Early Intervention in Special Education and Rehabilitation

THEMATIC COLLECTION OF INTERNATIONAL IMPORTANCE

Belgrade, 2016

Early Intervention in Special Education and Rehabilitation
Thematic Collection of International Importance

Publisher
University of Belgrade – Faculty of Special Education and Rehabilitation
Publishing Center of the Faculty

For publisher
PhD Snežana Nikolić, Dean

Processing and printing
Planeta print, Belgrade

Cover design
Boris Petrović, MA

Technical Editor
Biljana Krasić

Circulation 150

ISBN 978-86-6203-086-3

By decision no. 3/9 from March, 8th 2008. The Teaching and Research Council of the University of Belgrade – Faculty of Special Education and Rehabilitation initiated Edition: Monographs and papers.

By decision no. 3/122 from August, 30th 2016. The Teaching and Research Council of the University of Belgrade – Faculty of Special Education and Rehabilitation has given approval for the printing of Thematic Collection "Early Intervention in Special Education and Rehabilitation".

CONTENT

Theme 2

Functional Abilities of Children with Developmental Disabilities

Theme 3

Individual Treatment of Developmental Difficulties and Disabilities

Theme 4

Social Inclusion and Quality of Life in Persons with Disabilities

MOTOR DEVELOPMENT ASSESSMENT IN CHILDHOOD[a]

Milena Milićević[1] & Srećko Potić[2]

[1]Institute of Criminological and Sociological Research, Belgrade, Serbia
[2]High Medical College of Professional Studies "Milutin Milanković", Belgrade, Serbia

SUMMARY

Motor development is the most intense during the childhood period, and consequently, it requires the most of the attention and adequate monitoring. One of the reasons is the fact that each motor dysfunction has consequences on other developmental domains, and therefore, compromises overall psychomotor development. The aim of this paper is to, by examining the available literature extensively, allocate and present specific, widely used instruments of children's motor development assessment during the childhood period, created in order to identify developmental motor dysfunctions and disorders and designed to evaluate motor development itself. A literature review was conducted by searching electronic databases EBSCO, Science Direct, and Scopus. The references of identified studies were hand-searched for additional articles. For the purposes of this paper, five assessment tools were presented. These instruments were selected on the basis of the frequency of their use in research work and on the basis of availability of comprehensive and relevant information. In addition to the description of the structure and characteristics of instruments, for each of them, strengths are listed and limitations noted. It can be concluded that in order to get an adequate insight into the motor abilities and motor development in general, it is advisable to use more than one instrument of assessment. A comprehensive insight into all motor substructures is important from the aspect of the treatment of deficient or impaired motor functions and in terms of the determination of a child's motor potentials.

Key words: motor abilities, assessment, development, childhood

INTRODUCTION

Through development, a child achieves skills needed to meet numerous demands of everyday life and to cope with everyday tasks. The development allows continuous adaptation to different situations. Child development can be defined as a structuralization of cognitive, psychological and behavioral functions constructed by certain physical and biological characteristics, and by the maturation of central nervous system along with an exposure to various environmental factors (Cho, 2006, as cited in S. W. Kim et al., 2011).

There is a considerable disagreement in the literature on what developmental delays and developmental disorders imply. Developmental disorders, including developmental delays, are related to children with deviations in physical, intellectual

a This work resulted from the project "Crime in Serbia: Phenomenology, risks, and possibilities of social intervention" (registration number 47011) funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

and/or sensory development in relation to age and can be found in 5–10% of children (Kerstjens et al., 2009). Similarly, developmental delay implies a deviation in at least one of the developmental domains (motor abilities, perception, cognition, speech, behavior) whereby disabilities can have very heterogeneous manifestations (Petersen, Kube & Palmer, 1998). On the other hand, some authors describe the global development delay as a significant deviation in two or more development domains (gross motor abilities, fine motor abilities, cognition, speech and/or language, and socialization), and significant delay as performance that is two standard deviations or more below the normalized and age-appropriate performance, obtained by standardized diagnostic procedures (Shevell, Ashwal & Donley, 2003). In addition to differences in methods and assessment tools, as well as in diagnostic criteria, the data on the frequency of developmental disorders can be extremely variable due to these different views of experts on what is meant by developmental delays and disorders. However, regardless of all of these differences, the fact is that their frequency is not negligible.

Developmental disorders can be caused by different factors. However, they can be prevented or reduced by timely identification and early intervention. Early intervention implies early detection, diagnosis, and rehabilitation of children with developmental disorders. The primary goal of early intervention is certainly the improving of a child's competencies in all developmental domains by preventing, minimizing or reducing developmental delays (Potikj, Milichevikj, Nedovikj & Cakikj, 2011). Early intervention not only increases a child's developmental capabilities but also has an impact on the risks and consequences of a developmental disorder, including a child's disability and the consequences in both family functioning and family dynamics. Early intervention, in addition to the above, reduces the economic costs of society and the negative social consequences (Chen et al., 2002). The timing of early intervention starting is directly dependent on the timing of detection and clinical confirmation of developmental delay or risks for a delay. Early intervention can have a habilitation character, within the context of primary prevention. For that matter, it is placed before the occurrence of development delay and/or before the identification of developmental delays, in cases where there was a risk of it. Moreover, early intervention can have a rehabilitation character when focused on identified developmental disabilities in order to correct or to minimize their consequences (Potikj et al., 2011).

The insistence on early identification of developmental delays and disorders creates preconditions for using advantages of early intervention. At the same time, it puts greater challenges for screening and evaluation. Accordingly, many studies have been conducted in order to identify developmental disorders at the earliest stages of a child's development. As a result, many instruments have been developed for this purpose since then (Regalado & Halfon, 2001). Detection of developmental problems is far easier and more reliable if screening tests are used. Screening represents a brief assessment procedure undertaken with the aim to identify those children who require intensive and comprehensive assessment (Meisels & Provence, 1989). Developmental screening instruments include an assessment in several domains of development. Besides, it is recommended to create them as a relatively brief and cheap. A comprehensive multidisciplinary assessment of development is recommended for children with delays in at least two developmental domains (Tieman, Palisano & Sutlive, 2005).

It is widely believed that developmental disorders in children, particularly at an early age, are detected the most frequently and easily within the primary health care system. However, literature data do not support this view. According to the literature, 30–40% of school children in the United States of America have behavioral, mental or learning disabilities, and only 20–30% of these problems are detected before school (Boyle, Decoufle & Yeargin-Allsopp, 1994). Thus, some of the rehabilitation resources are irretrievably lost, further complicating the existing problem, with significant repercussions for the child, family, school and society as a whole.

