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ДОПУСТИТЬ К ЗАЩИТЕ В ГЭК
Руководитель ООП
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«15» июня 2021 г.

МАГИСТЕРСКАЯ ДИССЕРТАЦИЯ

ФИЗИЧЕСКОЕ РАЗВИТИЕ ДЕТЕЙ ДОШКОЛЬНОГО ВОЗРАСТА: ВЗАИМОСВЯЗИ С КОГНИТИВНЫМ И СОЦИАЛЬНО-КОММУНИКАТИВНЫМ РАЗВИТИЕМ

по основной образовательной программе подготовки магистров
направление подготовки 37.04.01 – Психология

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MASTER'S THESIS

PHYSICAL DEVELOPMENT OF PRESCHOOLERS: ASSOCIATIONS WITH COGNITIVE AND SOCIAL-COMMUNICATIVE DEVELOPMENT

for Main Educational Programme of Master's Training
Training Direction 37.04.01 – Psychology

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НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
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«27» апреля 2021г.

ЗАДАНИЕ

на выполнение выпускной квалификационной работы магистра обучающемуся Сидоренко Иулиании Александровне по направлению подготовки 37.04.01 «Психология», профиль «Развитие человека: генетика, нейронаука и психология»

1 Темы выпускной квалификационной работы
«Физическое развитие детей дошкольного возраста: взаимосвязи с когнитивным и социально-коммуникативным развитием»

2 Срок сдачи обучающимся выполненной выпускной квалификационной работы:
а) в деканат – 15.06.2021 б) в ГЭК – 15.06.2021

3 Исходные данные к работе:
Объект исследования – физическое развитие детей дошкольного возраста
Предмет исследования – взаимосвязи физического, социально-коммуникативного и когнитивного развития у детей дошкольного возраста
Цель исследования – (1) оценить психометрические свойства инструмента (опросник «Комплексная Оценка Траекторий развития детей дошкольного возраста» или «КОТ»), (2) изучить взаимосвязи между физическим, социально-коммуникативным и когнитивным развитием у детей дошкольного возраста

Задачи: провести анализ надежности внутренней согласованности и согласованности оценок педагогов; на основании данных опросника: исследовать гендерные различия в физическом развитии у детей дошкольного возраста, провести корреляционный анализ для проверки взаимосвязей между показателями физического, социально-коммуникативного и когнитивного развития.

Методы исследования: использованный в исследовании опросник включал в себя метод прямого наблюдения воспитателей дошкольных учреждений за детьми в их группах, статистический анализ: описательный анализ, U-критерий Манна-Уитни для изучения гендерных различий, коэффициент Альфа Кронбаха для анализа надежности внутренней согласованности, коэффициент Каппа Коэна для анализа согласованности оценок, коэффициент корреляции Спирмена для корреляционного анализа взаимосвязей.

Организация или отрасль, по тематике которой выполняется работа – психология развития, дошкольное образование.

4 Краткое содержание работы

Раннее физическое развитие влияет на ряд краткосрочных и долгосрочных результатов в области здоровья детей и других областях развития. Целью настоящего исследования является анализ психометрических свойств опросника “КОТ ” и исследование взаимосвязей между физической, когнитивной и социально-коммуникативной областями развития ребенка в дошкольном возрасте на основе данных, собранных с помощью инструмента “Комплексная оценка траекторий развития ребенка в дошкольном возрасте”. Анализ надежности продемонстрировал отличные уровни внутренней согласованности для каждой подшкалы и всего теста; взаимное согласие было существенным (k=0,766, p < 0,001). Результаты корреляционного анализа показали сильную связь между физическим и когнитивным (r = 0,756, p < 0,001), физическим и социально-коммуникативным развитием (r = 0,770, p < 0,001) у дошкольников. Значимые корреляции слабого эффекта были обнаружены между эмоциональным пониманием и ежедневной физической активностью (r = 0,210, p <.001), ежедневная физическая активность и смещение внимания показали слабую положительную корреляцию (r = 0,275, p < .001).

