Emergent literacy activities, instructional adaptations and school absence of children with cerebral palsy in special education

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1. Introduction

Before children learn to read, they have acquired emergent literacy skills, such as auditory perception, phonological awareness, vocabulary, and syntactic skills. These skills turn out to be good predictors of early reading, and children who lack behind in these skills have often a hard time acquiring literacy skills.

This is especially true for children with cerebral palsy. According to Bax et al. (2005, p. 572), cerebral palsy can be described as “a group of disorders of the development of movement and posture, causing activity limitations, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of CP are often accompanied by disturbances of sensation, cognition, communication, perception, and/or behavior, and/or by seizure disorders”. Disturbances in speech-related abilities and intellectual disabilities (Dormans & Pellegrino, 1998) occur in the majority of children with CP (cf. Mirenda & Mathy-Laikko, 1989). Peeters, Verhoeven, van Balkom, and de Moor (2008) have shown that children with CP lack behind in emergent literacy skills compared to their normally developing peers. Moreover, Peeters, Verhoeven, and de Moor (2009) have shown that the level of speech intelligibility in children with CP has a long-term impact on emergent literacy and word decoding. Although the child’s impairments play an important role in their literacy development, they are not the only factor of influence. External factors influencing literacy learning in these children such as the school environment turn out to be important as well. Recently, studies in classrooms have highlighted the importance of examining the curriculum or the activities that promote literacy learning, such as the child’s access to printed materials and opportunities to learn (Koppenhaver & Yoder, 1992). Katims (1991, 1994) conducted a study to explore
and document ways in which literate behaviors may be promoted in a group of preschool children with mild to moderate disabilities. The classroom procedures that were conducted to promote literate behaviors were immersing the children in a literate environment with repeated daily reading of familiar and predictable books. These activities resulted in the emergence of literate behaviors such as increases in emergent storybook reading, and better understanding of the concepts of print. Moreover, Mike (1995) conducted an ethnography study of one self-contained classroom at a school for children with CP. Factors that inhibited literacy learning of these children was restriction of instruction time, over reliance on individual instruction, and lack of student literate interactions. In addition, factors that facilitated literacy learning were the room as a text-rich environment, the latitude often given to children to govern their own literate behavior, regularly conducting story reading sessions, and the constructive use of computers. Moreover, the role of computers in promoting literacy for children with severe disabilities has been documented (Steelman, Pierce, & Koppenhaver, 1993) and research has indicated that using computerized interactive books, i.e., interactive multimedia stories, is a valuable tool for enhancing the development of emergent literacy of children with severe disabilities (Hetzroni & Schanin, 2002). These studies show that literate behaviors and skills can be promoted in children with impairments such as in the case for children with CP, in order to prevent later literacy failure. Furthermore, these studies stress the need for early curriculum programs that consist of classroom activities that promote these skills, before the start of formal reading.

Yet, studies are conflicting whether the often occurring additional impairments of children with CP influence the opportunities these children receive for literacy learning. Light and Keldford Smith (1993) stated that the educational opportunities may often compete with other priorities, such as medical or therapeutic appointments. In a similar vein, Smith (2001) suggested that the physical limitations may restrict the degree of active child-initiated or independent learning. Furthermore, according to Bishop, Byers Brown, and Robson (1990), school absence in children with disabilities turns out to be more frequent than in children without disabilities. In addition, research of Peeters, Verhoeven, de Moor, and van Balkom (2009b) indicated that teachers’ literacy expectations are lower for children with CP compared to normally developing peers. However, Jenks, de Moor, van Lieshout, and Withagen (2010) showed that children with CP in special education received dramatically less instruction time in arithmetic than children with CP and normally developing children in regular schools, not because of more school absence, but because less instruction time was planned due to paramedical therapy.

Although previous studies have shown that literacy skills of children with CP can be promoted by providing them adequate instruction, little is known about what classroom activities kindergarten children with CP are exposed to in comparison with their normally developing peers. In order to more fully comprehend the literacy learning opportunities of children with CP, a nation-wide exploratory study was conducted in the Netherlands of 52 kindergarten children with CP attending special education, and a comparison group of peers without impairments attending mainstream schools. First, an inventory of the children’s curriculum was made by investigating the amount of emergent literacy activities the groups are exposed to, together with the amount of instructional adaptations, and amount of school absence. For children with CP, data was also collected regarding the amount of type of therapies. Additionally, the emergent literacy activities, instructional adaptations, and school absence were all related to their level of emergent literacy skills and their level of speech, physical, and intellectual impairments. The following questions were the focus of the present study:

1. Are there differences in the amount of emergent literacy activities, instructional adaptations and school absence between the groups? If so/yes, what nature are these differences?
2. To what extent are the amount of emergent literacy activities, instructional adaptations, and school absence of children with CP related to their current level of emergent literacy and the child’s physical, speech, and intellectual impairments?

