The evaluation of the Conductive Education program and the implementation of a Cognitive Stimulation program in a home for children with developmental disabilities in a rural area of South Africa.

R.V. Vos, 3056821, Department of Psychology, Faculty of Social and Behavioural Sciences, Utrecht University, Utrecht, the Netherlands

N. van Westrhenen, 3056929, Department of Psychology, Faculty of Social and Behavioural Sciences, Utrecht University, Utrecht, the Netherlands

General coordinators: Prof. Dr. A. Vermeer and Prof. Dr. T. Knijn.

Supervisors: Mrs. Z. Magyarszeky (South Africa) and Dr. L. Wijnroks (The Netherlands)
Second Supervisors: Prof. Dr. M.A.G. van Aken and Dr. E. R. Bossema (The Netherlands)

Utrecht University
Faculty of Social and Behavioural Sciences
Heidelberglaan 1
3584 CS Utrecht
The Netherlands

Sizanani Village Trust
Sizanani Children's Home
P.O. Box 1372
Bronkhorstspruit 1020
South Africa

Abstract

Introduction: A Conductive Education (CE) program and a Cognitive Stimulation (CS) program were implemented in Sizanani Children's Home, a residential facility in South Africa for children and young adults with mental and physical disabilities, most of them diagnosed as cerebral palsy. The effect of one year CE on the development of functional skills and the effect of three months CS on play abilities were evaluated. **Methods:** The CE program included 39 participants in the age of 8 to 33 years, whereas the CS program included 18 participants in the age of 8 to 30 years. Gross motor functioning was assessed with the Gross Motor Functioning Classification System (GMFCS), whereas the functional skills were assessed with either the Pediatric Evaluation of Disability Inventory (PEDI) or the Goal Attainment Scale (GAS) and with the Functional Motor Assessment Scale (FMAS) and the Level of intervention Observation Instrument (LOI). For the CS program the Play Observation Scale (POS) was developed to measure play abilities. The CS program had two experimental conditions; one with and one without social interaction, in addition to a control condition. **Results:** One year of CE showed an improvement in the functional motor abilities of the participants measured with the GAS and FMAS. According to the PEDI, functional skills only improved in Caregiver Assistance in the Self-care scale, whereas the LOI showed an improvement in functional skills in dressing. No relation was found between the change in functional skills measured with the FMAS and the LOI and the level of gross motor functioning measured with the GMFCS. The CS program resulted in a non-significant improvement of the play abilities of the participants in the two experimental conditions. **Conclusion:** The results show that continuation of the CE program is beneficial for the functional skills of the children and young adults of Sizanani Children's Home. The effectiveness of the CS program at a longer term has to be awaited.

Keywords: Cerebral Palsy, Cognitive Stimulation, Conductive Education, Motor and cognitive disabilities, Physical and cognitive development, South Africa.

Samenvatting

Introductie: Een Conductive Education (CE) programma en een Cognitief Stimulatie (CS) programma zijn geïmplementeerd in Sizanani Children's Home, een residentiële inrichting in Zuid-Afrika voor kinderen en jong volwassenen met mentale en fysieke beperkingen, waarvan de meeste gediagnosticeerd zijn als cerebrale parese. Het effect van een jaar CE op de ontwikkeling van de functionele dagelijkse vaardigheden en het effect van drie maanden CS op spelvaardigheden werd geëvalueerd. **Methoden:** Aan het CE programma werd door 39 participanten in de leeftijd van 8 tot 33 jaar deelgenomen en aan het CS programma 18 participanten in de leeftijd van 8 tot 30 jaar. Grof motorisch functioneren werd gemeten met de 'Gross Motor Functioning Classification System' (GMFCS), terwijl het dagelijkse functioneren werd gemeten met of de 'Pediatric Evaluation of Disability Inventory' (PEDI) of de 'Goal Attainment Scale' (GAS) en met de 'Functional Motor Assessment Scale' (FMAS) en de 'Level of intervention Observation Instrument' (LOI). Voor het CS programma is de 'Play Observation Scale' (POS) ontwikkeld om de spelvaardigheden te meten. Het CS programma had twee experimentele condities; één met en één zonder sociale interactie, en een controle conditie. **Resultaten:** Één jaar van CE liet verbetering zien in de functionele motorische vaardigheden van de participanten gemeten met de GAS en de FMAS. Op de PEDI verbeterden de functionele vaardigheden alleen in 'Caregiver Assistance' in de 'Self-care' schaal, terwijl de LOI verbetering liet zien in functionele vaardigheden bij het aankleden. Geen relatie werd gevonden tussen de verandering in functionele vaardigheden gemeten met de FMAS en de LOI en het niveau van grof motorisch functioneren met de GMFCS. Het CS programma resulteerde in een niet significante verbetering van de spelvaardigheden van de participanten in de twee experimentele condities. **Conclusie:** De resultaten tonen aan dat het voortzetten van het CE programma bevorderlijk is voor de functionele dagelijkse vaardigheden van de kinderen en jong volwassenen in Sizanani Children's Home. De effectiviteit van het CS programma op lange termijn kan nog niet worden vastgesteld.

Sleutelwoorden: Cerebrale parese, Cognitieve Stimulatie, Conductive Education, Fysieke en cognitieve ontwikkeling, Motorische en cognitieve beperkingen, Zuid-Afrika.

Introduction

Sizanani Children's Home

Sizanani Children's Home is a residential facility in rural South Africa for children and young adults with neurological disorders, situated in Bronkhorstspruit. Sizanani Children's Home opened in March 1993. Sizanani Children's Home currently accommodates 63 children and young adults with moderate to profound mental and physical disabilities. Their ages range from 3 to 33 years. The Home employs approximately 29 childcare workers who take care of the daily needs of the children and young adults, but due to a shortage of specialized staff there was previously not enough treatment and education provided to them (Vermeer, Wijnroks & Magyarszeky, 2006).

Since 2003 the Home began the process of shifting its core function from nursing care towards developing the children's and young adult's potential to become more independent. Two intervention programs have been implemented to improve this independence, one was introduced in 2003 and focuses on the functional skills and the second is a pilot study set up in 2009 by the recent researchers and concerns the cognitive functioning of the children and young adults. Both programs are evaluated separately in the current study.