Руководитель выпускной квалификационной работы

канд. пед. наук, доцент факультета психологии _____ / О.Е. Богданова

Задание принял к исполнению

_____ _____ / И.А. Сидоренко

The Ministry of Science and Higher Education
of the Russian Federation
NATIONAL RESEARCH
TOMSK STATE UNIVERSITY (NR TSU)
Psychology Department

APPROVED
MSc programme Director
PhD, Professor
_____ Y.V. Smetana (Kovas)
«27» April 2021

STATEMENT

for the MSc graduation thesis to the student Sidorenko Iulianiya Alexandrovna in the field of study 37.04.01 «Psychology», training programme «Human Development: Genetics, Neuroscience and Psychology»

1 Title of the graduation thesis
"Physical Development of Preschoolers: Associations with Cognitive and Social-communicative Development"

2 Submission dates of the completed graduation thesis by the student:
a) to the Dean's office – 15.06.2021 б) to the State Examination Board – 15.06.2021

3 Baseline information:
Object of research – physical development in preschoolers
Subject of research – associations between specific indicators of physical, social-communicative and cognitive development in preschoolers
Purpose of research – to analyze psychometric properties of the "CAT" questionnaire and investigate the relationships between physical, cognitive and social-communicative domains of child development in preschool age based on the data collected with the tool "Comprehensive Assessment of the Trajectories of child development in preschool age"

Tasks: to conduct reliability analysis (internal consistency, inter-rater agreement), explore gender differences in preschoolers' physical development, carry out correlational analysis to investigate the associations between indicators of physical, social-communicative and cognitive development.

Research methods: the questionnaire used in the study included methods of direct observation of preschool teachers for children in their groups, statistical analysis: descriptive analysis, the Mann-Whitney U-test for studying gender differences, the Cronbach's Alpha coefficient for analyzing the reliability of internal consistency, the Cohen's Kappa coefficient for analyzing the reliability between evaluators, the Spearman correlation coefficient for correlation analysis of relationships.

Organization or field on which the work is being completed – developmental psychology, preschool education.

4 Summary of the graduation thesis:

Early physical development influences a number of short- and long-term outcomes in children's health and other developmental domains. The present study aims to analyze psychometric properties of the "CAT" questionnaire and investigate the relationships between physical, cognitive and social-communicative domains of child development in preschool age based on the data collected with the tool "Comprehensive Assessment of the Trajectories of child development in preschool age". The reliability analysis demonstrated excellent levels of internal consistency for each subscale and the whole test; inter-rater agreement was substantial ($k = .766, p < .001$). The correlation analysis' results indicated strong associations between physical and cognitive ($r = .756, p < .001$), physical and social-communicative development ($r = 0.770, p < .001$) in preschoolers. Significant correlations of weak effect size were found between emotional understanding and daily physical activity ($r = 0.210, p < .001$), daily physical activity and attention shifting showed a weak positive correlation ($r = 0.275, p < .001$).

Supervisor of the graduation thesis

Candidate of Pedagogical Sciences,
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Statement is accepted for completion by _____ / I. A. Sidorenko

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ABSTRACT

Early physical development influences a number of short- and long-term outcomes in children's health and other developmental domains. The present study aims to analyze psychometric properties of the "CAT" questionnaire and investigate the relationships between physical, cognitive and social-communicative domains of child development in preschool age based on the data collected with the tool "Comprehensive Assessment of the Trajectories of child development in preschool age". The reliability analysis demonstrated excellent levels of internal consistency for each subscale and the whole test; inter-rater agreement was substantial ($k = .766, p < .001$). The correlation analysis' results indicated strong associations between physical and cognitive ($r = .756, p < .001$), physical and social-communicative development ($r = 0.770, p < .001$) in preschoolers. Significant correlations of weak effect size were found between emotional understanding and daily physical activity ($r = 0.210, p < .001$), daily physical activity and attention shifting showed a weak positive correlation ($r = 0.275, p < .001$).

INTRODUCTION

Early childhood (from birth to five years) is considered a critical developmental period in a human's life as it plays a great role in later development and well-being. During this time major developmental trajectories are formed: neural, synaptic, cognitive, language, physical, etc. Also, most health routines and habits, which further track into childhood and adolescence (e.g. physical activity, screen time), become set at this time (Hinkley & Salmon, 2019; Jones & Okely, 2020 in Tremblay et al., 2020; Harlow et al., 2020). Equally important, this early period is sensitive, i.e., the time when we can most effectively intervene to help a child overcome developmental deficits and difficulties. Traditionally described as "pay now or pay (more) later" (e.g. Wright, 2017) or "the sooner, the better" (e.g. Ali et al., 2018), the idea impels national and local governments to focus their investments on health promotion in young children, i.e. on physical activity research and developing early childhood intervention programmes (Robinson et al., 2015 in Ali et al., 2017; Trost, 2020 in Tremblay et al., 2020). However, to answer the question of when and how we can intervene, we must first be able to trace children's individual development trajectories. Initial studies of childhood development mainly relied on the child's compliance with the key milestones (Gesell, 1925 in Ali et al., 2017). Later Mercer (1998 in Ali et al., 2017) suggested that development comprises two major processes: maturation and learning. Maturation refers to the developmental changes programmed in DNA and inter alia related to growth (Harris & Liebert, 1992 in Ali et al., 2017). Learning involves permanent changes in thinking and behaviour, promotion of skills is due to a child's perceptual and social incentives and the child is actively involved in their own development (Bruner, 1973 in Ali et al., 2017). To date, the majority of researchers share the notion that children development is a dynamic process influenced by various factors, including individual, social and cultural levels (Greenfield & Cocking, 2014; Hinkley et al., 2012). Such dynamic perspectives suggest that even though there is a widely recognized picture of typical child development based on the maturation processes (it is commonly mapped in so-called development milestones, behavioral or physical checkpoints seen in children as they grow, 'Developmental Milestones for All Ages', n.d.), it may vary greatly in children due to individual differences and developmental context. These variations could be explained by prematurity, low birth weight, unique experiences and different environmental settings, including peer and family relations, cultural and ethnic background, access to educational resources, which all lead to differences in promotion specific skills or proficiencies. From these perspectives, developmental age is considered as more relevant assessment measure as opposed to chronological age in early childhood (Ali et al., 2017).