2. Method

2.1. Participants

All 32 schools for children with physical and multiple disabilities in the Netherlands were asked to participate. Written consent of the children’s parents with CP was obtained.

Inclusion criteria for the children with CP were: Dutch as their native language, an intellectual level ranging from a mild intellectual disability to average intelligence or above, hearing and vision within the normal range, being able to respond intentionally, either through speaking or by means of alternative communication (e.g., looking, pointing or gesturing) and a chronological age between 60 and 75 months old.

Fifty-two children with CP participated in the present study: 33 boys (63.5%) and 19 (36.5%) girls. Fifty children (96.1%) had spastic CP and 2 children had ataxia (3.8%). Of the children with spastic CP, 13 children (26.0%) had quadriplegia, 22 children (44%) had diplegia, 8 children (16%) had hemiplegia, 5 children (10%) had a combination of spastic-ataxic CP, 1 child (2%) had spastic-hypotonia CP, and 1 child (2%) had spastic-dyskinetic CP. Nine of the 52 children (17.3%) had seizures. The speech-language therapists of the children reported that 24 children (46.2%) had no speech difficulties, 10 children (19.2%) had mild dysarthria, 6 children (11.5%) had moderate dysarthria, 9 children (17.3%) had severe dysarthria and were unable to speak, 1 child (1.9%) had moderate dyspraxia, and 2 children (3.8%) had a combination of severe dysarthria and dyspraxia. Twelve children (23.1%) use some sort of Augmentative and Alternative Communication (AAC) to communicate. The average age of the group children with CP was 72.00 months (SD = 5.70). All children with CP attended special schools for children with physical and multiple disabilities across the Netherlands. The comparison group consisted of 71 children without
impairments attending the second year of kindergarten in five different mainstream schools. The average age of comparison group was 72.21 months (SD = 3.69). The groups did not differ significantly in chronological age, \( t(121) = -.26, p > .05 \). All children were participating in a longitudinal study to the emergent literacy development of children with CP (cf. Peeters, Verhoeven, & de Moor, 2009; Peeters et al., 2008).

2.2. Materials

A teacher questionnaire was used concerning questions about emergent literacy activities of children with cerebral palsy that occurred in the context of Dutch kindergarten, instructional adaptations and school absence. Regarding child’s impairments, standardized tasks for speech intelligibility and intelligence were assessed, and two questionnaires were used to assess both the fine as well as the gross motor skills. Also, standardized task of emergent literacy were administrated

2.2.1. Teacher questionnaire

A written questionnaire was sent to teachers to obtain information about: amount of time dedicated to emergent literacy activities, instructional grouping, method adaptations, school absence and paramedical therapy. This self-administered questionnaire was composed of open-ended and multiple-choice items, and was constructed partly based on earlier research (Jenks et al., 2010). Fifty of the 52 (91.16%) of the questionnaires were returned.

2.2.1.1. Amount of time dedicated to emergent literacy activities. Four classroom activities were chosen as they were considered important activities for the emergent literacy of children and occur frequently in Dutch Kindergarten education. These classroom activities were: storybook reading, training reading precursors, independent picture-book reading and using educational software. First, the teachers were asked to mark for each activity separately if the child participated in that specific activity. Then, the teachers had to indicate how many times a week the child participated in that activity and to indicate the total amount of time the child spent on a that specific activity. To get an impression of the total amount of time per week the child spent doing a specific activity, these numbers were multiplied resulting in a score that reflected the average amount of time per week (in minutes) the child participated in that activity. For example, if teacher reported that a child participated in the activity independent picture-book reading three times a week for 20 min, the child was considered to do this activity on average 60 min/week. A short description of these emergent literacy activities was provided to the teachers. Also, the amount of time the child received emergent literacy instruction outside the classroom was asked.