The children and young adults of Sizanani Children's Home

Almost all the children and young adults in Sizanani Children's Home have intellectual and physical disabilities and most of them have been diagnosed as cerebral palsy. In the Western world 2 to 2.5 of every 1000 newborn children are diagnosed as this condition (Stanley, Blair & Alberman, 2000). In the rural district of Bushbuckridge in the Northern Province of South Africa, a poorer province with worse medical care compared to the province Mpumalange where Sizanani Children's Home is situated, a prevalence of 35.6 per 1000 children with developmental disabilities in this population has been reported (Christianson et al., 2002). Epilepsy (15.5%) and cerebral palsy (8.4%) were the most common associated disabilities in this group with disabilities. The prevalence of cerebral palsy in rural South Africa has been set at 3 per 1000 children (Christianson et al., 2002).

The term cerebral palsy is generally used as 'an umbrella term covering a group of non-progressive, but often changing, motor impairment syndromes secondary to lesions or anomalies

of the brain arising in the early stages of development' (Mutch, Alberman, Hagberg, Kodama & Velickovic, 1992, p 549). Deviances in the development of motor functions are already seen in the first 12 to 18 months of life. It affects the capacity to explore actively and to learn about space, effort, independence and the social consequences of moving and touching. This may result in both behavioural challenges and sensory impairments (Rosenbaum, 2003; Kennes et al., 2002). Research from Cadman, Boyle, Szatmari and Offort (1987) pointed out that children with both chronic illness and associated disability were at greater than threefold risk for psychiatric disorders and at considerable risk for social adjustment problems.

Conductive Education

An effective way to stimulate children with cerebral palsy in their motor functioning and to teach them skills that are necessary in everyday activities is Conductive Education. Dr. Andreas Petö conceived the concept known as Conductive Education (CE) in Hungary in the 1950s to assist children with motor dysfunction to attain 'orthofunction', enabling them to attend school with maximum independence (Coles & Zsargo, 1998). Hari and Akos (1988) described 'orthofunction' as "… that protean capacity involving the entire personality enabling the individual to satisfy the biological (and social) demands made upon him" (p. 140).

CE is based on an educational rather than a medical model of intervention and it integrates education and rehabilitation goals into one program. The four main elements of CE are: task-oriented learning within highly structured programs, facilitating motor actions by the structured use of rhythmic singing, integration of manual abilities into the context of activities of daily life and child-oriented group settings to facilitate psychosocial learning to increase the level of participation (Blank, von Kries, Hesse & von Voss, 2008). According to the study by Blank et al. (2008), CE improves especially coordinative hand functions and activities in daily life in children with cerebral palsy. Hand functions play a key role in self-care and independence in self-care is a major goal of CE.

Conductive Education program in Sizanani Children's Home

The CE program in Sizanani Children's Home was introduced in 2003 and focuses on teaching the children and young adults skills that are necessary in everyday activities. The childcare workers are trained to utilize their time with the children and young adults in the most optimal

way to create learning situations. The CE program is practised in everyday one hour group therapy sessions in which the children and young adults work toward specific developmental skills. All children and young adults have individual goals, but there is also a common focus. Depending on the current level of development and the individual goals of the children and young adults, the focus is on sensory development and basic motor skills, academic development, developing communication or independence and social skills.

Lange and Post (2008) measured the effects of the CE program between May 2005 and April 2008. According to this study, the CE program did not significantly improve the functional skills of the children and young adults, but a positive trend was found according to the used GAS-goals and the Social Functioning domain of the Caregiver Assistance scale of the PEDI. To investigate if there is a significant improvement between April 2008 and April 2009, the current study used the measurements done by Lange and Post in April 2008 as the baseline for a follow-up study to measure the effects of the CE program on the functional skills of the children and young adults in Sizanani Children's Home.

The research questions concerning the CE program were:

1a. Did the functional skills of the CE research group improve during the CE program between April 2008 and April 2009?

1b. Is the change in functional skills of the CE research group during the CE program between April 2008 and April 2009 related to the level of gross motor functioning as measured by Lange and Post in April 2008?

The expectations were that the functional skills of the CE research group would be improved between April 2008 and April 2009 and that this improvement was related to the children's and young adult's level of gross motor functioning measured in April 2008 by Lange and Post with the Gross Motor Functioning Classification System. In particular, the children and young adults with a higher baseline level of gross motor functioning would have improved less then the children and young adults with a lower baseline level of gross motor functioning, because for these children and young adults the ceiling of their abilities is closer to their current level of functioning, resulting in less room for improvement.

Cognitive Stimulation

Since cerebral palsy not only affects motor development but also the cognitive and social development, it seems beneficial to focus an intervention program also on the cognitive stimulation of children and young adults with cerebral palsy. Because one of the most important ways through which children learn and explore actively is play, one could gain insight into a child's cognitive development by observing play performance (Majnemer, Messier & Ferland, 2008). Playing with toys helps children to master developmental and cognitive tasks (Hsieh-Chun, 2008).

Piaget (1962) made a classification system for the successive stages by which children without disabilities master these developmental and cognitive tasks. The stages are based on the degree to which play remains purely sensorimotor or if the playing has some bearing on thought itself. The variables, which the successive stages are based on, are 'Functional play', 'Constructive play' and 'Dramatic play'. 'Functional play' is an activity that is done simply for the enjoyment of the physical sensation it creates. Generally speaking, the child engages in simple repetitive muscle movements with or without objects. Specific examples are pouring water from one container to another, making faces and ringing bells and buzzers. The definition of 'Constructive play' is the manipulation of objects to construct or to "create" something. Pounding on play dough for the sensory experience of the pounding is considered to be 'Functional play'; however, pounding for the purpose of making a "cookie" is coded as 'Constructive play'. Any element of pretend play is coded as 'Dramatic play'. The child may take on a role of someone else, or may be engaged in pretend activity, for example pouring pretend water into a cup and then "drinking" it. The child may also attribute life to an inanimate object and for instance make a puppet talk.

Where children without disabilities succeed through the successive stages of Piaget, children with cognitive disabilities appear to have limitations in their behaviour while playing with toys (Pierce-Jordan & Lifter, 2005; Rutherford & Rogers, 2003). They often seem to engage less in play activities than peers without disabilities, which may affect the development through the stages of Piaget (Reid, DiCarlo, Schepis, Hawkins, & Stricklin, 2003). Studies support the relationship between play performance, cognitive development and mental age (Majnemer et al., 2008). Besides the important role of play in the cognitive development, social interaction involving more capable peers and adults provides a context for a shared construction of

knowledge and understanding. Vygotsky theorized that every function of the child's development occurs first at the social level before the individual level (Vygotsky, 1987, in Fu & Stremmel, 1993). These two variables, play performance and social interaction, are considered to be important factors for the development of a Cognitive Stimulation program.