Hence, the question is not about whether a child meets developmental norms or milestones: they work well as a checklist (e.g., 'Child Milestone Checklists For All Ages', n.d.), but they are not sufficient for tracing trajectories and adjustment for a child's individual differences. The project "Comprehensive Assessment of the Trajectories of child development in preschool age" or CAT is an attempt to make a tool meeting such requirements. A universal questionnaire for both educationalists and researchers was developed to assess the development trajectory of a preschool-aged child, to identify its strong and weak aspects for designing individualized development or intervention programmes. The tool is robust and easy-to-implement, which allows capturing various aspects of child development in line with the educational areas identified in the Federal State Educational Standard for Preschool Education. It has six subscales, five representing a specific developmental domain (social and communicative, cognitive, artistic and aesthetic, physical, language development) and a subscale encompassing individual differences in children's behaviour during key activity types defined by preschool curriculum. The current study focuses on investigating the physical development of preschoolers.

As the Early Intervention Foundation (EIF) puts it, the physical development of a child includes their physical health, maturation and the presence or absence of a physical disability. What is more, the EIF highlights that physical development provides the basis for positive development in all other domains (*What Is Early Intervention?*, 2018). This is due to the close interrelation of physical development (physical activity, gross and fine motor skills, etc.) with children health outcomes and other major developmental areas, such as cognitive, social, communicative, emotional development.

The optimal amount of physical activity a day proved to be essential for a child's normal growth and development (Trost, 2020 in Tremblay et al., 2020). Given this fact, it is crucial to use evidence-based findings to define the 'optimal' duration and intensity of the physical activity required for positive physical development and gaining positive outcomes in short-term (in childhood) and long-term (adolescence and adulthood) perspectives. For this purpose, some national governments (e.g., Australia, Canada, United Kingdom) and international organizations (e.g., World Health Organization or WHO) have developed official early childhood physical activity guidelines for both parents and practitioners. Jones & Okely (2020 in Tremblay et al., 2020) and Ali et al. (2017) reviewed the existing physical activity recommendations for young children and presented results in informative comparative tables. They include the country name, the release year (Jones & Okely, 2020) and the physical activity duration specified for different age groups of preschoolers. Age categories were primarily identified in accordance with definitions of national institutions. For instance, New Zealand recommendations adopted the terms

presented by the New Zealand Ministry of education (2009), which are infants (0-18 months), toddlers (1-3 years) and young children or preschoolers (2.5 years to school entry, typically 5 years). Also, the age of school entry varies across the countries. Therefore, age categories may slightly differ from country to country: e.g., Australians defines toddlers as children of 1-3 years and preschoolers as 3–5-year-olds, while in Canada these age groups are 1-2 and 3-4 years old, respectively. The wording is different in precision of the recommendations: British guideline specifies the types of recommended physical activity, such as crawling for infants, rolling, playing and hopping for toddlers and active and outdoor play for preschoolers (Jones & Okely, 2020 in Tremblay et al., 2020). Otherwise, national recommendations are quite consistent with each other, being based on scientific findings and supporting the idea that physical activity is natural and life-long and should be encouraged from birth. However, as was mentioned before, meeting the norms is not comprehensive for tracing the child's physical development paths. That is why the CAT tool uses a detailed assessment of the child's behaviour by two preschool educationalists.