Storybook reading. During this activity the teacher reads a familiar or unfamiliar storybook to the children. Usually, the children sit in a circle and listen to the story, are able to ask questions about the story or the teacher may ask the children questions about the story. Through communicating about aspects of the story children learn to understand the story line.

Independent picture-book reading. If the child is not yet able to read the text of the story, the child can look through the picture-book while looking at pictures and making up a story. Sometimes classrooms have a reading-corner where children can sit comfortably and read picture-books independently.

Training reading precursors. During this activity the teachers give instruction to the whole class or to an individual child, or children do exercises. Teachers were asked to indicate which reading precursors the child is training in the last half year of kindergarten. The following reading precursors were verified: auditory perception, rhyme, memory, auditory synthesis, auditory analysis, and letter knowledge.

Type of reading precursors. Six yes–no questions addresses which of the mentioned reading precursors the child was training.

Educational software. During this activity the child sits in front of a computer and plays language games on the computer, such as matching a word with a picture, making a rhyme with pictures, listening to a story told by the computer and answering questions about the story, or learning the alphabet.

Instruction time outside classroom. One open-ended question concerned the amount of emergent literacy instruction time the child received outside the classroom, for example, during remedial teaching or during speech and language therapy.

2.2.1.2. Instructional adaptations. Three questions were asked regarding instructional grouping and method adaptations.

Instructional grouping. This categorical question concerned the type of instructional grouping the child received most often during instruction aimed at promoting emergent literacy skills such as training reading precursors. Response options were: whole class or group instructions, individual instruction, and both group and individual instructions.

Types of method. This categorical question addressed the type of method that is most often used for the particular child. Response options ranged from: official method, official method as a source book, self-constructed materials. Combinations were possible.

Method adaptations. Five questions concerned the instructional adaptations that applied to the particular child. The first yes–no question concerned if the particular child received any adaptations. If so, the teacher could mark which of the following adaptations applied to the child: slower speed, additional instruction, additional exercises, or enlarging the materials. A combination of two or more adaptations was possible.
2.2.1.3. School absence and therapy. School absence. One categorical question concerned the amount of school absence since the start of the school year. The response options ranged from: 1 (almost) no absence, very little absence (0–25% of the time), small part absence (around 25%), half of the time absent (around 50%), large part absent (around 75%), to 6 almost completely absent (around 100%).

Therapy. One open-ended question concerned the amount average amount of therapy the child has in a regular week, one open-ended questionnaire regarding the average total therapy time the child has in a regular week, and one open-ended question in which the amount of instruction the child missed on average cause of therapy time.

2.2.2. Emergent literacy skills

2.2.2.1. Auditory perception. To assess auditory perception abilities, the auditory perception task of the standardized Dutch Language Proficiency Test was administrated (Verhoeven & Vermeer, 2001). In this task, the child was presented with minimally differing word pairs and had to indicate whether the words in a pair sounded alike. Response adaptations for children with speech difficulties consisted of nodding or pointing to left or right to indicate if the words sounded the same or different. All items were tested and the maximum score was 50. The task was highly reliable with a Cronbach’s alpha of .97 (Verhoeven & Vermeer, 1999).

2.2.2.2. Rhyme. The rhyme perception (Irausquin, 2001) task was used to measure emergent phonological awareness. The task consisted of 10 highly frequent Dutch CVC word pairs. The child had to decide, aided or unaided, whether the auditorily presented word pairs rhymed or not. After four successive failures the task was ended. The internal consistency in this study was sufficient with a Cronbach’s alpha of .73.

2.2.2.3. Phonological awareness. To test phonological awareness skills, the first-phoneme recognition task was used (de Jong, van Otterloo, & Regtvoort, 2006). This task consists of 10 items with CVC words. Each item consists of five pictures, one stimulus picture and four response pictures. During the exercise items, the test assistant pointed at the stimulus picture and named that picture (e.g., roof). Subsequently, the test assistant explained that the stimulus word could be split up in two parts, the first-phoneme of that word versus the rest of the word (e.g., rrrrr-oof). The test assistant subsequently named all four response pictures with explicitly emphasis on the first-phoneme of the words. The child had to point at one of the four response pictures that started with the same first-phoneme as the stimulus word (i.e., r). During the test items, the test assistant named the stimulus picture and the response pictures without explicitly emphasizing the first-phoneme of the word. The internal consistency of this task in this study was good with a Cronbach’s alpha of .83.