Cognitive Stimulation program in Sizanani Children's Home

The focus of the previous studies in Sizanani Children's Home has been at the physical and functional development of the children and young adults. In Sizanani Children's Home there is not much personal attention and interaction with the children and young adults. The expectation is that the implementation of structured social interaction and play with the children and young adults will enhance their cognitive abilities. For this reason a three month Cognitive Stimulation (CS) program was designed and implemented as a pilot study. The goal of this program was to stimulate the cognitive development of the participants through the provision of extra stimuli in the form of toys to look at and touch and play with within a social context. To control for the effects of both cognitive stimulation and social interaction, three conditions were set up. The children and young adults in the first condition received cognitive stimulation within a social context; those in the second experimental condition received just the cognitive stimulation without social interaction; and the children and young adults in the third condition, the control group, did not receive any cognitive stimulation and social interaction during the three months.

The research questions concerning the CS program were:

2a Did the play abilities of those who received the three months of CS program improve compared to those who did not receive the CS program?

2b. Do the play abilities of those who received the three months of CS program with social interaction differ from those who received the CS program without social interaction?

It was expected that the play abilities of the children and young adults who received the CS program would be improved more than the play abilities of the children and young adults who did not receive the CS program, and that the play abilities of those who received the CS program in a situation with social interaction would improve more than those who received the CS program without social interaction.

Methods

Conductive Education program

Design

The current research concerning the CE program is part of a longitudinal research project and has a quasi-experimental baseline-intervention-follow-up design.

Participants

The CE program included the same children and young adults as the CE research group in April 2008, minus two children who past away last year. The CE research group consisted of 39 children and young adults, thus 62% of all children and young adults in Sizanani Children's Home. The CE research group included 27 boys aged between 8 and 30 years (M = 20.2, SD = 5.3) and 12 girls aged between 10 and 33 years (M = 19.6, SD = 7.1). The diagnosis of the children and young adults was as follows: spastic quadriplegia N = 21, spastic diplegia N = 4, ataxia N = 3, spastic hemiplegia N = 1, spastic triplegia N = 1, athetoid athetosis N = 1, and other (i.e. developmental delay, brain injury, autism and hydrocephaly) N = 5. In addition, some of the children and young adults suffer from epilepsy, visual and hearing impairments, microcephaly and hyperactivity. The level of gross motor functioning of the CE research group as assessed with the Gross Motor Functioning Classification System for cerebral palsy (GMFCS; Palisano et al, 1997) by Lange and Post in April 2008 is shown in Table 1.

Table 1: *Level of gross motor functioning according to the GMFCS in the CE research group**

Level	Description level	Number (%)
1	Walks without limitations	1 (2.6%)
2	Walks with limitations	3 (7.7%)
3	Walks using a hand-held mobility device	2 (5.1%)
4	Self-mobility with limitations; may use powered mobility	11 (28.2%)
5	Transported in a manual wheelchair	22 (56.4%)

Note. GMFCS = Gross Motor Functioning Classification System for cerebral palsy.

* Data obtained by Lange and Post (2008).

Instruments

Gross motor functioning was assessed with the Gross Motor Functioning Classification System for cerebral palsy (GMFCS), whereas functional skills were assessed with either the Pediatric Evaluation of Disability Inventory (PEDI) or the Goal Attainment Scale (GAS) and with the Functional Motor Assessment Scale (FMAS) and Level of intervention Observation Instrument (LOI). Since it was expected that the PEDI is not sensitive enough to evaluate functional skills of those children and young adults scoring a level 5 of the GMFCS, for those children and young adults the GAS was used instead of the PEDI. Each of those instruments will be described below.

Gross Motor Functioning Classification System for Cerebral Palsy

The Gross Motor Functioning Classification System for Cerebral Palsy (GMFCS; Palisano et. al., 1997) is a five-level classification system which measures the present abilities and limitations in gross motor function of children and young adults with cerebral palsy on the basis of their self-initiated movement with particular emphasis on sitting, walking and wheeled mobility. The first level represents good abilities in sitting and walking and the fifth level represents a low level of independence (see Table 1).

Pediatric Evaluation of Disability Inventory

The Pediatric Evaluation of Disability Inventory (PEDI; Haley, Coster, Ludlow, Haltiwanger & Andrellos, 1992) evaluates functional skills in children with cerebral palsy. The PEDI was only used for those children and young adults scoring a level 1 to 4 on the GMFCS. The PEDI can be administered by parents or a caregiver who knows the child well for evaluation and discrimination of the level of functional abilities. The PEDI consists of three scales: the Functional Skills scale, the Caregiver Assistance scale and the Modification scale. Each of these scales is designed to capture a different aspect of the child's daily functioning in three domains: Self-care, Mobility and Social Function. The Self-care domain contains areas like eating and washing; the Mobility domain contains simple transfers and mobility in different environments; and the Social domain is concerned with living with others in one community and social functional skills.

The Functional Skills scale includes 197 items distributed across 15 areas of Self-care, 13 areas of Mobility and 13 areas of Social function. Capability in those areas is measured by identification of functional skills for which the child has demonstrated mastery and competence. For each skill specific behavioural scoring criteria are provided. The items of the Functional Skills scale can be scored as either 0 = 'unable' or 1 = 'able'. Per domain the scores were added and these raw scores were transformed into scaled scores from 0 to 100, where a score of 100 equals the highest motor functioning. The items 8, 9, 20, 21, 22, 23 of the Self-care domain and the items 51, 53, 54, 56, 58 and 59 of the Mobility domain of the Functional Skills scale were deleted because there were not applicable for Sizanani Children's Home.

The Caregiver Assistance scale measures the extent of help needed in 20 typical daily situations, using a six-point scale ranging from 0 = 'total assistance' to 5 = 'independent'. The level of caregiver assistance provides a general assessment of independence and of the amount of help a child needs to complete a particular functional activity. Per domain the scores were added and these raw scores were transformed into scaled scores from 0 to 100, where a score of 100 equals the highest level of independence. The item G (i.e. 'walking on stairs') from the Mobility domain of the Caregiver Assistance Scale was deleted because it was not applicable for Sizanani Children's Home.

