ICT resources and their application in your classroom?

□ Very much

□ Quite

□ A little

□ Not at all