2.2.2.4. Verbal working memory. The task was based on a serial-recognition experiment of Gathercole, Pickering, Hall, and Peaker (2001) and did not require physical or speech production abilities. In the newly constructed task, the child heard a string of words and after 2 s the child heard another string of words (e.g., [boat], [knife], [cap], versus [boat], [window], [cap]). The child had to decide whether the two successive strings of words were identical or not. The task consisted of strings of words that increased in length, starting with a length of one word and increasing to a length of eight words. For this task, a set of 10 highly frequent monosyllabic consonant–vowel–consonant (CVC) words were used which occurred in a list of words used in the context of kindergarten education (Schaerlaekens et al., 1999) and differed phonologically and semantically as much as possible from each other. There were a total 48 items; 6 items of each string length. If the child had only three or less items of a string length correct, the task was ended. The internal consistency of this task in this study was very high with a Cronbach’s alpha of .95.

2.2.2.5. Vocabulary. Receptive vocabulary was assessed using a Dutch version (Schilichting, 2005) of the Peabody Picture Vocabulary Test III (Dunn & Dunn, 1997). In this standardized test, the task of the child was to point to one of the four pictures that corresponded with the word spoken by the test assistant. Raw scores were converted to standard scores (M = 100, SD = 15). The test manual described an internal consistency interval of Cronbach’s alpha between .92 and .94.

2.2.2.6. Syntactic skills. To assess the syntactic skills a Syntactic Pattern subtest of the Dutch Language Proficiency Test was administrated (Verhoeven & Vermeer, 1986). In this task, the child heard a sentence which constitutes a syntactic pattern, and had to indicate which of the three pictures matches that syntactic pattern. All 32 items were scored. The task was highly reliable with a Cronbach’s alpha between .90 and .97 (Verhoeven & Vermeer, 1999).

2.2.3. Child’s impairments

2.2.3.1. Speech intelligibility. In order to assess children’s speech production ability, the standardized Word Articulation task of the SLI Screening test was administrated (Verhoeven, 2006). In the Word Articulation task the child was asked to repeat real words. Words were presented one-by-one by a computer with recorded voice, whereby the task started with words containing only one syllable and increased to words containing up to five syllables. When a child made five successive errors, the task was ended. Eighty-four percent of the children with CP were able to do this task since they had some level of
understandable speech; the other children who were given a score of zero. The maximum score was 40. The test manual reported a good internal consistency with Cronbach’s alpha of .94 for the Word Articulation task.

2.2.3.2. Intelligence. Nonverbal reasoning was measured with the Raven Coloured Progressive Matrices (Raven, 1956). This task measures nonverbal reasoning with a minimal interference of language and is a commonly used instrument to assess intelligence, or general reasoning ability in the nonspeaking population (cf. Dahlgren Sandberg, 1998). Children were asked to point to the correct one of the six pictures that completed the presented figure. The task consisted of 36 items. Raw scores were converted to standard scores ranging from .5 to 9.5 using Dutch norms (Van Bon, 1986). The reliability of the test is considered satisfactory (Evers, van Vliet-Mulder, & Groot, 2000). This task was administered six months earlier during a measurement of the longitudinal study.

2.2.3.3. Fine motor function. The fine motor function skills were assessed by means of the Dutch version of the Manual Ability Classification System (MACS) for children with CP (Eliasson et al., 2006). The purpose of the MACS is to assess the child’s ability to handle objects and his or her need for assistance or adaptation in order to be able to perform tasks in everyday life on five different levels. A particular emphasis is placed on handling objects in an individual’s personal space. According to the manual, the higher the level that is applicable the more the child is impaired in his or her fine motor skills, but to make interpretations easier the levels were recoded. Therefore, level one refers to children who cannot handle objects and have severely limited abilities to perform even simple actions, while level five refers to handling objects easily and successfully. Research has indicated that the MACS has good validity and reliability (Eliasson et al., 2006).

2.2.3.4. Gross motor function. To assess the gross motor function of children with CP, a Dutch version of the Gross Motor Function Classification System (GMFCS) (Palisano et al., 2000) was used. The GMFCS consists of five levels based on self-initiated movement with particular emphasis on sitting and walking. The purpose of the GMFCS is to determine what level best represents the child’s present abilities and limitations in motor function. Level one refers to walking without restrictions, while in level five self-mobility is severely limited even with the use of assistive technology. Research has indicated that the GMFCS has good reliability and validity. The interrater reliability of two blinded raters applied four times during the study was high ($G = .93$), even as the test–retest reliability ($G = .79$).