No less urgent issue is the growing number of children with hypodynamy and obesity, which some authors define as 'crisis' (Helble & Francisco, 2017; Karnik & Kanekar, 2012) and even 'worldwide epidemic' (Ali et al., 2017; Christian & Gereffi, 2018; Di Cesare et al., 2019; Ding Ding et al., 2016). It was first thought that predominantly developed countries face the challenge, but more recent studies reject this assertive (e.g., Tremmel et al., 2017). Some developing countries have also experienced drastic rise in childhood obesity. For example, the number of overweight and obese children reached 23% in China and 22.5% in Malaysia (Helble & Francisco, 2017). Moreover, Christian and Gereffi (2018) point out that obesity rates increased more rapidly in children than adults in China and Brazil. They also cite the 2016 Report of the WHO and Commission on Ending Childhood Obesity (2016) stating that Asia had 48% of the world's overweight children under five years, while Africa had 25%. Contrary to the popular belief that young children are "naturally physically active", in the last decade more and more studies have focused on children's physical inactivity, sedentary behaviour, their correlates and outcomes (Ali et al., 2017; Hinkley & Salmon, 2011 in Tremblay et al., 2020), highlighting the enhancing relevance of the matter. Amongst other things, these works show that parental reports tend to overestimate children's levels of physical activity, which are in fact often much less than adequate (Reilly, 2011 in Tremblay et al., 2020; Chaput et al., 2017; Cliff et al., 2017; Guerrero et al., 2019; Lee et al., 2018). Specifically, recent objective monitoring studies assessed that less than half of children follow recommended daily moderate-to-vigorous physical activity levels (Christian & Gereffi, 2018; Dias et al., 2019). Previous findings reported even fewer numbers: 4% to 10% of children under the age of five were found not meeting physical activity guidelines, which suggest

180 minutes of physical activity participation per day (Goldfield et al., 2012; Hnatiuk et al., 2012 in Ali et al., 2017). More precise findings related to children's compliance with physical activity recommendations were provided by the studies on the Canadian 24-Hour Movement Guidelines released in 2017 (Chaput et al., 2017; Lee et al., 2017; Lucena Martins et al., 2020). The guidelines suggest three groups of recommendations: physical activity (60 minutes of moderate-to-vigorous physical activity), sleep time (10-13 hours) and screen time (maximum 1 hour) a day. The results indicated that a low proportion (8.9%-17.4%) of children met all three recommendations but it was largely driven by screen time met by only 11.4% to 17.8% of children. Physical activity rates though showed quite high results in all the studies: 93.1% to 96.5% of children. Similar results were found in the studies on the new Australian Integrated 24-Hour Movement Guidelines for the Early Years (Cliff et al., 2017; McNeill et al., 2020; Santos et al., 2017). 2% to 12.7% of children were compliant with overall guidelines, 12%-24% of children met screen time recommendations, while physical activity still demonstrated much higher proportions – 40% to 99.3% of children. However, the main limitation of the studies is the subjective nature of self-reported parental recall used to assess sleep and screen time which may have resulted in over or underestimation.

According to the World Health Organization (*Obesity and Overweight*, n.d.), the worldwide obesity prevalence is now nearly three times higher than in 1975. In particular, an estimated 38.2 million children under 5 years were overweight or obese, as of 2019. The tendency is forcing governments and researchers to take measures while physical inactivity and, consequently, raised body mass index is a major risk factor for a range of health problems. They are cardiovascular diseases (mainly heart disease and stroke), high blood pressure, diabetes, musculoskeletal disorders (especially osteoarthritis), and some types of cancer. For children in particular, there is a mass of future risks, e.g., higher chance of obesity, premature death and disability in adulthood. Obese children are also can experience breathing difficulties, increased risk of fractures, hypertension, etc. Moreover, the literature finds scientific evidence that the lack of physical activity, exceeded sedentary behavior and obesity in young age are serious risk factors for cognitive and neural development, academic, social development and emotional well-being achievement (Álvarez-Bueno et al., 2017; de Greeff et al., 2018; Pryor et al., 2015). An extensive discussion of the existing findings will be further presented in the literature review.

Besides its negative physical and psychological outcomes, the rising worldwide prevalence of obesity has even more global negative consequences. It damages the human capital and, therefore, presents a burden for the national and world economies. Conservatively estimated, physical inactivity cost health-care systems international $ (INT$) 53.8 billion worldwide in 2013, of which $31.2 billion was paid by the public sector, $12.9 billion by the private sector, and $9.7 billion by

households (Ding Ding et al., 2016). In 2014 the global economic impact of obesity was estimated to be US $2.0 trillion or 2.8% of the GDP (Dobbs et al., 2014 in Tremmel et al., 2017). Along with excess health care expenditure, obesity cause lost productivity and foregone economic growth as a result of lost work days, lower productivity at work, mortality and permanent disability (Andreyeva et al., 2004; Dee et al., 2014; Finkelstein et al., 2009; Specchia et al., 2015 in Tremmel et al., 2017). In the Russian Federation, the statistics consider obesity as the second noncommunicable diseases (also known as chronic diseases, tend to be of long duration and are not passed from person to person, (*Non Communicable Diseases*, n.d.) to contribute to the economic burden estimated 7.6 billion € or 0.7% of GDP (gross domestic product) in 2016.