The importance of motor development evaluation is even greater if motor development is seen as the basis for overall child development, regardless of its mutual conditionality with cognitive and emotional component in synchronized triad of psychomotor development. Motor development is the most intense during the childhood period and consequently, it requires the most of the attention and adequate monitoring. One of the reasons is the fact that each dysfunction in the motor domain has consequences on other developmental domains and therefore compromises child's psychomotor development in general. Precisely, this is the starting point of special education and rehabilitation of persons with physical disabilities.

The aim of this paper is to, by examining the available literature extensively, allocate and present specific, widely used instruments of motor development assessment during the childhood period. Selected are and presented those instruments that are created to identify developmental motor dysfunctions and disorders and designed to evaluate motor development itself. Therefore, this narrative literature review synthesizes the findings in this field in order to consider the existing possibilities of motor development assessment and to provide guidelines for future research and practical work.

METHOD

Basic search was conducted by Google Scholar – Advanced Search using the following keywords: assessment tools and developmental screening, in combination with the exact phrases: motor skills, motor abilities, and motor development. Next, abstracts of all collected articles were reviewed. Twenty-three instruments designed for the assessment of motor abilities of children under the age of six were allocated. An insight into the selected instruments' frequency of use in both scientific and research work was conducted through a comprehensive search of electronic databases (EBSCO, Science Direct, and Scopus). Additionally, the references of identified studies were hand-searched for additional articles. Research studies focused on the psychometric characteristics of instruments presented in this paper were added by further search of electronic databases.

As the search terms, full names of the instruments were used as syntagms with a defined prerequisite of appearing within the full text and the abstract. Search was limited to studies published in peer-reviewed journals in English from January 2000. The search yielded 487 titles. The titles and abstracts were reviewed using the inclusion criteria: 1) primary, original research, 2) preschool aged participants (or under the age of six), and 3) the assessment of their motor development.

The frequency of use of selected assessment tools was based on a total number of studies that had met the given criteria. Five motor development assessment tools designed for preschool children, along with their revisions and preceding versions were allocated as the most frequent and then presented in this paper. In addition, frequency of the most commonly used instruments was variable and ranged from 26, which was the frequency of the Test of Gross Motor Development-2 – TGMD-2 (Ulrich, 2000), to 103 as found in research studies that had used either one of the editions of the Movement Assessment Battery for Children – Movement ABC & Movement ABC-2 (Henderson, Sugden & Barnett, 2007; Henderson & Sugden, 1992). The frequency of remaining assessment tools presented in this paper was between these two values.

RESULTS

The second edition of The Ages & Stages Questionnaire – ASQ (Squires & Bricker, 1999) is designed to include a child's development through different stages and in different environments systematically, yet to remain adaptable to the specific needs of each family. This parent-report, age-graded developmental screening instrument is standardized for the age from four months to 60 months. Development is evaluated every two months during the first two years of life, and quarterly during the third year while the assessment is planned every six months in the fourth and fifth year. There is also the possibility of age adjusting during the first two years of life in case of premature birth. Each of the 19 subtests consists of 30 items which assess five domains of child development: communication, gross motor, fine motor, problem solving and personal-social. In addition, at the end of this instrument, the authors have suggested 20 different activities that are adequate for each developmental stage (from the age of four to the age of 60 month). Parents or caregivers may use these intervention activities suggestions in order to stimulate, and to further monitor their child's development. This tool has both discriminative and evaluative character. It can be used as an instrument for detection of children with developmental disorders, as well as for assessing the need for further monitoring or involvement in programs of early or preschool intervention. At the same time, it can be used as an instrument for developmental evaluation of a child at risk or with developmental delays. However, different psychometric characteristics can be found in the literature, primarily according to the method of administration or the environment in which this questionnaire is completed. When the questionnaire was distributed by mail, the sensitivity of 90%, specificity of 77%, positive predictive value of 40% and negative predictive value of 98% were noted (Skellern, Rogers & O'Callaghan, 2001). Therefore, the authors have recommended that this instrument should be considered for screening of cognitive and motor development disorders in prematurely born children. Similar recommendations were presented by other authors (Kim & Sung, 2007). On the other hand, the sensitivity of 67%, specificity of 39%, positive predictive value of 34% and negative predictive value of 71% were found in situations where a parent or caregiver of a child completed questionnaire in waiting rooms of pediatric clinics (Rydz et al., 2006). Based on this, it was concluded that not all necessary preconditions for a screening instrument were fulfilled. In a study conducted

in Taiwan on a sample of 101 participants aged between 34 and 38 months (Tsai, McClelland, Pratt & Squires, 2006), the highest reliability, measured by Cronbach's alpha coefficient, was noted in the communication subscale (0.91) and the lowest in the socio-emotional development subscale (0.83). The reliability of this instrument for screening purposes is confirmed, however, greater caution is recommended when interpreting the developmental differences between boys and girls with regard to the instrument's insufficient sensitivity to gender differences (Richter & Janson, 2007). Moreover, the predictive value of this screening instrument is proven when it comes to severe school difficulties at five years of age in preterm-born children (Halbwachs et al., 2014). Despite the expected, it was not confirmed that ASQ could identify additional developmental delays in young children with bilateral sensorineural hearing loss aged from six months to 36 months (Wiley & Meinzen-Derr, 2013).

The third edition of The Ages & Stages Questionnaires – ASQ-3 (Squires & Bricker, 2009) brings certain innovations and improvements. Subtests for the age of two months and nine months were added, and some questions are open-ended. In addition, developmental activities for the period from the first to the fourth month, and for the period from the 60th to 66th month of life are proposed. The questionnaire was standardized on a sample of 15,138 participants aged from birth to 66 months (47.4% female and 52.6% male). Reliability of this instrument was measured by Cronbach's alpha coefficient in the following developmental domains: communication (from 0.57 to 0.83), gross motor skills (from 0.57 to 0.87), fine motor skills (from 0.51 to 0.83), problem-solving ability (from 0.53 to 0.78), and socio-emotional development (from 0.51 to 0.71). Test-retest reliability, measured after two weeks on a sample of 145 participants, was 92% while interrater reliability was 93% (between parents and professionals). The authors have further emphasized that this version of the questionnaire is statistically more sensitive to developmental differences than the previous one (Squires & Bricker, 2009). The high sensitivity (82%) and specificity (78%), moderate sensitivity and specificity across age subgroups were confirmed on a sample of 334 children aged 12 to 60 months (Limbos & Joyce, 2011).

As confirmed, ASQ-3 is reliable developmental screening instrument that can be used to screen children for developmental delay in the waiting room of pediatric practices (San Antonio, Fenick, Shabanova, Leventhal & Weitzman, 2014). In this research, the starting point was the observation that developmental screening instrument were often used in nonstandardized conditions although validation was conducted under standardized conditions. Therefore, the reproducibility of ASQ-3 under nonstandardized conditions was compared with standardized conditions (San Antonio et al., 2014).