2.2.4. Procedure
Concerning the motor functions of the children with CP, a small questionnaire was sent to a pediatric neurologist or a specialist in rehabilitation medicine who was familiar with the child. Intelligence, speech intelligibility, and emergent literacy tasks were assessed by individually testing the children in a quiet room in their schools by an instructed test assistant; an assistant teacher was present as well for the children with CP. Prior to these tasks, there was a training phase, to make sure the children understood the tests. Response adaptations for children with speech difficulties for were nodding or pointing, aided or unaided.

2.2.5. Statistical method
Statistical analyses were performed to provide answers to the research questions. First of all, descriptive statistics (means, standard deviations) were computed for all emergent literacy activities, instructional adaptations, and school absence. Then, multivariate analyses of variance between the groups were calculated regarding the amount and time of emergent literacy activities. Chi-square analyses were conducted to investigate if the groups differed in the percentage of reading precursors that were trained in the classrooms and in the type of method adaptations. A Mann–Whitney test was used to compute if the groups differed in the amount of school absence. For the group of children with CP, it was examined to what extent the emergent literacy activities, instructional adaptations and school absence were related to their level of emergent literacy skills and the level of child’s impairments by means of spearman’s correlation analyses.

3. Results
3.1. Amount of emergent literacy training
MANOVA analyses showed that there is a main effect of GROUP regarding the time dedicated to the specific emergent literacy activities in the classrooms, Wilk’s lambda $= .500$, $F(5, 95) = 18.99$, $p < .001$, and $\eta^2_p = .50$. Univariate tests pointed out that this main effect of Group applied only to the following two activities: Rhyming games and singing, and Educational software. Children with CP engaged in more rhyming activities and were using less educational software. Table 1 also shows that there were differences between the groups regarding the amount of book reading activities, such as storybook reading and independent picture-book reading. In addition, children with CP were receiving more emergent literacy instruction outside the classroom. In addition, the group of children with CP on average spent more time outside the classroom for additional instruction, such as remedial teaching or speech-language therapy. As much as 45% of the children with CP received emergent literacy instruction outside the classroom compared to only 4% of the comparison group.

Although the time dedicated to reading precursors did not differ significantly between the groups ($p < .05$), this does not mean that all children were training the same reading precursors. Table 2 shows the percentage of children of each group
that were training specific reading precursors. The percentage of children with CP that were learning the different reading precursors was significantly lower for almost all reading precursors (all \( p < .05 \)), except for Letter Knowledge (\( p > .05 \)). The percentage of children in both groups that were learning the graphemes of the alphabet was comparable. The average total amount of reading precursors that were trained in the group of children with CP was 3.69 (\( SD = 1.69 \)), while the children in the comparison group trained an average 5.28 (\( SD = .72 \)) reading precursors, these differences were significant, \( t(117) = -7.06, p < .001 \). From Table 2, we can conclude that although the amount of time the groups were training the diverse reading precursors was comparable, children with CP were mostly training the more easy reading precursors such as auditory perception and rhyme. Skills of phonemic awareness, such as auditory synthesis and auditory analysis were trained in less then half of the children with CP.

### Table 1
Amount of time dedicated to emergent literacy activities and instruction time outside the classroom for the children with CP and the comparison group.

<table>
<thead>
<tr>
<th></th>
<th>Comparison</th>
<th>CP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Emergent literacy activities in class (min)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storybook reading</td>
<td>70.10</td>
<td>36.21</td>
</tr>
<tr>
<td>Rhyming games and singing</td>
<td>43.98</td>
<td>12.99</td>
</tr>
<tr>
<td>Independent picture-book reading</td>
<td>27.80</td>
<td>13.15</td>
</tr>
<tr>
<td>Educational software</td>
<td>18.24</td>
<td>14.71</td>
</tr>
<tr>
<td>Training reading precursors</td>
<td>31.63</td>
<td>20.47</td>
</tr>
<tr>
<td>Instruction time outside classroom (min)</td>
<td>2.11</td>
<td>10.55</td>
</tr>
</tbody>
</table>

* Missing values were excluded list wise.