All of these explains the urgency of the matter and the importance of the current study's objectives, which are to analyze psychometric properties of the CAT questionnaire and investigate the relationships between physical development and other domains of child development in preschool age based on the data collected with the tool "Comprehensive Assessment of the Trajectories of child development in preschool age".

LITERATURE REVIEW

Researchers distinguish several structural elements of the physical development: physical activity (e.g. Ali et al., 2017; Álvarez-Bueno et al., 2017; Nilsen et al., 2020), gross and fine motor skills (e.g. Cook et al., 2019; McLeod et al., 2018; Peyre et al., 2019), coordination and physical fitness (e.g. Kohl et al., 2013; Poitras et al., 2017). All of them are to some extent associated with various outcomes in children's health and other developmental domains and, subsequently, are reflected in the CAT questionnaire's subscales.

The physical development subscale includes 4 blocks, each constituting an indicator associated with positive physical development: «Attitude to physical activity» (getting pleasure from motor activity, success in mastering motor skills, participation in sports games and competitions); «Control and coordination of gross and fine motor skills» (spatial orientation, maintaining balance in outdoor games, mastering complex movements, skillful and correct use of cutlery, pencils, brushes, scissors, etc.); «Responsibility for one's own health» (the ability to assess your own physical capabilities, compliance with the rules of personal hygiene and routine moments of stay in kindergarten, compliance with the requirements of safe behavior in various situations: while working with scissors, while walking, playing, etc.); «Physical well-being» (the ability to assess your physical condition and seek help if necessary, moderate activity and energy during the day).

The direct influence of getting pleasure from activity on the frequency of participation in such activity aligns with the hedonic theory of behaviour. The same is true for physical activity: intrinsic regulation (i.e., behavioural engagement for reasons of pleasure) and affective attitude (i.e., expectations of enjoyment, fun, pleasure) are associated with a medium-size fostering effect for physical activity (Nasuti & Rhodes, 2013; Rhodes et al., 2009; Teixeira et al., 2012 in Rhodes & Kates, 2015). In the systematic review by Teixeira et al. (2012) physical activity motivation was considered from the perspective of self-determination theory. The theory suggests that the origins of human motivation lie in their innate psychological needs for competence, autonomy and relatedness (Deci & Ryan, 2000). The results indicated intrinsic (inherent satisfaction from doing an activity) and more autonomous motivation (acknowledgement of activity's personal value and utility) to be strong determinants of continuous participation in physical exercise. Also, positive attitude and affective response along with enjoyment (of physical education, sport, exercise) were found to be a significant predictor of physical activity behavior (Cairney et al., 2012; Conner et al., 2015; Rhodes & Kates, 2015). Similar evidence was found for positive associations between school-age children's motor skill ability, physical activity enjoyment (Okely & Booth, 2000 in Robinson et al., 2012), and physical activity participation (Okely et al., 2001; Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006 in Robinson et al., 2012). Another important personal attribute determining health behaviours is temperament (Leppänen et al., 2021). One of the three core dimensions that constitute temperament is surgency which inter alia encompasses a person's activity level and enjoyment from high-intensity activities (Shiner et al., 2012 in Leppänen et al., 2021). It was found that surgency is positively associated with greater levels of low, moderate and vigorous physical activity and a higher chance of compliance with physical activity recommendations (Leppänen et al., 2021). Activity temperament, also defined as a 'predilection for movement' (Anderson et al. 2004 in Carson et al., 2017), strongly predicted sedentary behaviour (associated negatively) in young children (n=555, 2-6 years) and along with gender, season and family structure explained 20% of total sedentary behaviour variance (Schmutz et al., 2018). Child personality, preferences and requests for physical activity was a construct included in the HAPPY survey (Hinkley et al., 2012) that measures correlates of preschool children's physical activity across the three domains of the social ecological model (individual, social, physical environment).