The Modification scale measures adaptations or use of objects, but was not used in this research because of a lack of sufficient specialized equipments in Sizanani Children's Home. The scale could be left out without affecting the other scales (Haley et al., 1992).

Goal Attainment Scale

The Goal Attainment Scale (GAS; Kiresuk & Shurman, 1968) measures achievement of a specific task for a child. This development was operationalized by achieving two different goals based on the CE program, within a six month period with a two month interval. An example is:

- 2 month goal: To learn to raise head to midline in prone position momentarily.
- 4 month goal: To learn to raise head to midline in prone position for 5 seconds.
- 6 month goal: To learn to raise head to midline in prone position for 10 seconds.

The scoring at the scale is as follows: for achievement of the first goal at two months, 1 point is received, for the achievement of the second goal at four months 2 points are received, and for the achievement of the final goal at six months, the maximal score of 3 points is received.

Functional Motor Assessment Scale

The Functional Motor Assessment Scale (FMAS; Vermeer, 1989) is an observation method whereby the children have to demonstrate several functional motor abilities. The FMAS consists of 14 items which could be answered on a 5-point Likert scale from 1 = 'non-independent execution of the skill' to 5 = 'independent execution of the skill'; a score of 0 is given if the child was not able to get into the starting position (Vermeer, Kruithof & van Zoggel, 1995). A scaled score is computed by adding all the item scores and dividing these by the total number of items. The items 12 and 14 referring to stairs and bicycles were left out in the present study because they were not applicable for Sizanani Children's Home.

Levels of intervention Observation Instrument

The Levels of intervention Observation Instrument (LOI; Vermeer et al., 2006) is an observation method to categorize teaching strategies used by professionals to bring a child to an independent performance on a task. The categorization takes place on a 7-point scale measuring the level of guidance needed for the child during dressing and feeding. The score 1 equals the lowest independence, where the score 7 equals the highest independence. A sixty-second time interval was used to score the level of guidance until the task was finished. Every guidance level is a score point (level 1 is one point, level 2 two points etcetera). To calculate the scaled score all sample points are added and divided by the number of samples and then by the number of possible answers (i.e. 7), which results in a scaled score ranging from 0 to 1.

Procedure

To categorize the gross motor functions of the children and young adults, the results of the measurements of the previous researchers on the GMFCS were used (Lange & Post, 2008). The PEDI was administered by interviewing the childcare workers in a separate, quiet, room and was conducted in English. For the GAS, the researchers observed the individual goals of the children and young adults. The child had to be in the right starting position and the child was motivated with music or toys to help them achieve the goal. The goals were evaluated with the help of the childcare workers who know the abilities of the child well. Scores were given dependent on the achievements of the children and young adults. The children and young adults were also observed with the FMAS. The researchers gave the child instructions on what to do. Childcare workers

were available for translation if the child did not understand English. Scores were given dependent on the children's and young adult's achievements. The observations for the LOI were conducted during dressing, which started directly after the moment the child was dry after bathing, and during feeding, from the first bite until the plate was empty. Every minute the level of the guidance was scored. The first four participants were observed by both researchers and since the scores given by both researchers were identical, it was decided to observe separately from then on.

Statistical analysis

All analyses were conducted using the Statistical Package for Social Sciences (SPSS, version 16.0, 2007). The scores at the PEDI, GAS, FMAS and LOI of April 2009 were compared to the scores obtained in April 2008 by Lange and Post with paired-samples t-tests. The assumption of normality was analyzed with histograms. Not all dependent variables appeared to be normally distributed, but it was decided to use the t-test because it is robust against violation of this assumption.

In order to test whether the change in functional motor abilities as measured with the FMAS and the functional skills as measured with the LOI were dependent on the level of gross motor functioning as measured with the GMFCS, first a change score was calculated by subtracting the score in April 2009 from the score in April 2008. Then Spearman's correlation coefficients were calculated between the change scores of the FMAS and LOI on the one hand and the GMFCS score on the other. This was done for the FMAS and LOI only, since these were the only two instruments in which all the five levels on the GMFCS were represented.

For all analysis a $p < .05$ was significant.

Cognitive Stimulation program

Design

The Cognitive Stimulation study had a non-randomised pretest-posttest matched control group design, with three conditions. The three conditions were two experimental conditions, one with cognitive stimulation and social interaction and one condition with only cognitive stimulation, and one control condition. The 18 participants were divided into three equal groups across these three conditions, based on their level of the GMFCS and the results of the first measurement of the POS, to make the groups as equal as possible (see Table 2).

Participants

The CS program included 18 children and young adults, thus 29% of all the children and young adults in Sizanani Children's Home. Only the children and young adults from the CE research group who were physically able to play with toys were selected for the CS program. More specifically, these were the children and young adults scoring a level 1 to 4 at the GMFCS and one child scoring a level 5 on the GMFCS measured by Lange and Post in April 2008 (Table 1). The CS research group included 13 boys aged from 8 to 30 years (M = 21.4, SD = 6.3) and 5 girls aged from 17 to 27 years (M = 21.4, SD = 4.4). To test the homogeneity of the three conditions, an Analysis of Variance was computed for age. Since the results did not show significant differences between the conditions in age (F(17;14) = 1,02, p = .49), no post-hoc test was computed. Homogeneity was not tested for gender. Since gender is a nominal variable a chi-square analysis had to be computed but because of the small sample size the assumptions for this test were violated. The diagnosis of the children and young adults in this group was as follows: spastic quadriplegia N = 5, spastic diplegia N = 3, athetoid athetosis N = 2, spastic hemiplegia N = 1, spastic triplegia N = 1, ataxia N = 1, and other (i.e. developmental delay, autism and hydrocephaly) N = 5. Table 2 describes the participants characteristics, level on the Play Observation Scale (POS) and level of gross motor functioning as assessed with the GMFCS by Lange and Post in April 2008 of the children and young adults in the three conditions.