### Table 2
Percentage of reading precursors trained in both groups.

<table>
<thead>
<tr>
<th>Reading precursors trained</th>
<th>Comparison</th>
<th>CP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>%</td>
</tr>
<tr>
<td>Auditory perception</td>
<td>63</td>
<td>88.7</td>
</tr>
<tr>
<td>Rhyming</td>
<td>71</td>
<td>100</td>
</tr>
<tr>
<td>Memory games</td>
<td>71</td>
<td>100</td>
</tr>
<tr>
<td>Auditory synthesis</td>
<td>69</td>
<td>97.2</td>
</tr>
<tr>
<td>Auditory analysis</td>
<td>67</td>
<td>94.4</td>
</tr>
<tr>
<td>Letter knowledge</td>
<td>34</td>
<td>47.9</td>
</tr>
</tbody>
</table>

### 3.2. Instructional adaptations

There were no differences regarding instructional grouping, \( \chi^2(1, N = 120) = 4.37, p = .113 \), and \( \eta = .17 \). Most children of both the comparison (76.1%) and the group of children with CP (63.3%) were receiving instruction with the whole class or group, i.e., 54 and 31 children respectively, followed by both whole class or group instruction, and individual instruction, and only a minority group of children with CP received mostly individual instruction.

However, there were significant differences between the groups regarding the instructional method used for the children, \( \chi^2(6, N = 119) = 30.99, p < .001 \), and \( \eta = .51 \). A large percentage of children in the comparison group received a combination of an official method and self-constructed materials, while the sort of method for the children with CP was more divided over the different types and combinations.

Table 3 shows that children with CP received more adaptations in emergent literacy method. This applied to all types of adaptations (all \( p < .05 \)). Furthermore, the children with CP received in total more types of adaptations (\( M = 1.94, SD = 1.31 \)) compared to the comparison group (\( M = .53, SD = .94 \)), \( t(117) = 6.80, p < .001 \).

### Table 3
Differences in method adaptations for the comparison group (\( N = 71 \)) and the children with CP (\( N = 48 \)).

<table>
<thead>
<tr>
<th>Group</th>
<th>( \chi^2 )</th>
<th>N</th>
<th>( \eta )</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method adaptations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tempo/speed (i.e., slower)</td>
<td></td>
<td>7</td>
<td>14.6</td>
<td>.50</td>
</tr>
<tr>
<td>Additional instruction</td>
<td></td>
<td>13</td>
<td>27.1</td>
<td>.62</td>
</tr>
<tr>
<td>Additional exercises</td>
<td></td>
<td>17</td>
<td>35.4</td>
<td>.39</td>
</tr>
<tr>
<td>Enlarging materials</td>
<td></td>
<td>1</td>
<td>2.1</td>
<td>.33</td>
</tr>
</tbody>
</table>
3.3. School absence and therapy

Regarding school absence, the Mann–Whitney test indicated that the group of children with CP were more absent during a school year compared to the comparison group, \( U(49, 71) = 1185.50, \ p = .001 \) (two-tailed). Furthermore, on average, the children with CP were having 5.30 (SD = 2.17, range 1–11) therapies a week, i.e., a total of 163.15 min (SD = 99.62). While some children were only having one therapy, some children were having a total of 11 therapies a week. Ten children (20.40%) were missing emergent literacy instruction cause of different therapies, with an average of 41.00 min (SD = 16.63) instruction time each week.

3.4. Relationship between emergent literacy activities, instructional adaptations, and school absence with emergent literacy skills for children with CP

Table 4 shows that there are systematic positive relationships between the amount of instruction time regarding storybook reading and training reading precursors with different skills of emergent literacy. The better children with CP are in, for example, Rhyming and Memory, the more instruction they receive in training these reading precursors. The better the children are in different skills of emergent literacy, the more reading precursors are trained. Or in other words, the more reading precursors are trained the better the children are in different emergent literacy skills. These results suggest that the amount of instruction children with CP is not suited to skills of the children. Children who have difficulty with, for example, auditory perception or phonemic awareness skills do need relatively more instead of less instruction compared to children who are already good at these skills.

