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Computer and microswitch-based programs to improve academic activities by six children with cerebral palsy

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ABSTRACT

This study was aimed at extending the use of assistive technology (i.e. microswitch such as a pressure sensor, interface and laptop) with a new setup, allowing six children with cerebral palsy and extensive motor disabilities to improve their academic activities during classroom. A second objective of the study was to assess a maintenance/generalization phase, occurring three months after the end of the intervention, at participants' homes, involving their parents. A third purpose of the study was to monitor the effects of the intervention program on the indices of positive participations (i.e. constructive engagement) of participants involved. Finally, a social validation procedure involving 36 support teachers as raters was conducted. The study was carried out according to a multiple probe design across behaviours followed by maintenance/generalization phase for each participant. That is, the two behaviours (i.e. choice among academic disciplines and literacy) were learned first singly, then combined together. Results showed an increasing of the performances for all participants involved during intervention phases. Furthermore, during maintenance phase participants consolidated their results. Moreover, positive participation augmented as well. Support teachers, involved in the social validation assessment, considered the combined intervention as more favourable with respect to those singly learned. Clinical, educational and practical implications of the findings are discussed.

1. Introduction

Cerebral palsy (CP) refers to a group of non progressive disorders concerning the posture and/or the movement, caused by a defect in the fetus or a lesion in the immature brain (Bax et al., 2005; Rosenbaum, Paneth, Leviton, Goldstein, & Bax, 2007) and constitutes a frequent cause of long-term physical disability during childhood, added to speech and cognitive impairments (Huang, Tseng, Chen, Shieh, & Lu, 2013). Consequently, children with CP may have serious limitations in different functional activities. For example, some of them will exhibit ambulation difficulties, some may encounter intellectual disabilities (Palisano, Rosenbaum, Bartlett, & Livingston, 2008), some other may present literacy incapacities

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dues to movement deficits (Peeters, de Moor, & Verhoeven, 2011). Thus, the aforementioned clinical conditions may seriously hamper the social image, desirability and status of children with CP, aggravating their passivity and reducing their participation and/or active role in daily life (Spittle & Orton, 2014). Undoubtedly, school is one of the basic contexts where children acquire academic competences and expand social network (Shenker, Coster, & Parush, 2005). According to Jenks, de Moor, van Lieshout, and Withagen (2010) children with CP do not receive adequate instruction time concerning arithmetic in school settings, while Peeters, Verhoeven, de Moor, and van Balkom (2009) point out that children with CP may pose various problems of words decoding, in light of low levels of speech intelligibility. To overcome these issues, one may envisage the use of assistive technology (AT) (Lancioni & Singh, 2014).

AT includes tools and/or devices designed to ensure to a child presenting self-determination and independence despite the developmental disabilities, to improve his/her quality of life (Felce & Perry, 1995; Lancioni et al., 2006b; Livingstone & Paleg, 2014). That is, by using an AT device or system, a child with CP may interact autonomously with the outside world, eventually acquiring mastery and reaching satisfactory levels of self-concept (Shields, Loy, Murdoch, Taylor, & Dodd, 2007; von der Luft, Harman, Koenig, Nixon-Cave, & Gaughan, 2008). Literature concerning the use of AT for children with developmental disabilities and CP is robust (Dhas, Samuel, & Manigandan, 2014; Lancioni, Sigafoos, O'Reilly, & Singh, 2012; Pousada, Pareira, Groba, Nieto, & Pazos, 2014; Shih, 2014), although its implementation in school settings has been few investigated (Huang, Sugden, & Beveridge, 2009; Salminen, Petrie, & Ryan, 2004).

Within this topic, Stasolla, Caffò, Picucci, and Bosco (2013) exposed three children with cerebral palsy and severe communication impairments to a computer-aided program, enabling participants to ask for their personal needs (e.g. leisure option), with the mediation of a caregiver, in their home setting. A similar setup was assessed by Stasolla and De Pace (2014) for two boys emerged from a minimally conscious state, and subsequently by Stasolla, Caffò, et al. (2015) who proposed to three children, emerged from a minimally conscious state and extensive motor disabilities, an update of the aforementioned program, allowing the participants to access to literacy process. Moreover, indices of positive participation were recorded as sign of constructive engagement of participants involved (Stasolla, Damiani, & Caffò, 2014a). Those indices have been already detected in Alzheimer's patients (Caffò et al., 2014; Lancioni et al., 2013, 2014).

2. What this paper adds

The present study would represent a further extension of the aforementioned empirical evidences (in terms of participants involved and adaptive behaviours considered), providing a new setup for six children with cerebral palsy and extensive motor disabilities in a school setting. Specifically, the study pursues the following objectives: (a) updating the technology with new options available for each participant involved, (b) introducing a maintenance/generalization phase, three months after the end of the intervention at participants' homes, involving their parents, (c) monitoring its effects on positive participation, and (d) carrying out a social validation assessment with 36 support teachers as raters (Lancioni et al., 2006a; Stasolla, Perilli, & Damiani, 2014d).

3. Method

3.1. Participants and settings

The participants (Alan, Carey, David, Gary, Sharon and Tom) were 10.4, 9.3, 9.5, 11.6, 11.2 and 12.2, respectively (mean age 10.7) at the beginning of the study. They were all diagnosed with cerebral palsy by their neurologists, who recruited and reported them to the research team. Although no formal IQ score was available, since no test was feasible due to their general conditions, they were estimated as borderline between the normal and the mild level of intellectual disabilities, from clinical observations. They presented lack of speech, communication and developmental impairments, low awareness of sphincter needs, dystonic movements, although they were capable of few ambulation responses, if adequately supported by a caregiver. Moreover, they were all equipped with a wheelchair and were capable of "yes" and "no" responses, by using head movements. They were unable to interact positively with surrounding objects due to extensive motor disabilities. They attended regular class with a support teacher and a special educational program and had, three days per week, physiotherapy and speech sessions at home. They were included in this study since they were able to match a picture with an academic activity and they were literate, although they were unable to access to the literacy process, due to extensive motor impairments.

The study was carried out within school context, with the cooperation of their support teacher (i.e. baseline and intervention phases, see Section 3.5). The subsequent maintenance/generalization phase was conducted at participants' homes, with the cooperation of their parents. The academic activities (see below) were selected upon concordance between parents, support teachers and participants. The families and the schools staff considered the rehabilitative program high desirable. In fact, they signed a formal consent for the participation to it, which was approved by a local scientific-ethic committee.

3.2. Selection of stimuli and academic activities

Matched to an informal interview with their parents and support teachers, a preliminary formal screening of preference, concerning the academic activities and positive stimulation to be used as primary reinforcement, was assessed, according to