Table 2: *Participants characteristics and POS level and GMFCS classification in the CS research group per condition*

Condition	Gender		Age		POS level		GMFCS classification*				
	Boy	Girl	*M*	*SD*	*level 1*	*level 2*	1	2	3	4	5
E1	5	1	20.8	7.2	2	4	-	1	-	4	1
E2	5	1	22.3	3.8	1	5	-	1	1	4	-
C	3	3	21.0	6.5	1	5	1	1	1	3	-

Note. E1 = cognitive stimulation and social interaction condition, E2 = cognitive stimulation condition, C = control condition, POS = Play Observation Scale, GMFCS = Gross Motor Functioning Classification System for cerebral palsy.

*Data obtained by Lange and Post (2008)

Instruments

For the CS program a Play Observation Scale (POS) was developed to measure play abilities during the program. This scale will be described below.

Play Observation Scale

The purpose of the POS was to assess the children's and young adult's cognitive play in a free play setting. The variables chosen were based upon Piaget's (1962) classification of successive stages of play: 'Functional play', 'Constructive play' and 'Dramatic play'.

The POS consists of two levels so that the participants with a low level as well as the participants with a higher level of cognitive functioning at the start of the CS program were able to improve their play abilities. Level 2 was used for those participants who had a maximum score on the level 1 of the POS during the first measurement. Both level 1 and 2 contained five different toys that were used during the observations as well as during the play sessions. Level 2 contains the two most difficult toys used in level 1 and three more difficult toys.

The play abilities in both levels were measured on a 5-point scale from 0 to 4 based on the stages of Piaget (see Attachment 1 for the scoring tables). Scores of the POS were obtained by observation during a 15-minute play session with all toys, with three minutes of observation for each toy. For the observations of the play abilities at level 1 and with the two similar toys used in

level 2, the child was observed using 10-second intervals. After each 10-second interval a score from zero to four was given, based on the behaviour shown. After fifteen minutes of observation a mean score was calculated from all scores that were given. For the three more difficult toys at level 2 just one scoring point from 0 to 4 was given after three minutes of observation, since these toys were not suitable for using a 10-second scoring interval (see Attachment 2 for the scoring sheets). Finally a total mean score of all five toys was computed per assessment.

Procedure

The CS program consisted of three months of cognitive stimulation. At the start it was decided which children and young adults would participate in level 1 and which in level 2, based on the results of the first measurements with the level 1 scale. The children and young adults who had a maximal score at the first measurement were assigned to level 2 and measured again with the level 2 scale before the start of the play sessions.

The six participants in the first experimental condition received a 10-minute play session twice a week for three months including cognitive stimulation in combination with social interaction. During a play session one of the five toys was placed in front of the participant, two toys were successively used for five minutes per session and this was the same every two sessions. After two sessions the toys were changed for two other toys of the five selected toys. The children and young adults were given verbal instructions and encouragements, like positive feedback by smiling and laughing with the child. The social interaction also included playing with the participants. This interaction was equal for all six participants. In the second experimental condition the six participants only received the toys without extra social interaction and stimulation; the researchers were in the same room as the child during the play sessions but they did not interact with them. The third condition was a control condition where there was no extra cognitive stimulation and social interaction from the researchers during the three month program.

The effect of the CS program was measured with the POS. There was a baseline measurement of all children and young adults before the start of the program. The first eleven children and young adults were observed by both researchers independently. The inter observer reliability was computed and appeared to be almost perfect (Cohen's Kappa = .90, $p < .001$). Therefore, the researchers decided to observe separately from then on.

After one and a half month the children's and young adult's cognitive play was assessed a second time using the POS in all three groups. At the end of the intervention, a final assessment was conducted, three months after the start of the intervention.

Analysis

The effect of the CS program on play abilities was examined with a 2 (condition: experimental vs control) x 3 (time of assessment: baseline vs first follow-up vs second follow-up) Analyses of Variance with time of assessment as a repeated measures factor. The effect of social interaction in the CS program on play abilities was also examined with a 2 (condition: experimental with vs without social interaction) x 3 (time of assessment: baseline vs first follow-up vs second follow-up) Analyses of Variance with time of assessment as a repeated measures factor. This design produces main effects for condition and time of assessment, and an interaction effect for the interaction between these two variables. The interaction effect indicates whether one group improves more than the other across time. Because the design includes more than two assessment times, in case of a significant overall time effect (i.e. across all three assessments), the contrasts between specific times were analyzed post-hoc.

For all analyses a $p < .05$ is significant.

Results

Conductive Education program

Development of the functional skills of the CE research group

The FMAS and LOI were completed for all 39 children and young adults of the CE research group. The PEDI was completed for 17 of the 39 children and young adults and the GAS was completed for the remaining 22 children and young adults. Since one of the participants with a GAS goal made a lot of progress during the last year, a PEDI score was also obtained for this child, resulting in a group of 18 children and young adults with a PEDI score.

Table 3 displays the scores at the PEDI, GAS, FMAS and LOI of the CE research group at the assessments of both April 2008 and April 2009 as well as the results of the analyses reflecting the statistical significance of the changes. One year of CE resulted in a significant

improvement on the GAS and FMAS of the children and young adults. The PEDI showed that the functional skills improved in Caregiver Assistance in the Self-care scale. According to the LOI, the amount of guidance needed declined in dressing, but not in feeding.

Table 3: *Comparison of scores at the PEDI, GAS, FMAS and LOI of April 2008 and April 2009*

			April 2008		April 2009			
	N	*Range*	*M*	*SD*	*M*	*SD*	*t*	*p*
PEDI FS SC	18	1-100	39.5	16.4	39.9	19.4	0.15	.885
PEDI FS M	18	1-100	44.9	17.1	44.2	16.5	-0.45	.662
PEDI FS SF	18	1-100	39.0	16.6	39.6	24.4	0.18	.859
PEDI CA SC	18	1-100	36.6	29.5	41.5	33.5	2.14	.048
PEDI CA M	18	1-100	45.0	20.0	42.8	27.5	-0.53	.602
PEDI CA SF	18	1-100	32.3	26.8	37.5	37.1	1.21	.245
GAS goal 1	23	0-3	0.2	0.7	1.8	1.3	6.08	.000
GAS goal 2	16	0-3	0.4	0.6	1.9	1.2	4.56	.000
FMAS	39	0-5	1.9	1.2	2.1	1.2	3.24	.003
LOI feeding	39	0-1	0.4	0.4	0.4	0.4	1.55	.129
LOI dressing	39	0-1	0.2	0.2	0.3	0.2	4.08	.000

Note. PEDI = Pediatric Evaluation Disability Inventory: FS = Functional Skills scale, CA = Caregiver Assistance scale, SC = Self-Care domain, M = Mobility domain, SF = Social Functioning domain, GAS = Goal Attainment Scale, FMAS = Functional Motor Assessment Scale, LOI = Levels of intervention Observation Instrument.