The second major block of the CAT questionnaire is devoted to motor skills which are seen to be crucial for children early development (Eddy et al., 2020). Mastering motor skills were found to be interrelated with physical activity levels in preschoolers and an important prerequisite for physical activity engagement in later life (Loprinzi et al., 2012 in Loprinzi et al., 2015; Määttä et al., 2019; Ridgway et al., 2009 in Ali et al., 2017; Barnett et al., 2009). The longitudinal cohort study by Barnett et al. (2009) set in New South Wales, Australia examined the relationship between motor skill proficiency in elementary school and levels of physical activity participation later in adolescence. During the first measurement, elementary school children (mean age = 10.1) were assessed in proficiency in object control (kick, catch, throw) and locomotor (hop, side gallop, vertical jump) skills. After six (seven) years, the participants completed Australian Physical Activity Recall Questionnaire assessing their physical activity participation. The participants who showed object control skills proficiency in childhood demonstrated a 10% to 20% higher chance of vigorous physical activity participation. The review of more recent studies by Figueroa & An (2017) found that positive association between motor skill proficiency and physical activity significant differs between weekdays and weekends. In the study by Foreweather et al. (2014 in Figueroa & An, 2017) total motor skills score was positively associated with moderate-to-vigorous physical activity during weekend ($p = 0.034$) but not in weekday ($p > 0.05$). Webster et al. (2020) reported a significant moderate regression between preschoolers' fundamental motor skill competence measured using the Test of Gross Motor Development and moderate-to-vigorous classroom-based physical activity measured using accelerometers. Also, children's motor skills were negatively associated with screen-time that considered one of the strong prerequisites for sedentary behaviour (Webster et al., 2019).

The relationship between motor skills and cognitive functioning in early childhood (Cook et al., 2019; Wassenberg et al., 2005) was first theoretically described by Piaget, who suggested that young children's learning is mainly based on movement, manipulation and object control (Piaget, 1964 in Navarro-Patón et al., 2021). This relationship is partly accounted for emerging neuroimaging evidence that shows simultaneous co-activation of the cerebellum (responsible for motor skills) and prefrontal cortex (responsible for higher-order cognition) during specific cognitive and motor tasks (Berman et al., 1995 in Cook et al., 2019). For instance, Wassenberg (2005) specified that motor skills were positively related to scores on cognitive tests of working memory, verbal fluency and VMI. The notion is supported by earlier neuroscience papers (Casey et al., 2005 in Ali et al., 2017) stating that the development (maturation) of the brain areas crucial for primitive motor and sensory functioning anticipates the areas related to higher-order cognition

and action. It suggests that fundamental motor skills form the basis for the development of higher-order cognitive abilities (Diamond, 2000 in Ali et al., 2017). This view is far from comprehensive though, as motor and cognitive skills are related in more complicated and reciprocal way. The latter was examined in the longitudinal study by Peyre et al., (2019) investigating the contribution of early cognition changes (measured using the Strengths and Difficulties Questionnaire, SDQ) to motor skills competence (assessed with parent-proxy questionnaire and neuropsychological tests) throughout the preschool age. The theoretical rationale for the study is the comorbidity of the neurodevelopmental disorders associated with disruptions in motor and cognitive skills: Developmental Coordination Disorder (DCD) characterized by disrupted acquisition and execution of motor skills, as well as attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD). The typical comorbidity of DCD with other developmental conditions with their inherent speech, language, emotional, behavioural and social skills deficits lead to the belief in their common aetiology. Some of them do occur due to the same etiological factors (Edwards et al., 2011 in Peyre et al., 2019), as executive functions deficits can cause a number of other disruptions in cognitive development (e.g., gross and fine motor skills, language, social-emotional abilities). The linear regression revealed a negative association between SDQ Inattention symptoms (inability to concentrate, distractibility and impulsivity) at 3 years were inversely related to the motor skills changes (standardized β = -0.09, SD = 0.03, p = 0.007). The logistic regression model, SDQ Inattention symptoms score at 3 years was related to higher odds of a declining trajectory of motor skills (OR [95% CI] = 1.37 [1.02–1.84]). Other longitudinal evidence suggest that early fine motor skills predict better academic performance later in life (Grissmer et al., 2010; Pagani et al., 2010 in Haapala, 2013).

A number of researchers focus on relationship between motor skills competence and specifically executive functions (inhibition, shifting, working memory) as a core indicator of cognitive development in children (Cook et al., 2019; Haapala, 2013; Ludyga et al., 2021; McNeill et al., 2020). Executive functions have been found to contribute to the vast majority of later-life factors, e.g., school readiness and academic achievement in childhood, antisocial behaviour in adolescence (Nelson et al., 2017; Welsh et al., 2011 in Cook et al., 2019), socio-economic status in adulthood (Moffitt et al., 2011 in Cook et al., 2019). A neuroimaging study using electroencephalography (EEG) method revealed a moderate relationship between motor skills and inhibition assessed with Go/NoGo task (Ludyga et al., 2021). Cook et al. (2019) aimed to investigate this relationship within low- and middle-income context. Thus, 129 South African children (3-6 years) were assessed in executive functions and gross motor (locomotor and object control) skills proficiency. The results also indicated significant positive associations between inhibition and locomotor