The Child Development Inventory – CDI (Ireton, 1992) is a result of the revision of The Minnesota Child Development Inventory – MCDI (Ireton & Thwing, 1972) that was primarily created with the basic idea to collected data on the developmental status of children aged one to six years from parents. During the many years of clinical and research work, a set of items was improved, and more representative samples for both norming (n=568) and standardization (n=887) were provided. Besides, CDI is adjusted for children from 15 to 78 months of age, although it can be used for assessing the development of older children and children with lower functional abilities (Ireton, 1992). Children's development is assessed through a total of 270 items grouped into

eight scales: Social, Self Help, Gross Motor, Fine Motor, Expressive Language, Language Comprehension, Letters, and Numbers. General Development is a ninth scale and it consists of 70 items. In the last section, which consists of 30 items, parents or caregivers note down various problems and symptoms that are related to their child's vision and hearing, health, eating, sleeping, and toilet training, as well as "clumsiness" or other motor coordination disorder, speech and language disorders, attention-activity problems, behavior problems, and emotional problems. Both Gross Motor and Fine Motor Scale consists of 30 items each. Most items are designed to assess gross motor development during the second year of life, and fine motor development during the third year of life, that is ten, and seven items. On the other hand, gross and fine motor development are assessed by only one item each after the fifth year of life, by one item for gross motor development at the age of six and by none at the same age when it comes to the domain of fine motor development. Graphical representation, given in the form of The Child Development Inventory Profile, clearly illustrates the present level of development in the domains evaluated according to established norms. Therefore, this profile provides insight into the child's developmental potentials, and into the deficient developmental domains. However, it should be noted that statistically significant gender differences were found in a total of 32 items ($p < 0.01$). According to determined values of Cronbach's alpha coefficient, all scales have acceptable reliability, higher in those domains with a larger number of items. Report on the sensitivity of 0.50, specificity 0.86, positive predictive value of 50% and negative predictive value of 86% can be found in the literature (Rydz et al., 2006).

The Child Development Inventory – CDI (Ireton, 1992) is not the only assessment tool which originated from the revision of the original one, that is The Minnesota Child Development Inventory – MCDI (Ireton & Thwing, 1972). One of these assessment tools is The Minnesota Infant Development Inventory – MIDI (Ireton & Thwing, 1980) which is designed for the assessment from birth to 15 months of age in five developmental domains: gross motor, fine motor, language, comprehension, and personal-social. The high sensitivity of developmental delay detection (85%) and slightly lower sensitivity (77%) when it comes to the identification of normal development were confirmed (Creighton & Sauve, 1988). The second assessment tool is The Preschool Development Inventory – PDI (Ireton, 1988), a standardized instrument created to detect children with developmental, health or behavioral problems, and designed for children aged three to five years. The overall level of development is estimated in the domains of motor development, language development, self-help and social behavior. In addition, PDI consists of three sections in which parents describe their child, give their observations about the difficulties and report questions or concerns if they have any. The reported problems are then compared with the data recorded in the equivalent subscale, which all together, with a graphical representation, facilitate the interpretation of results and making a conclusion on whether there is a developmental delay or difficulty and in which domain is evident. The advantage of PDI is the acknowledgment of differences between boys and girls when it comes to the development of certain skills. This is achieved by the provision of a choice between numbers of items. In terms of validity, the PDI is more sensitive to general developmental deviations than to delays in different domains of

development. At the same time, the PDI is the least sensitive to variations in the motor development and the occurrence of socio-emotional problems, unless they are extreme.

According to the literature, 11% of 220 participants between the ages of three and four years had a low score in the general development domain according to the PDI and were subsequently placed in early childhood/special education (Ireton, Diamond & Carney, 1993). At the same time, the presence of one or more symptoms as indicators of potential problems in learning at older ages was identified in 14% participants. The study was repeated on the same sample after two years. The sensitivity of 0.68, specificity of 0.88, and positive predictive power of 0.41 were calculated. In addition, the authors pointed out that a statistically significant matching of information obtained from parents and the results of professionals' assessment of a child's need for early childhood/special education was confirmed, as concluded in the subsequent study (Ireton et al., 1993; Ireton & Glascoe, 1995). However, not all studies have confirmed these findings. As an early detection tool, the PDI is not sensitive enough in predicting of academic performance in the lower school grades school considering that the PDI did not identify almost two-thirds of the children who were later unsuccessful in school (Schraeder, 1993).

The Test of Gross Motor Development-2 – TGMD-2 (Ulrich, 2000) is a standardized test for the qualitative measurement of gross motor abilities designed for children aged three through 10 years. The TGMD-2 is used to detect children whose gross motor development is significantly behind the age-expected one, for planning an instructional program in gross motor development, and for assessment and evaluation of individual progress and success of the applied program. It takes about 15 to 20 minutes per participant to fulfill the test. Both adequate space and equipment are necessary for testing (several different types of balls, cones, etc.). The TGMD-2 assesses 12 different gross motor skills and consists of two subtests. The first subtest evaluates locomotor skills (run, gallop, hop, leap, horizontal jump, and slide). The second subtest is focused on object control in several ways (two-hand strike, stationary bounce, catch, kick, and overhand throw). If the test is used for comparing the performance of children with the age-appropriate norms, then the examiner first clearly and precisely verbally describes each task, followed by an accurate demonstration. Next, the examiner should provide a practice trial to make sure that the child understands the given tasks, and an additional demonstration when necessary. Each motor task is performed twice, both performances are recorded, described and evaluated according to several given performance criteria (as a pass or a failed attempt). The examiner must carefully analyze the performance quality and maturity of movements according to age norms. The emphasis is on the sequences of motor performance, rather than on the outcome of the execution of motor task as a whole. The Gross Motor Quotient (GMQ), as a result of the scoring procedure, indicates an individual's current status of gross motor development. According to the author, the GMQ is a highly reliable indicator of development and a composite of both subtests. Higher scores indicate well-developed locomotor skills and object control skills while lower scores indicate the lower development of these skills. Total score and subtests scores are highly correlated with chronological age (0.81-0.87). In addition, children with developmental disorders have lower achievements than children with typical development. The advantage of this test is that the motor tasks are familiar and

easy to explain and demonstrate, that testing itself requires a short time to administer, and that equipment and materials are inexpensive and easy available. The detailed criteria for successful performance and clear illustrations are given in the manual making a scoring procedure reliable and easy. It is possible to analyze each component of motor task separately and to determine the starting point for treatment of gross motor development more precisely. However, as the author himself says, there are several limitations that should certainly be kept in mind when selecting this assessment tool. First, the testing procedure requires a lot of space. Next, conclusions should not be made based on this test only as it doesn't provide a comprehensive insight into an individual's motor performance. Among other things, there are numerous factors to consider, such as poor motivation or inexperience, developmental disabilities, and others. The TGMD-2 was standardized on a representative sample of 1,208 participants from 10 different USA states. The validity of TGMD-2 in terms of its content and selected gross motor skills, predictive validity for certain activities, reliability in relation to different demographic characteristics of participants and in relation to the stability of scores over time (0.84-0.96) were confirmed (Ulrich, 2000).