Relation between gross motor functioning according to the GMFCS and the functional motor abilities according to the FMAS and LOI

Spearman correlation coefficients were computed for the relation between the development on the FMAS and LOI and level of gross motor functioning according to the GMFCS (Lange & Post, 2008). The results show very weak and not significant relations of the GMFCS with the FMAS (r = -0.08, p = .63), LOI feeding (r = -0.22, p = .18) and LOI dressing (r = -0.23, p = .17).

Cognitive Stimulation program

Comparison of the CS research group receiving and not receiving the CS program

Table 4 displays the scores on the POS of all 18 children and young adults in the CS program at the baseline measurement (t1), at one and a half month follow-up (t2) and three month follow-up (t3). In Figure 1 it seems that the cognitive stimulation and social interaction condition (E1) as well as the cognitive stimulation condition (E2) show a slight increase in play abilities and that the control condition (C) receiving no extra cognitive stimulation and social interaction does not show an increase in play abilities. According the statistical analyses, however, both the condition effect (experimental vs control) and the time effect are not significant (F(1;16) = 0.63; p = .44 and F(1;16) = 1.06; p = .32 respectively) and neither is there a significant interaction effect of condition and time (F(1;16) = 1.94; p = .18). No post-hoc test was computed since there was no significant time effect.

Comparison of the CS research group receiving CS with and without social interaction

In Figure 1 it seems that the cognitive stimulation and interaction condition (E1) show an improvement in play abilities and that the cognitive stimulation condition (E2) first shows a slight increase and then a slight decline in play abilities. According the statistical analyses however, both the condition effect (experimental with vs without social interaction) and the time effect are not significant (F(1;10) = 0.05; p = .84 and F(1;10) = 3.19; p = .11 respectively) and neither is there a significant interaction effect of condition and time (F(1;10) = 1.10; p = .32). No post-hoc test was computed since there was no significant time effect.

Table 4: *Scores at the POS in the three conditions of the CS program*

		t1		*t2*		*t3*	
Condition	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*
E1	6	1.3	0.9	1.7	1.2	1.8	1.1
E2	6	1.4	1.1	1.6	1.1	1.5	0.9
C	6	1.2	1.0	1.2	0.9	1.1	0.9
Total	18	1.3	0.9	1.5	1.1	1.5	1.0

Note. POS = Play Observation Scale, E1 = cognitive stimulation and social interaction condition, E2 = cognitive stimulation condition, C = control condition.

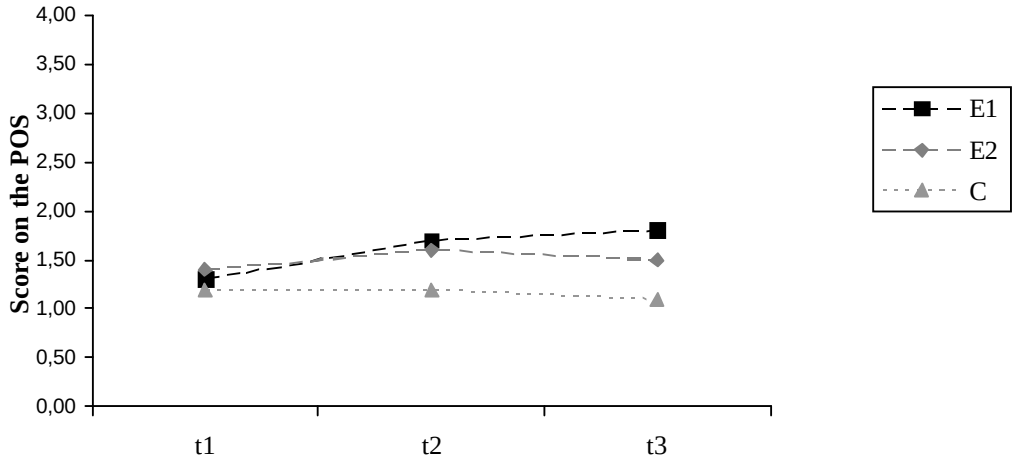

Figure 1: *Development on the POS*

Discussion

This study evaluated two different interventions, the Conductive Education (CE) program and the Cognitive Stimulation (CS) program, in a home for children and young adults with developmental disabilities. The objective of the study was to examine the effectiveness of these two programs for children and young adults with cerebral palsy.

The CE program focuses on functional skill development. This study measured the development of those skills in children and young adults at Sizanani Children's Home between April 2008 and April 2009. It was expected that the functional skill level would have improved during this period and that this improvement is related to the level of gross motor functioning as measured in April 2008 by Lange and Post. In particular, the children and young adults with a higher baseline level of gross motor functioning were expected to show less improvement in their skill development then children and young adults with a lower baseline level of gross motor functioning, because for those children and young adults the ceiling of their abilities is closer to their current level of functioning, resulting in less room for improvement.

The GAS, FMAS, LOI dressing and the Self-care domain of the Caregiver Assistance scale of the PEDI all showed a significant increase in functional skills between April 2008 and April 2009, but not the LOI feeding and the remaining scales of the PEDI. The improvement at the FMAS and LOI dressing was, however, not related to the level of gross motor functioning as measured with the GMFCS. In summary, the functional skills improved significantly according to most of the indices during the following year, but independent of the baseline gross level of motor functioning.

Since cerebral palsy not only affects motor development, but also affects the cognitive and social development (Rosenbaum, 2003; Kennes et al., 2002), a second intervention program, the Cognitive Stimulation (CS) program, was implemented in Sizanani Children's Home with the focus on enhancing the cognitive development. The design of the study comprised of two experimental cognitive stimulation conditions; one condition with cognitive stimulation in a social interaction situation and one condition with cognitive stimulation only, in addition to a control condition without extra cognitive stimulation or social interaction. The aim of the two experimental conditions was to stimulate the cognitive development of the children and young adults through the provision of extra stimuli in the form of toys to look at and touch and play with, with and without a social context. It was expected that the play abilities of the children and young adults in the two experimental conditions would be improved more than of those in the control condition, and that the play abilities of those who received additional social interaction would improve more than those who received no additional interaction.