3.5. Relationship between amount of emergent literacy activities and instructional adaptations with child impairments for the children with CP

The same patterns are visible when the child’s levels of impairments are related to the amount of instruction time, instructional adaptations, and school absence. Table 5 shows that children with relatively good skill in speech intelligibility

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Spearman correlations between aspects of the amount of instruction, instructional adaptations, and school absence with emergent literacy skills for children with cerebral palsy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aud</td>
<td>Rhyme</td>
</tr>
<tr>
<td>Rhyming games and singing (time)</td>
<td>.03</td>
</tr>
<tr>
<td>Independent picture-book reading (time)</td>
<td>.09</td>
</tr>
<tr>
<td>Educational software (time)</td>
<td>.37</td>
</tr>
<tr>
<td>Training reading precursors (time)</td>
<td>.53</td>
</tr>
<tr>
<td>Amount of reading precursors trained (total)</td>
<td>-.07</td>
</tr>
<tr>
<td>Instruction outside classroom</td>
<td>-.06</td>
</tr>
<tr>
<td>Amount of therapy</td>
<td>-.06</td>
</tr>
<tr>
<td>Missing instruction cause of therapy</td>
<td>-.03</td>
</tr>
<tr>
<td>School absence</td>
<td>.09</td>
</tr>
</tbody>
</table>

Aud, auditory perception; Phon, phonemic awareness; STM, auditory STM; Voc, vocabulary; and Syntax, syntactic awareness.

* \( p < .05. \)
** \( p < .01. \)
*** \( p < .001. \)
† \( p < .10. \)

<table>
<thead>
<tr>
<th>Table 5</th>
<th>Relationship (Spearman’s rho) between the amount of instruction, instructional adaptations, and school absence with child’s impairments.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech intelligibility</td>
<td>Intelligence</td>
</tr>
<tr>
<td>Rhyming games and singing (time)</td>
<td>-.04</td>
</tr>
<tr>
<td>Independent picture-book reading (time)</td>
<td>.12</td>
</tr>
<tr>
<td>Educational software (time)</td>
<td>-.17</td>
</tr>
<tr>
<td>Training reading precursors (time)</td>
<td>.38</td>
</tr>
<tr>
<td>Amount of reading precursors (total)</td>
<td>.29</td>
</tr>
<tr>
<td>Instruction outside classroom</td>
<td>-.31</td>
</tr>
<tr>
<td>Number of adaptations in method</td>
<td>-.38</td>
</tr>
<tr>
<td>Amount of therapy</td>
<td>.19</td>
</tr>
<tr>
<td>Missing instruction cause of therapy</td>
<td>.00</td>
</tr>
<tr>
<td>School absence</td>
<td>-.14</td>
</tr>
</tbody>
</table>

* Missing variables are excluded analysis by analysis.

* \( p < .05. \)
** \( p < .01. \)
receive relatively more instruction time in training reading precursors and are trained more diverse reading precursors compared to children with speech impairments. The same pattern applies to their intelligence and physical skills. Furthermore, the more impaired the fine or gross motor skills, the more the child was absent in the last school year. Children with impairments in fine motor function have more adaptations in the methods. Furthermore, children with good speech intelligibility receive more instruction inside the classroom, while children with relatively less good speech intelligibilities receive more instruction time outside the class, such as with a speech–language therapist or remedial teacher. Table 5 shows further that there are marginally significant relationships between the level of speech intelligibility with the amount of storybook reading, and the level of gross motor skills with independent picture-book reading (all ps <.01).

4. Conclusions and discussion

From the present study, several conclusions can be drawn. First of all, instruction time for children with cerebral palsy and their normally developing peers in regular schools differs for some emergent literacy activities. Educational software is an activity that takes place less often in the classrooms of children with CP, and more importantly, only one out of five children with CP play with educational software in the classroom. Previous research has indicated that educational software is a valuable tool for promoting emergent literacy skills, such as phonological awareness (Hetzroni & Schanin, 2002). Speech feedback in computer-aided instruction can improve the literacy skills of nonspeaking children, as it gives them the opportunity to map oral language onto written language (Steelman et al., 1993). Furthermore, assistive technology, such as switches and interfaces, can assist in reducing some of the physical barriers and promote opportunities for independence in literacy development (Hetzroni & Schanin, 2002). The fact that children with CP rarely use this tool cannot fully be explained by the fact that most educational software is not adapted to the physical needs of these children, since more and more options and tools have become available to use educational software for children with physical disabilities (cf. Segers, Nooijen, & de Moor, 2006; Voort, Hoenkamp, Hulstijn, & de Moor, 1993). However, it seems that most children for whom these tools would be necessary or supportive to learn independently have no access to assistive technology. An increased use of educational software constitutes an opportunity for schools for children with physical disabilities to promote the emergent literacy development of these children.