In a study conducted in Flanders by Simons & Van Hombeeck (2003, as cited in Cools, Martelaer, Samaey & Andries, 2009), the authors came to the conclusion that there were cultural differences that affected the performance on the TGMD-2. These differences could explain significantly lower achievement of children in Flanders in comparison to children in the United States of America. As an example, the authors reported that both striking and overhand throwing items were highly related and typical to baseball and therefore potentially inadequate for standard use in different cultures (Simons & Van Hombeeck, 2003, as cited in Cools et al., 2009). However, this instrument is often used with the aim to evaluate basic motor abilities in a population of children with typical development (Cepicka, 2010; Evaggelinou, Tsigilis & Papa, 2002; Hardy, King, Farrell, Macniven & Howlett, 2010; Logan, Robinson & Getchell, 2011; Robinson, 2011; Williams et al., 2009) and in a population of children at risk (Robinson & Goodway, 2009). Moreover, TGMD-2 is applied in the assessment of children with various speech-language disorders (Visscher et al., 2010), developmental coordination disorder (Niemeijer, Smits-Engelsman & Schoemaker, 2007), attention deficit hyperactivity disorder (Harvey et al., 2009) and autistic spectrum disorders (Staples & Reid, 2010), as well as in children with visual impairments (Houwen, Hartman, Jonker & Visscher, 2010; Houwen, Hartman, & Visscher, 2009, 2010) or intellectual disability (Hartman, Houwen, Scherder & Visscher, 2010; Simons et al., 2007; Westendorp, Hartman, Houwen, Smith & Visscher, 2011; Westendorp, Houwen, Hartman & Visscher, 2011).

The Movement Assessment Battery for Children – Movement ABC (Henderson & Sugden, 1992) and Movement ABC-2 (Henderson et al., 2007) originate from The Test of Motor Impairment – TOMI (Stott, Moyes & Henderson, 1984) and The Oseretsky Scales for the Motor Capacity of Children (Burton & Miller, 1998), as stated by Cools, Martelaer, Samaey & Andries (2009). These norm-ranked assessment tools are designed for evaluation of basic motor skills development status with an emphasis on detection of delays or deficits in motor development. These tests are particularly useful when examining the problem of functional integration of motor control or in the detection of problems that could occur for the first time in the older preschool or early school

age. Tests are adapted for children aged four to 12 years. This battery of tests consists of a total of 32 items divided into four age groups (4–6, 7–8, 9–10 and 11–12 years). Eight individual tests are constructed for each age group in order to measure three categories of movement skills: manual dexterity, ball skills, and balance skills (static and dynamic). Both quantitative and qualitative aspects of performance are recorded. It takes approximately 20 to 30 minutes to administer. Testing procedure requires no special training. The specific instruction, equipment, and description are given for each task. Each task or item is assessed on a 6-point scale (0 – best, 5 – worst). The sum is then converted to percentile. A larger sum indicates a lower achievement. A more detailed insight into the development status for each category of motor skills is provided through the profile of a child's motor performance and qualitative observations (optional), as well as through the comparison to normative tables. The authors recommend this battery of tests for program planning in educational or clinical settings, but also for an evaluation of corrective programs created for children with motor coordination disorders, as well as for various research purposes.

The first version of the test (Movement ABC) was standardized on a sample of 1,234 participants from the United States of America (Henderson & Sugden, 1992). The sample was stratified according to demographic characteristics, origin, and gender. The most important advantages of the test are visible in its cross-cultural validity and simple administration (Cools et al., 2009). The main limitations are the lack of specificity due to a wide range of age groups and to the low efficiency as seen in the time required to complete all the tasks in this test (20-30 minutes for eight tasks). However, the reliability and validity of the first version of this test were not evaluated in any additional, independent studies. The data on which its authors relied upon originated from studies on the reliability and validity of TOMI, regardless of the significant differences between their scoring systems (Wiart & Darrah, 2001). Further, in the focus are the skills presumed for each age, i.e. norms, while qualitative observations added in the revision do not have a substantive impact on the overall score, thus representing a description of difficulties that a child has during any given task. According to the conclusion of research conducted in Flanders, the Movement ABC is a reliable instrument for the detection of mild and moderate forms of motor disorders in preschool children (Van Waelvelde, Peersman, Lenoir & Smits Engelsman, 2007). However, during the research, the authors noted the systematic repetition of errors in measurement and the learning effect due to frequent repetition of tasks, and therefore recommended that this battery of tests should be part of a more comprehensive assessment.

The revised version, the Movement ABC-2 (Henderson et al., 2007) has brought some improvements. Namely, the age groups were expanded and reorganized (3–6, 7–10 and 11–16 years), certain requisites were changed and instructions were given more clearly and precisely. Some tasks were modified leading to less difficult monitoring and comparing of results between different age groups of children. Standardization is repeated, this time on a sample of 1,172 participants from Great Britain and Northern Ireland. The sample stratification was performed by geographical region, population density, social class and ethnicity. When motor performances of 32 participants average age of 4.2 years measured by the TGMD-2 and the Movement ABC-2 were compared, it was concluded that each of the assessment tools provided a similar overall picture of

the motor skills of preschool-aged children, but still evaluated and provided different information on specific aspects of motor functioning (Logan et al., 2011). In the next published study that included 183 participants aged 36 to 64 months, specific aspects of both reliability and validity was presented for the first age group (Ellinoudis et al., 2011). Reliability for manual dexterity, aiming and catching, and balance tasks, assessed by Cronbach's alpha coefficient, were 0.51, 0.70 and 0.66, respectively. Test-retest reliability values were high for all the items with the exception of the drawing trail activity. All the test items were moderately, but statistically significantly correlated with the total score for this age group. At the same time, the score for each of the three developmental domains was highly correlated with the total score and moderately correlated with each other, additionally supporting the validity of the Movement ABC-2. As concluded, the results indicated that the Movement ABC-2 is a reliable and valid tool for the assessment of movement difficulties among 3–5-year-old children. Moreover, the Movement ABC-2 can be used to examine the effectiveness of motor intervention programs (Ellinoudis et al., 2011). For research and practical purposes, the Movement ABC-2 is the most commonly used in a population of children with developmental coordination disorder (Cairney, Hay, Veldhuizen, Missiuna & Faught, 2009; Dewey et al., 2011; Fong, Lee & Pang, 2011; Fong, Lee, Chan et al., 2011; Li, Wu, Cairney & Hsieh, 2011; Van Waelvelde, Oostra, Dewitte, Van Den Broeck & Jongmans, 2010; Venetsanou et al., 2011; Watter et al., 2008; Zhu, Wu & Cairney, 2011).