[β = 0.20, p = 0.047] and object control skills [β = 0.24, p = 0.024], while working memory was associated with locomotor skills only [β = 0.21, p = 0.039]. Findings of the review by Haapala (2013) supported the positive relationship between motor skills proficiency and multiple cognitive tasks targeting IQ, attention, inhibitory control, item memory, academic performance in children at school age (5-13 years). Based on the existing literature I hypothesize that the block of gross and fine motor skills development (in physical development domain) will be positively associated with the cognitive development subscale.

PHYSICAL LITERACY (RESPONSIBILITY FOR ONE'S HEALTH)

The subscale called "Responsibility for one's own health" encompasses questions about child's ability to assess their physical capabilities. Such self-assessment could be an important mediator of actual physical competence and physical activity participation. For example, perceived motor competence is child's beliefs about their ability to perform motor skills (Stodden et al., 2008 in Brian et al., 2018). It was found to have a predictive effect on the levels of physical activity participation (Babic et al., 2014 in Brian et al., 2018) since if children believe they are not competent enough at some activity, they tend not to engage in it. A cross-cultural study by Brian et al. (2018) compared perceived and actual motor skills of preschool-age children (n = 326, aged 4-5). The results indicated that both perceived and actual motor skills are significantly related.

Another concept that can be attributable to physical development indicators included in the CAT questionnaire is physical literacy, which is now increasing research interest. The field is emergent, so there is no unambiguous definition but the one made by Whitehead (2013 in Edwards et al., 2017) is now most commonly used by researchers, as it distinguishes the concept from other very close constructs, such as, for example, physical activity. Whitehead defines physical literacy as "the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life". It also shares with other existing definitions the mention of positive effect (fun and enjoyment) and motivation (confidence, self-competence). For instance, the definition by Dudley (2015 in Cairney et al., 2018) states that physical literacy encompasses the knowledge, skills, motivation, and feelings related to physical activity (PA) and movement. According to both definitions, physical literacy corresponds with the following indicators in the CAT questionnaire: attitude to physical activity, responsibility for one's own health and physical well-being. Some authors describe physical literacy as the foundation for healthy lifestyle, as it may foster physical activity engagement (Edwards et al., 2017). Cairney et al. (2018) explored the Preschool Physical Literacy Assessment tool (Pre-PLAy) which comprises the assessment of simple skill movement competencies (e.g., sending, transporting), coordinated

movements, motivation and enjoyment, and overall physical literacy. It has been found that the Pre-PLAy results are associated with gross motor skills and predict physical activity in females. Another study, a randomized controlled trial by Pigou (2013 in Ali et al., 2017) estimated the effect of a child-centered nine-week physical literacy intervention on preschoolers (toddlers). The participants showed better safety skills and agility tasks performance and no difference in maintaining balance. Moreover, there is evidence of positive effect of physical literacy on cardiovascular fitness, strength, motor skill competence, obesity (Gately, 2010 in Edwards et al., 2017).

PHYSICAL WELL-BEING

The physical well-being block includes two major indicators of physical development: the ability to assess one's own physical capabilities, and daily physical activity engagement. Sufficient levels of physical activity a day is a serious protective factor against a range of negative health outcomes: excess body mass index and obesity, type II diabetes, high blood pressure, cardiovascular diseases, musculoskeletal and bone health problems (Ali et al., 2017; Cardon et al., 2011 in Tremblay et al., 2020; Määttä et al., 2019; Navarro-Patón et al., 2021; Poitras et al., 2017; Rhodes & Kates, 2015). Apart from physical health outcomes, physical activity has also been positively associated with a range of other developmental outcomes, e.g., in social-emotional and cognitive domains (Álvarez-Bueno, 2017a, 2017b; Cliff et al., 2017; de Greeff et al., 2018; Mavilidi et al., 2018; McNeill et al., 2018, 2020; Meijer et al., 2020). The relationship between children's physical activity and cognition has been examined as mediated by improved oxygen saturation, glucose delivery, cerebral blood flow and elevated neurotransmitter levels (Diamond, 2015 in Bueno, 2017). A meta-analysis of neuroimaging studies by Meijer et al. (2020) examined the effect of short-term and long-term physical activity participation on neurophysiological functioning and brain structure in children aged 5-12 years. The results indicated a significant positive effect of long-term physical activity on neurophysiological functioning ($d = 0.39, p = 0.001$), whereas no significant association was found between physical activity and brain structure. Short-term physical activity was also found to evoke changes in neurophysiological functioning ($d = 0.32, p = 0.044$), although the effect showed limited robustness. The study using both cross-sectional and longitudinal methods by McNeil et al. (2020) reported that children who met at least two recommendations of the Australian 24-hour Movement Guideline (physical activity and sleep time) had higher scores in attention shifting ($p = 0.026$) and phonological working memory ($p = 0.034$) tasks. Longitudinally, children who were compliant with at least physical activity recommendation scored higher at attention shifting 12 months after the first measurement ($p = 0.002$). However, no associations were found between meeting the guidelines and other executive