The play abilities of the children and young adults in the two experimental conditions seemed to be improved somewhat after the three months of the program, but this was not

significantly different from the control group without the program (see Table 4 and Figure 1). There was neither a significant difference in play abilities after three months between those in the play condition with social interaction and those in the play condition without social interaction.

In conclusion, the results show that the CE program is a useful way to improve the functional skills of children and young adults with cerebral palsy. The effectiveness of the CS program at a longer term and with a larger group of participants has to be awaited. To accomplish continuation of the program, the childcare workers will be educated about the program, both individually and group wise. A manual will be constructed of the set up and continuation of the play sessions as well as of the use of the POS during the observations.

The results of this study are important to Sizanani Children's Home because they show that the children and young adults are able to improve their abilities in a relatively short period of time and that they are able to reach a higher level of skill development when effort is put in an intensive training program. In general, the results are clinically relevant because they provide new evidence for CE as an effective way to stimulate children and young adults with cerebral palsy in their motor functioning and teaching them skills necessary in everyday activities (Blank, von Kries, Hesse & von Voss, 2008). The results of CS seem to show a very small improvement in the play abilities of children and young adults of the Home after a short period of the CS program. Since previous studies supported the relation between play performance and cognitive development (Majnemer, Messier & Ferland, 2008; Hsieh-Chun, 2008), an initial conclusion can be drawn that improvement in play abilities affect the cognitive developmental level in a positive way as well. Further research is necessary to explore this relationship.

The strength of the CE study is the use of reliable and valid instruments. The reliability and validity of the PEDI, FMAS and the LOI were proven to be good for children and young adults with disabling conditions or cerebral palsy (Custers, 2001; Vermeer et al., 1995; Vermeer et al., 2006) and these tests are sensitive enough to detect small changes in the development of the children. Another strength is that since the CE measurements in 2008 and 2009 were taken by different researchers, the researchers were not prejudged which prevented an observer bias. The strength of the CS study is the use of two experimental conditions and a control condition, which made it possible to evaluate the effect of cognitive stimulation as well as social interaction. The use of three measurement times improved the reliability of the study and provided a higher chance to detect changes in play abilities over time. The use of five different toys provided the

children and young adults the opportunity to demonstrate their play abilities in different ways, which resulted in a more extended behaviour sampling.

There are several methodological issues in both studies. First, in the CE program for the PEDI, which is taken by different childcare workers, the large differences between the scores of 2008 and 2009 could be due to different interviewees in stead of an actual change in the abilities of the children and young adults. Second, instructions were given and interviews were taken in English, which may occasionally have led to miscommunication between the researchers and the childcare workers, especially with the PEDI. To avoid this miscommunication as much as possible, the researchers asked the questions in different forms. Third, the sample size in the CE program was relatively small. The program included 39 children and since not all the measurements of the CE program were done for all the children of the research group, the sample size for especially the GAS and PEDI were even smaller. Small to moderate time effects or small to moderate group differences cannot be found when sample sizes are so small.

A weakness in the CS program was the sample size as well, since the program only included three (non-randomized) groups of six children each. This resulted less power and made it more difficult to find significant changes. Second, the 18 participants of the CS program were selected by their level of gross motor functioning according to the GMFCS (Lange & Post, 2008) and divided over the three different conditions by the researchers themselves, but not randomly. Finally, since for the CS program no tool to assess play abilities was available a test was constructed based on Piaget's (1962) classification of successive stages of play. During the first observations this test had to be changed several times since the scale was to narrow and had to be extended. In spite of these extensions it is still possible that the POS was not sensitive enough to detect small effects.

In spite of the limitations of both studies, continuation of both the CE program and the CS program in Sizanani Children's Home is recommended for the potential benefit of the physical and cognitive development of the children and young adults. Nevertheless, the effectiveness of the CS program at a longer term has to be awaited.

References

Blank, R., von Kries, R., Hesse, S. & von Voss, H. (2008). Conductive Education for children with cerebral palsy: Effects on hand motor functions relevant to activities of daily living. *Archives of Physical Medicine and Rehabilitation, 89,* 251-259.

Cadman, D., Boyle, M., Szatmari, P. & Offord, D.R. (1987). Chronic illness, disability, and mental and social well-being: findings of the Ontario child health study. *Pediatrics, 79,* 805-813.

Christianson, A.L., Zwane, M.E., Manga, P., Rosen, E., Venter, A., Downs, D. & Kromberg, J.G.R. (2002). Children with intellectual disability in rural South Africa: prevalence and associated disability. *Journal of Intellectual Disability Research, 46,* 179-186.

Coles, C. & Zsargo, L. (1998). Conductive Education: towards an 'educational model'. *British Journal of Special Education, 25,* 70-74.

Custers, J. W. H. (2001). *Pediatric Evaluation of Disability Inventory: The Dutch adaptation*. Utrecht: Utrecht University.

Fu, V. R. & Stremmel, A. J. (1993). Teaching in the zone of proximal development: Implications for responsive teaching practice. *Child and Youth Care Forum, 22,* 337-350.

Haley, S. M., Coster, W. J., Ludlow, L. H., Haltiwanger, J. T. & Andrellos, P. J. (1992). *Pediatric Evaltuation of Disability Inventory (PEDI). Development, standardization and administration manual.* Boston: Boston University.

Hari, M. & Akos, K. (1988). *Conductive Education*. London: Routledge.

Hsieh-Chun, H. (2008). Effects of ordinary and adaptive toys on pre-school children with developmental disabilities. *Research in Developmental Disabilities, 29,* 459–466.

Kennes, J., Rosenbaum, P., Hanna, S.E., Walter, S., Russell, D., Raina, P., Bartlett, D. & Galuppi, B. (2002). Health status of school-aged children with cerebral palsy: information from a population-based sample. *Developmental Medicine & Child Neurology, 44,* 240-247.

Kiresuk, T. J. & Sherman, R.E. (1968). Goal Attainment Scaling: a general method for evaluating comprehensive community mental health programs. *Community Mental Health Program, 4,* 443-453.

Lange, A.M.C.M.J.G. & Post, P.L.J. (2008). *Children and adolescents with motor disabilities in rural South Africa; An evaluation of the current status and development of the functional abilities and caregiver assistance in Sizanani Children's Home.* Utrecht: Utrecht University.