As one of the most commonly used assessment tools for fine and gross motor development, the original edition of The Bruininks-Oseretsky Test of Motor Proficiency – BOTMP (Bruininks, 1978) and the 2005 revision (The Bruininks-Oseretsky Test of Motor Proficiency – BOT-2; Bruininks & Bruininks, 2005) should be mentioned. Both tests are standardized, norm-referenced measures used in order to detect mild and moderate motor coordination deficits. The first version was designed for children aged four to 15 years while the second version was designed for children aged up to 21 years. The BOT-2 consists of a total of 53 items divided into eight subtests: fine motor precision, fine motor integration, manual dexterity, bilateral coordination, balance, running speed and agility, upper-limb coordination and strength. Tasks are given according to the severity, from the least to the most difficult ones within each subtest. Each subtest can be administered separately. The total motor score is calculated as the sum of individual scores (fine motor control, manual coordination, body coordination, strength, and agility). The age-based standard scores, percentiles ranks and age equilvalents are provided, along with the optional qualitative categories of motor performance. It takes 45 to 60 minutes to administer. The authors were guided by certain criteria when selecting motor tasks, such as the need to provide sufficiently broad and comprehensive overview of the motor development status in terms of motor skills. Next, the test was created as a representative in terms of motor behavior, pointing out potential vulnerabilities in motor skills, but also motor potentials of each child. Furthermore, the test was designed to emphasize motor activity as a whole but also to be sufficiently discriminative when it came to individual motor skills. It can be administered in a population of children with mild and moderate intellectual disabilities, and children with attention disorders or speech disorders. The BOTMP is often used in adapted physical education, and in occupational and physical therapy

(Burton & Miller, 1998, as cited in Cools et al., 2009). The revision has brought some improvements to the presentation of the items. The assessment of the youngest group of children (4–5 years) was upgraded, better coverage of gross and fine motor skills completed and better quality of associated equipment provided. The BOT-2 is recommended for the diagnosis of motor impairment, screening and early detection of motor disorders, treatment planning, development and evaluation of the effects of motor training, as well as and for different research purposes. The first version of the test (BOTMP) was standardized in the United States of America on a sample of 765 participants with typical development between the ages of four years and six months to 14 years and six months (Wiart & Darrah, 2001). The revision (BOT-2) was standardized on a sample of 1,520 participants from 239 different places across the United States of America, 510 of which were between the ages of 4 to 6 years (Bruininks & Bruininks, 2005). The sample was statistically representative. The validity of the BOT-2 was confirmed in a population of persons with developmental coordination disorder, with mild to moderate intellectual disability, with a highly functional autism and with Asperger syndrome (Bruininks & Bruininks, 2005). Discriminant validity of the test varies depending on whether subjects are persons with typical development or persons with different severity of developmental disorders (Cools et al., 2009). However, the test was not standardized on a sample of participants from Europe (Cools et al., 2009). The most common criticism of this test as an assessment tool refers to the fact that it requires a high level of knowledge in the field of medicine, which further complicates wider use. In addition, the time required for administration can represent as a problem for younger children. Therefore, assessment is usually carried out in two or more times in preschool children, with breaks in between, in order to complete the assessment process adequately (Peerlings, 2007, as cited in Cools et al., 2009). Both BOTMP and BOT-2 can be administered in their short (BOTMP-SF) or brief form (BOT-2 Brief Form) as instruments for screening and quick assessment of general motor skills. When it comes to an identification of motor disorders in five years old children, it should be noted that the validity of the BOTMP-SF was not confirmed (Venetsanou, Kambas, Aggeloussis, Serbezis & Taxildaris, 2007). According to the results presented, higher average total scores were obtained in the shorter version than in the longer one, and the lower sensitivity (13.6%) and negative predictive value (72.5%) were confirmed in identifying motor disorders.

DISCUSSION

There are several reasons why early recognition and detection of children with developmental disorders is crucially important. Primarily, it represents a basis for the early identification of developmental disorders and/or delays in development or some of its domains. Therefore, it allows early intervention, reducing the impact of developmental delays or disorders on the functioning of a child and its family, and preventing disability. If the prevention of disability is set as an objective, then a continuous and regular monitoring of child development imposes itself as a primary one in all systems, regardless of whether it is healthcare, education or social protection system. Consequently, further

research on the accuracy and reliability of tools used for development screening and assessment are needed. Numerous procedures used in the process of evaluation of a child's development in general, as well as a child's motor development, are already developed and still developing every day. Their selection, besides on their reliability and validity, depends on the purpose of testing, child's characteristics, context, preferences, and experience of the examiner (Tieman et al., 2005).

With the aim to gain theoretical insight into the possibilities of motor development assessment during childhood, this paper presents five instruments with their revisions and versions from which they originated. Assessment tools that contain motor development items are selected based on the frequency of their use in scientific and research work and on the availability of comprehensive and relevant information on those instruments.

Three of the instruments presented (TGMD-2, Movement MABC and ABC-2, BOTMP and BOT-2) have been created solely for the purpose of assessing developmental delays and disorders in the domain of mobility and for the evaluation of motor development. The remaining two instruments (ASQ, CDI) provide insight into the overall development of a child, including the development of motor functions, abilities, and skills. It should be noted that three instruments (TGMD-2, Movement MABC and ABC-2, BOTMP and BOT-2) are standardized for the age that exceeds preschool, or, in other words, they can be used to assess motor development beyond the age of six years. However, this should not be taken as a significant limitation, in terms of the aim of present study. It is possible to assess development in the mobility domain with each of these instruments during childhood or until the age of six years, as the items (described in the review of instruments) are usually the same while only norms are different for different age groups. Next, two instruments (ASQ, TGMD-2) have discriminative and evaluative character, while the remaining only have a discriminatory character. All instruments presented are standardized, and studies with basic psychometric characteristics are listed for each one. In addition, strengths and some limitations are listed. This might be important to examiners when deciding or selecting an instrument in order to assess the status of motor development of children.

All the strengths and limitations of all instruments presented are highly variable. Furthermore, the fact is that it is overambitious to expect that it is possible to gain an insight into a very complex developmental domain, such as motor development during childhood, with a single assessment tool. For these reasons, we believe that it is necessary to use several instruments for an adequate assessment and evaluation of motor development, especially in children with the previously identified developmental delay or disorder. Particularly since the corpus of motor performances is understood in different ways by different authors, and consequently, there are very heterogeneous subsegmental motor structures that need to be evaluated. Only an adequate assessment of all motor substructures may result in a comprehensive insight into overall motor development. The significance is evident both from the aspect of treatment of deficient or impaired motor functions, as well as from the aspect of determination of a child's motor potentials. One more reason to use several procedures in the evaluation lies in the fact that the data which are necessary for determining a child's motor status are collected indirectly, from parents, caregivers or relatives. Moreover, some instruments

are more sensitive to general developmental deviations than to delays in a certain developmental domain, while in others just the opposite. Finally, it is necessary to have a multidisciplinary approach to the issue of assessment, both in the motor domain, as well as in other developmental domains. Thus, a good basic foundation for early intervention is realized, as well as synchronized acting on identified delays or disorders, taking into account the development of a child as an indivisible whole.