Another difference in instruction time between the groups is that children with CP were spending relatively more time doing rhyme and auditory perception activities and less time doing phonemic awareness activities such auditory analysis and auditory synthesis. An explanation for the fact that children with CP were relatively more time spending in rhyming activities and auditory perception can be found in the fact these skills are the first phonological awareness skills that emerge (Wagner et al., 1997). Rhyme, which indicates onset–rime awareness, is one of the first phonological awareness skills that emerge. Auditory analysis and auditory synthesis require the awareness of the individual phonemes of the words, which is much more difficult that onset–rime awareness. The same explanation is true for the fact that more children with CP were only training auditory discrimination and rhyme abilities, while only a minority of the children is learning skills of phonemic awareness. Phonemic awareness is only trained in less than half of the children with CP while it is one of the best predictors of early reading success. The results show further that within the classrooms of children with CP; relatively much time is dedicated to storybook reading. Reading storybooks to children is a meaningful and enjoyable activity for most children, probably also for the children with CP. Although storybook reading in general is considered to be a stimulant for the language development of the children such as book orientation skills and vocabulary growth, is has less clear relationships with word decoding skills (de Jong & Leseman, 2001). Conclusively, emergent literacy instruction in special education classrooms for children with CP is mostly concerned with relatively easy, meaningful and less abstract skills, such as phonemic awareness.

The present study has pointed out that the amount of instruction time of the children with CP is related to their level of speech, intellectual, and physical impairments. The more severe these impairments, the lesser instruction time in emergent literacy and the less specific reading precursors are trained. For children with speech impairments, the results showed that the more severe their speech impairments the more instruction they were receiving outside the classroom, probably in remedial teaching or in speech language therapy, and the more adaptations take place in methods. These results indicate that the instruction for children with CP with speech impairments is adapted to their abilities and needs.

Another finding from the present study is that for children with CP the amount of time they receive instruction in reading precursors and the more different reading precursors are trained the better their skills of emergent literacy are. The results indicate that it is effective to train reading precursors in the way it is done in special education.

The present study has shown that especially children with severe speech, intellectual, and physical impairments are at risk for receiving insufficient instruction time in emergent literacy skills, as the amount of instruction time in the class in training reading precursors is related to the level of child’s impairments. Although the children with CP with severe speech impairments receive additional instruction time outside the classroom, this is insufficient for these children to develop the emergent literacy skills as a similar level as their classmates. Especially these children who are at risk for limited literacy learning should receive all the possible support to prevent them for emergent literacy and reading problems.

The present study has some limitations. To begin with, correlation analyses pointed out that the levels of the child's speech intelligibility, intelligence, and motor function are strongly related to the amount of diverse reading precursors that they trained and the amount of instruction time for training reading precursors. From these results it could be speculated that teachers were only training the skills which they think the child is ready to learn, suggesting that they only react on what they see the child is able to do, instead of looking at the learning potential of the children. Longitudinal studies are needed to
shed more light on the influence instruction and training time of reading precursors have of the level of abilities. Another limitation of the present study is that we looked at the different classroom activities that took place during a school week globally. Children with CP and accompanying speech difficulties often have speech-language therapy which stimulates their emergent literacy skills as well, although these activities were not taken into account. Furthermore, the studied activities were very global indicators of what happened in the classrooms. There may be important differences between the classrooms in what exactly is done during these activities and the quality of the activities, so these aspects should be studied more detailed.

With an eye on educational practice, we suggest that teachers should collect information about the Individual Educational Plan (IEP) of the children with CP. With reference to a study on the quality of arithmetic education for children with CP, Jenks et al. (2010) concluded that the majority of the IEPs did not include well-formulated arithmetic goals and many were not based on optimal assessment. It can thus be recommended that school teachers should look more closely at the quality of arithmetic and literacy instruction by including information about the IEPs of these children.

Another clinical implication of this study is that instruction time in emergent literacy skills and paramedical therapy should be more closely adapted to each other in order to make sure that children with CP will miss as less literacy instruction as possible. This is especially important to make sure these children will not lack behind in their literacy development.

Acknowledgements

This study is funded by the European Union, Interreg 4-BMG-V-1=31 and Viataal (St. Michielsgestel, The Netherlands). Special appreciation is expressed to the children and teachers who participated, and the clinical experts of the participating schools.

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