Majnemer, A., Messier, J. & Ferland, F. (2008). Play behavior of school age children with intellectual disability: Their capacities, interests and attitude. *Journal of Developmental and Physical Disabilities, 20,* 193-207.

Mutch, L., Alberman, E., Hagberg, B., Kodama, K. & Velickovic, M. (1992). Cerebral palsy epidemiology: where are we now and where are we going? *Developmental Medicine & Child Neurology, 34*, 547–555.

Palisano, R., Rosenbaum, P., Walter, S., Russell, D., Wood, E. & Galuppi, B. (1997). Gross Motor Function Classification System for Cerebral Palsy. *Developmental Medical Child Neurology, 39*, 214-223.

Piaget, J. (1962). *Play, dreams and imitations in childhood.* New York: Norton.

Pierce-Jordan, S. & Lifter, K. (2005). Interaction of social and play behaviors in preschoolers with and without pervasive developmental disorder. *Topics in Early Childhood Special Education, 1*, 34–47.

Reid, D. H., DiCarlo, C. F., Schepis, M. M., Hawkins, J. & Stricklin, S. B. (2003). Observational assessment of toy preferences among young children with disabilities in inclusive settings: Efficiency analysis and comparison with staff opinion. *Behaviour Modification, 27*, 233–250.

Rosenbaum, P.L. (2003). Cerebral palsy: What parents and doctors want to know. *British Medical Journal, 326*, 73-96.

Rutherford, M.D. & Rogers, S.J. (2003). Cognitive underpinnings of pretend play in autism. *Journal of Autism and Developmental Disorders, 33,* 289-302.

Stanley, F.J., Blair, E. & Alberman, E. (2000). *Cerebral palsies: epidemiology and causal pathways*. London: Mac Keith.

Vermeer, A. (1989). Assessment of functional motor behaviour in the daily life of cerebral palsied children. *International Journal of Rehabilitation Research, 12,* 453-454.

Vermeer, A., Kruithof, H. & van Zoggel, B. (1995). The 'Functional Motor Assessment Scale' for children with cerebral palsy. *Journal of Rehabilitation Sciences, 8*, 94-98.

Vermeer, A., Wijnroks, L. & Magyarszeky, Z. (2006). Effect of Conductive Education in a home for children with developmental disabilities. In A. Vermeer & H. Tempelman (Eds). *Health care in rural South Africa: An innovative approach* (313-329). Amsterdam: VU University Press.

Attachment 1

Play Observation Scale Scoring Table Level 1

Toy	Description	Piaget's Variables	Scoring Point				
			0	1	2	3	4
1	Ball with sensory aspects	Functional Play	No action	Touching and making sound	Rolling	Rolling over	Throwing the ball
2	Instrument Xylophone	Functional & Constructive Play	No action	Touching	Making sound without stick/ building blocks	Making sound with the stick	Making music
3	Car	Functional & Dramatic Play	No action	Touching	Rolling	Play driving	Play driving and making sound
4	Puzzle box	Functional Play	No action	Touching, feeling wholes	Building with blocks/ move lit aside and put blocks in box	Try to put blocks in wholes	Put blocks in right wholes
5	Duplo/ wooden blocks	Functional & Constructive Play	No action	Touching	Put two blocks together	Put more than two blocks together	Building with the blocks

Attachment 1

Play Observation Scale Scoring Table Level 2

Toy	Description	Piaget's Variables	Scoring Point				
			0	1	2	3	4
4	Puzzle box	Functional Play	No action	Touching	Building with blocks/ move lit aside and put blocks in box	Try to put blocks in wholes	Put blocks in right wholes
5	Duplo/ wooden blocks	Functional & Constructive Play	No action	Touching	Put two blocks together	Put more than two blocks together	Building with the blocks
6	Puzzle	Functional & Constructive Play	No action	Touching	Try to do puzzle/ wrong pieces together	Put two to five pieces together	Put more than five pieces together
7	Memory	Constructive Play	No action	Touching	Turn and compare cards/find wrong pair	Find one to five pairs	Find more than five pairs
8	Alphabet puzzle	Functional & Constructive Play	No action	Touching	Search for pairs/find wrong pair	Find one to five pairs	Find more than five pairs

Attachment 2

Play Observation Scale Coding Sheet Level 1

Name of Child:_____ Unit ___ Free Play Session _____

1	0.10	0.20	0.30	0.40	0.50	1.00	1.10	1.20	1.30	1.40
Scoring Point										
	1.50	2.00	2.10	2.20	2.30	2.40	2.50	3.00	Total	Mean
Scoring Point										

2	0.10	0.20	0.30	0.40	0.50	1.00	1.10	1.20	1.30	1.40
Scoring Point										
	1.50	2.00	2.10	2.20	2.30	2.40	2.50	3.00	Total	Mean
Scoring Point										

3	0.10	0.20	0.30	0.40	0.50	1.00	1.10	1.20	1.30	1.40
Scoring Point										
	1.50	2.00	2.10	2.20	2.30	2.40	2.50	3.00	Total	Mean
Scoring Point										

4	0.10	0.20	0.30	0.40	0.50	1.00	1.10	1.20	1.30	1.40
Scoring Point										
	1.50	2.00	2.10	2.20	2.30	2.40	2.50	3.00	Total	Mean
Scoring Point										

5	0.10	0.20	0.30	0.40	0.50	1.00	1.10	1.20	1.30	1.40
Scoring Point										
	1.50	2.00	2.10	2.20	2.30	2.40	2.50	3.00	Total	Mean
Scoring Point										

Attachment 2

Play Observation Scale Coding Sheet Level 2

Name of Child:_____ Unit ___ Free Play Session _____

4	0.10	0.20	0.30	0.40	0.50	1.00	1.10	1.20	1.30	1.40
Scoring Point										
	1.50	2.00	2.10	2.20	2.30	2.40	2.50	3.00	Total	Mean
Scoring Point										

5	0.10	0.20	0.30	0.40	0.50	1.00	1.10	1.20	1.30	1.40
Scoring Point										
	1.50	2.00	2.10	2.20	2.30	2.40	2.50	3.00	Total	Mean
Scoring Point										

6	Total
Scoring Point	

7	Total
Scoring Point	

8	Total
Scoring Point	