CONCLUSION

A literature review showed that the presented instruments for the assessment of motor skills during childhood are widely used in research practice in recent decades. However, regardless of the frequency of their use worldwide during the observed period, none of these instruments was standardized on the population in this country. Based on the review of literature and instruments, on the theoretical considerations of their psychometric characteristics and provided possibilities of administration, as well as based on their strengths and limitations, we believe that the application of presented instruments could significantly improve both research and practical work, in the fields of assessment and evaluation of motor development during childhood.

REFERENCES

1. Boyle, C. A., Decoufle, P., & Yeargin-Allsopp, M. (1994). Prevalence and Health Impact of Developmental Disabilities in US Children. *Pediatrics,* 93(3), 399–403.
2. Bruininks, R. H. (1978). T*he Bruininks-Oseretsky Test of Motor Proficiency – Examiners manual.* Circle Pines, MN: American Guidance Service.
3. Bruininks, R. H., & Bruininks, B. D. (2005). *Test of Motor Proficiency*, 2nd edition, Manual. Circle Pines, MN: AGS Publishing.
4. Burton, A. W., & Miller, D. E. (1998). *Movement Skill Assessment*. Champaign: Human Kinetics.
5. Cairney, J., Hay, J., Veldhuizen, S., Missiuna, C., & Faught, B. E. (2009). Comparing probable case identification of developmental coordination disorder using the short form of the Bruininks-Oseretsky Test of Motor Proficiency and the Movement ABC. Child: *Care, Health and Development,* 35(3), 402–408. http://doi.org/10.1111/j.1365-2214.2009.00957.x
6. Cepicka, L. (2010). Normative data for the Test of Gross Motor Development-2 in 7-yr.-old children in the Czech Republic. *Perceptual and Motor Skills*, 110(3 Pt 2), 1048–52. http://doi.org/10.2466/pms.110.C.1048-1052
7. Chen, I.-C., Chen, C.-L., Wong, M.-K., Chung, C.-Y., Chen, C.-H., & Sun, C.-H. (2002). Clinical analysis of 1048 children with developmental delay. *Chang Gung Medical Journal*, 25(11), 743–750.
8. Cools, W., Martelaer, K. De, Samaey, C., & Andries, C. (2009). Movement skill assessment of typically developing preschool children : A review of seven movement skill assessment tools. *Journal of Sports Science and Medicine*, 8(2), 154–168.
9. Creighton, D. E., & Sauve, R. S. (1988). The Minnesota Infant Development Inventory in the developmental screening of high-risk infants at eight months*. Canadian Journal of Behavioural Science/Revue Canadienne Des Sciences Du Comportement*, 20(4), 424–433. http://doi.org/10.1037/h0079933

10. Dewey, D., Creighton, D. E., Heath, J. a, Wilson, B. N., Anseeuw-Deeks, D., Crawford, S. G., & Sauve, R. (2011). Assessment of developmental coordination disorder in children born with extremely low birth weights. *Developmental Neuropsychology,* 36(1), 42–56. http://doi.org/10.1080/87565641.2011.540535
11. Ellinoudis, T., Evaggelinou, C., Kourtessis, T., Konstantinidou, Z., Venetsanou, F., & Kambas, A. (2011). Reliability and validity of age band 1 of the Movement Assessment Battery for Children – Second Edition. *Research in Developmental Disabilities*, 32(3), 1046–1051. http://doi.org/10.1016/j.ridd.2011.01.035
12. Evaggelinou, C., Tsigilis, N., & Papa, A. (2002). Construct validity of the test of gross motor development: A cross validation approach. *Adapted Physical Activity Quarterly*, 19(4), 483–495.
13. Fong, S. S. M., Lee, V. Y. L., Chan, N. N. C., Chan, R. S. H., Chak, W. K., & Pang, M. Y. C. (2011). Motor ability and weight status are determinants of out-of-school activity participation for children with developmental coordination disorder. *Research in Developmental Disabilities*, 32(6), 2614–2623. http://doi.org/10.1016/j.ridd.2011.06.013
14. Fong, S. S. M., Lee, V. Y. L., & Pang, M. Y. C. (2011). Sensory organization of balance control in children with developmental coordination disorder. *Research in Developmental Disabilities*, 32(6), 2376–2382. http://doi.org/10.1016/j.ridd.2011.07.025
15. Halbwachs, M., Muller, J. B., Tich, S. N. T., Gascoin, G., Chauty-Frondas, A., Branger, B., … Flamant, C. (2014). Predictive value of the parent-completed ASQ for school difficulties in preterm-born children <35 weeks' GA at five years of age. *Neonatology,* 106(4), 311–316. http://doi.org/10.1159/000363216
16. Hardy, L. L., King, L., Farrell, L., Macniven, R., & Howlett, S. (2010). Fundamental movement skills among Australian preschool children. *Journal of Science and Medicine in Sport*, 13(5), 503–508. http://doi.org/10.1016/j.jsams.2009.05.010
17. Hartman, E., Houwen, S., Scherder, E., & Visscher, C. (2010). On the relationship between motor performance and executive functioning in children with intellectual disabilities. *Journal of Intellectual Disability Research,* 54(5), 468–477. http://doi.org/10.1111/j.1365-2788.2010.01284.x
18. Harvey, W. J., Reid, G., Bloom, G. a, Staples, K., Grizenko, N., Mbekou, V., … Joober, R. (2009). Physical activity experiencies of boys with and without ADHD. *Adapt Physical Activity Quarterly,* 26(2), 131–150. http://doi.org/http://www.ncbi.nlm.nih.gov/pubmed/19478346
19. Henderson, S. E., & Sugden, D. A. (1992). *Movement Assessment Battery for Children*. Sidcup, UK: Therapy Skill Builders.
20. Henderson, S. E., Sugden, D. A., & Barnett, A. L. (2007). *Movement Assessment Battery for Children – 2 Examiner's manual.* London, UK: Harcourt Assessment.
21. Houwen, S., Hartman, E., Jonker, L., & Visscher, C. (2010). Reliability and validity of the TGMD-2 in primary-school-age children with visual impairments. *Adapted Physical Activity Quarterly,* 27(2), 143–159.
22. Houwen, S., Hartman, E., & Visscher, C. (2009). Physical activity and motor skills in children with and without visual impairments. *Medicine and Science in Sports and Exercise*, 41(1), 103–109. http://doi.org/10.1249/MSS.0b013e318183389d
23. Houwen, S., Hartman, E., & Visscher, C. (2010). The Relationship Among Motor Proficiency, Physical Fitness, and Body Composition in Children With and Without Visual Impairments. *Research Quarterly for Exercise and Sport*, 81(3), 290–299. http://doi.org/10.1080/02701367.2010.10599677
24. Ireton, H. R. (1988). *Preschool Development Inventory manual.* Minneapolis, MN: Behavior Science Systems.
25. Ireton, H. R. (1992). *Child Development Inventory manual*. Minneapolis: Behavioral Science Systems.

26. Ireton, H. R., Diamond, D., & Carney, J. (1993). Preschool Screening Using the Parent's Preschool Development Inventory Report. *Assessment for Effective Intervention*, 18(4), 269–281.
27. Ireton, H. R., & Glascoe, F. P. (1995). Assessin Children's Development Using Parents' Reports: The Child Development Inventory. *Clinical Pediatrics*, 34(5), 248–255. http://doi.org/10.1177/000992289503400504
28. Ireton, H. R., & Thwing, E. J. (1972). *Manual for the Minnesota Child Development Inventory*. Minneapolis: Behavioral Science Systems.
29. Ireton, H. R., & Thwing, E. J. (1980). *The Minnesota Infant Development Inventory*. Minneapolis, MN: Behavior Science Systems.
30. Kerstjens, J. M., Bos, A. F., ten Vergert, E. M. J., de Meer, G., Butcher, P. R., & Reijneveld, S. A. (2009). Support for the global feasibility of the Ages and Stages Questionnaire as developmental screener. *Early Human Development,* 85(7), 443–447. http://doi.org/10.1016/j.earlhumdev.2009.03.001
31. Kim, E. Y., & Sung, I. K. (2007). The ages and stages questionnaire: screening for developmental delay in the setting of a pediatric outpatient clinic. *Korean Journal of Pediatrics*, 50(11), 1061. http://doi.org/10.3345/kjp.2007.50.11.1061
32. Kim, S. W., Han, Z., Jeon, H. R., Choi, J. Y., Chung, H. J., Kim, Y. K., & Yoon, Y. H. (2011). Neurodevelopmental Disorders of Children Screened by The Infantile Health Promotion System. *Annals of Rehabilitation Medicine,* 35(6), 867. http://doi.org/10.5535/arm.2011.35.6.867
33. Li, Y.-C., Wu, S. K., Cairney, J., & Hsieh, C.-Y. (2011). Motor coordination and health-related physical fitness of children with developmental coordination disorder: A three-year follow-up study. *Research in Developmental Disabilities*, 32(6), 2993–3002. http://doi.org/10.1016/j.ridd.2011.04.009
34. Limbos, M. M., & Joyce, D. P. (2011). Comparison of the ASQ and PEDS in Screening for Developmental Delay in Children Presenting for Primary Care. *Journal of Developmental & Behavioral Pediatrics,* 32(7), 499–511. http://doi.org/10.1097/DBP.0b013e31822552e9
35. Logan, S. W., Robinson, L. E., & Getchell, N. (2011). The comparison of performances of preschool children on two motor assessments. *Perceptual and Motor Skills*, 113(3), 715–723. http://doi.org/10.2466/03.06.25.PMS.113.6.715-723
36. Meisels, S. J., & Provence, S. (1989). *Screening and assessment: Guidelines for identifying young disabled and developmentally vulnerable children and their families*. National Center for Clinical Infant Programs, 733 15th St., NW, Suite 912, Washington, DC 20005.
37. Niemeijer, A. S., Smits-Engelsman, B. C. M., & Schoemaker, M. M. (2007). Neuromotor task training for children with developmental coordination disorder: a controlled trial. *Developmental Medicine & Child Neurology*, 49(6), 406–411. http://doi.org/10.1111/j.1469-8749.2007.00406.x
38. Petersen, M. C., Kube, D. A., & Palmer, F. B. (1998). Classification of developmental delays. *Seminars in Pediatric Neurology*, 5(1), 2–14. http://doi.org/10.1016/S1071-9091(98)80012-0
39. Potikj, S., Milichevikj, M., Nedovikj, G., & Cakikj, M. (2011). Assessment of psychomotor status of children as a prerequiste for early intervention. In L. Ajdinski (Ed.), *Book of Papers* "*Early Intervention and Developmental Disorders*" (pp. 187–202). Skopje: Association of Special Educators and Rehabilitators of the Republic of Macedonia & Faculty of Philopsophy.
40. Regalado, M., & Halfon, N. (2001). Primary care services promoting optimal child development from birth to age 3 years: review of the literature. *Archives of Pediatrics & …*, 155, 1311–1322. Retrieved from http://archopht.jamanetwork.com/article.aspx?articleid=191309

41. Richter, J., & Janson, H. (2007). A validation study of the Norwegian version of the Ages and Stages Questionnaires. *Acta Paediatrica, International Journal of Paediatrics*, 96(5), 748–752. http://doi.org/10.1111/j.1651-2227.2007.00246.x
42. Robinson, L. E. (2011). The relationship between perceived physical competence and fundamental motor skills in preschool children. Child: *Care, Health and Development*, 37(4), 589–596. http://doi.org/10.1111/j.1365-2214.2010.01187.x
43. Robinson, L. E., & Goodway, J. D. (2009). Instructional Climates in Preschool Children Who Are At-Risk. Part I. *Research Quarterly for Exercise and Sport*, 80(3), 533–542. http://doi.org/10.1080/02701367.2009.10599591
44. Rydz, D., Srour, M., Oskoui, M., Marget, N., Shiller, M., Birnbaum, R., … Shevell, M. I. (2006). Screening for Developmental Delay in the Setting of a Community Pediatric Clinic: A Prospective Assessment of Parent-Report Questionnaires. *Pediatrics,* 118(4), e1178–e1186. http://doi.org/10.1542/peds.2006-0466
45. San Antonio, M. C., Fenick, A. M., Shabanova, V., Leventhal, J. M., & Weitzman, C. C. (2014). Developmental Screening Using the Ages and Stages Questionnaire Standardized Versus Real-World Conditions. *Infants & Young Children.* http://doi.org/10.1097/IYC.0000000000000005
46. Schraeder, B. D. (1993). Assessment of measures to detect preschool academic risk in very-low-birth-weight children. *Nursing Research*, 42(1), 17–21.
47. Shevell, M., Ashwal, S., & Donley, D. (2003). Practice parameter: Evaluation of the child with global developmental delay: Report of the Quality Standards Subcommittee of the American Academy of Neurology and The Practice Committee of the Child Neurology Society. *American Academy of Neurology,* 60(3), 367–380. http://doi.org/10.1212/01.WNL.0000031431.81555.16
48. Simons, J., Daly, D., Theodorou, F., Caron, C., Simons, J., & Andoniadou, E. (2007). Validity and Reliability of the TGMD-2 in 7-10 Year Old Flemish Children With Intellectual Disability. *Adapted Physical Activity Quarterly*, 71–82.
49. Skellern, C. Y., Rogers, Y., & O'Callaghan, M. J. (2001). A parent-completed developmental questionnaire: follow up of ex-premature infants. *Journal of Paediatrics and Child Health*, 37(2), 125–9. http://doi.org/10.1046/j.1440-1754.2001.00604.x
50. Squires, J., & Bricker, D. (1999). *Ages & Stages Questionnaires (ASQ): A Parent-completed, Child-monitoring system, second edition*. Baltimore: Brookes Publishing Company.
51. Squires, J., & Bricker, D. (2009). *Ages & Stages Questionnaires, third edition (ASQ-3): A Parent-completed child-monitoring system*. Baltimore: Brookes Publishing Company.
52. Staples, K. L., & Reid, G. (2010). Fundamental Movement Skills and Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*, 40(2), 209–217. http://doi.org/10.1007/s10803-009-0854-9
53. Stott, D. H., Moyes, F. A., & Henderson, S. E. (1984). *Test of Motor Impairment: Manual.* Guelph, ONT: Brook Educational Pub.
54. Tieman, B. L., Palisano, R. J., & Sutlive, A. C. (2005). Assessment of motor development and function in preschool children. *Mental Retardation and Developmental Disabilities Research Reviews,* 11(3), 189–196. http://doi.org/10.1002/mrdd.20074
55. Tsai, H.-L. A., McClelland, M. M., Pratt, C., & Squires, J. (2006). Adaptation of the 36-Month Ages and Stages Questionnaire in Taiwan: Results From a Preliminary Study. *Journal of Early Intervention,* 28(3), 213–225. http://doi.org/10.1177/105381510602800308
56. Ulrich, D. A. (2000). *Test of Gross Motor Development, 2nd ed. Examiner's manual*. Austin, TX: Pro-ED. Inc.
57. Van Waelvelde, H., Oostra, A., Dewitte, G., Van Den Broeck, C., & Jongmans, M. J. (2010). Stability of motor problems in young children with or at risk of autism spectrum disorders, ADHD, and or developmental coordination disorder. *Developmental Medicine & Child Neurology*, 52(8). http://doi.org/10.1111/j.1469-8749.2009.03606.x

58. Van Waelvelde, H., Peersman, W., Lenoir, M., & Smits Engelsman, B. C. M. (2007). The reliability of the Movement Assessment Battery for Children for preschool children with mild to moderate motor impairment. *Clinical Rehabilitation*, 21(5), 465–470. http://doi.org/10.1177/0269215507074052
59. Venetsanou, F., Kambas, A., Aggeloussis, N., Serbezis, V., & Taxildaris, K. (2007). Use of the Bruininks-Oseretsky Test of Motor Proficiency for identifying children with motor impairment. *Developmental Medicine & Child Neurology*, 49(11), 846–848. http://doi.org/10.1111/j.1469-8749.2007.00846.x
60. Venetsanou, F., Kambas, A., Ellinoudis, T., Fatouros, I., Giannakidou, D., & Kourtessis, T. (2011). Can the Movement Assessment Battery for Children-Test be the "gold standard" for the motor assessment of children with Developmental Coordination Disorder? *Research in Developmental Disabilities*, 32(1), 1–10. http://doi.org/10.1016/j.ridd.2010.09.006
61. Visscher, C., Houwen, S., Moolenaar, B., Lyons, J., Scherder, E. J. A., & Hartman, E. (2010). Motor proficiency of 6- to 9-year-old children with speech and language problems. *Developmental Medicine & Child Neurology*, 52(11), 1–5. http://doi.org/10.1111/j.1469-8749.2010.03774.x
62. Watter, P., Rodger, S., Marinac, J., Woodyatt, G., Ziviani, J., & Ozanne, A. (2008). Multidisciplinary assessment of children with developmental coordination disorder: using the ICF framework to inform assessment. *Physical & Occupational Therapy in Pediatrics*, 28(4), 331–352. http://doi.org/http://dx.doi.org/10.1080/01942630802307093
63. Westendorp, M., Hartman, E., Houwen, S., Smith, J., & Visscher, C. (2011). The relationship between gross motor skills and academic achievement in children with learning disabilities. *Research in Developmental Disabilities,* 32(6), 2773–2779. http://doi.org/10.1016/j.ridd.2011.05.032
64. Westendorp, M., Houwen, S., Hartman, E., & Visscher, C. (2011). Are gross motor skills and sports participation related in children with intellectual disabilities? *Research in Developmental Disabilities,* 32(3), 1147–1153. http://doi.org/10.1016/j.ridd.2011.01.009
65. Wiart, L., & Darrah, J. (2001). Review of four tests of gross motor development. *Developmental Medicine & Child Neurology,* 43(4), 279–285. http://doi.org/10.1111/j.1469-8749.2001.tb00204.x
66. Wiley, S., & Meinzen-Derr, J. (2013). Use of the ages and stages questionnaire in young children who are deaf/hard of hearing as a screening for additional disabilities. *Early Human Development.* http://doi.org/10.1016/j.earlhumdev.2012.10.005
67. Williams, H. G., Pfeiffer, K. A., Dowda, M., Jeter, C., Jones, S., & Pate, R. R. (2009). A Field-Based Testing Protocol for Assessing Gross Motor Skills in Preschool Children: The Children's Activity and Movement in Preschool Study Motor Skills Protocol. *Measurement in Physical Education and Exercise Science,* 13(3), 151–165. http://doi.org/10.1080/10913670903048036
68. Zhu, Y. C., Wu, S. K., & Cairney, J. (2011). Obesity and motor coordination ability in Taiwanese children with and without developmental coordination disorder. *Research in Developmental Disabilities*, 32(2), 801–807. http://doi.org/10.1016/j.ridd.2010.10.020

AUTHOR INDEX

Š

T

V

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

376.1-056.26/.36-053.2(082)
316.614-056.26/.36-053.2(082)
613.95-056.26/.36-053.2(082)

EARLY Intervention in Special Education and Rehabilitation : thematic collection of international importance / [editors Snežana Nikolić,Radmila Nikić, Vera Ilanković]. - Belgrad : Faculty of Special Education and Rehabilitation, Publishing Center of the Faculty, 2016 (Belgrade : Planeta print). - 697 str. : ilustr. ; 24 cm

Tiraž 150. - Str. 7-8: Preface / editors. - Napomene i bibliogrfske reference uz tekst. - Bibliografija uz svaki rad. - Registar.

ISBN 978-86-6203-086-3

a) Деца са посебним потребама - Образовање - Инклузивни метод - Зборници b) Деца са посебним потребама - Социјализација - Зборници c) Деца са посебним потребама - Нега - Зборници
COBISS.SR-ID 226046220