functions indicators (visual-spatial working memory and inhibition). In concordance with the literature, the current study examines association between physical and cognitive development in preschoolers. Specifically, relationships between physical and cognitive development subscales will be studied, as well as their specific indicators – items *4.4.5. Shows moderate activity and energy during the day* targeting daily physical activity levels and *6.1.9. It is difficult to switch from performing one action to another; "loops" on a certain action* targeting shifting (the ability to voluntarily shift one's attention between activities).

Some research specifies the type of physical activity (and their relationships with developmental outcomes in children) in their research questions: e.g., organized sports (Harlow et al., 2020; McNeill et al., 2018), dance training (Biber, 2016; Lobo & Winsler, 2006), or swimming (Jorgensen (Zevenbergen), 2016). Participation in organized sport was found to have beneficial effect on children's social competence and development (Biber, 2016; Harlow et al., 2020; Lobo & Winsler, 2006). Similar results were found for physical activity in general. The study by Cliff et al. (2017) examined the associations between preschool children's (mean age = 4.2 ± 0.6 years, 57% boys) compliance with the new Australian 24-h Movement Guidelines for the Early Years and young children's social-cognitive development. The latter was measured with the Test of Emotion Comprehension (TEC) assessing the competence of emotional understanding and the Theory of Mind (ToM). Meeting three or two as compared to meeting one or none recommendations was related to higher TEC ($p < 0.02$) and ToM score ($MD = 0.28;\ 95\%\ CI = -0.002, 0.48, p = 0.05$). Specifically, meeting the recommendations on sleep time and physical activity or sleep and screen time were associated with better TEC ($MD = 1.36;\ 95\%\ CI = 0.31, 2.41$) and ToM ($MD = 0.25;\ 95\%\ CI = -0.002, 0.50;\ p = 0.05$) performance. The existing findings suggest that physical activity has significant beneficial effect on children's social skills. Based on this notion, it is assumed to find a significant association between physical and social-communicative development subscales. A scoping review of papers describing the effect of participation in organized sport on a range of social outcomes (e.g., teamwork, cooperation, friendship) in children was made by Harlow et al. (2020). Based on this evidence, the relationship between similar indicators will be examined: item *4.1.3. Enjoys participating in sports games* and the block of *1.3. Self-regulation and self-control*. Furthermore, the present study will examine the association between emotional understanding (item *1.3.4. Demonstrates an understanding that his actions have an impact on the feelings and / or behavior of other children and the caregiver*) and physical activity (item *4.4.5. Shows moderate activity and energy during the day*) indicators.

The relevance of supporting positive paths of young children's physical development fosters the rising interest in the development of reliable measuring tools. When it comes to early childhood research, self-reports are not appropriate, thereby questionnaires targeting either parents or preschool education professionals are seen as typically used in the literature. However, the main limitation of parent-proxy reports is their inherent biases, including the tendency to overestimate the physical activity levels of their children (Cliff & Janssen, 2019 in Tremblay et al., 2020). This is partly because children's physical activity manifests in very natural activities, such as playing, running, rolling, not distinguishable physical exercises, as in adulthood. In this way, direct observation appears to be a more objective method, relatable in preschool center settings, such as kindergartens (Golos & Weintraub, 2020; Oliver et al., 2007; Trost, 2007). The direct observation method was chosen for the CAT tool, which implies two educators assessing the same children based on their previous 2-week pedagogical observations. It is therefore important for the current literature review to introduce examples of existing studies that assess the inter-rater reliability of preschool educators' estimates of child development.

An interdisciplinary research group from the University of Nevada Cooperative Extension worked out the Preschool Movement Assessment (PMA) tool for measuring fundamental movement skills, as a major part of children physical development (Lindsay et al., 2018). The questionnaire targets early childhood educators and aims to determine sustainable changes and improvement in competency of movement skills following an intervention. 6 trained raters used the PMA tool to assess 123 preschoolers (aged 3-5 years) in an intervention. All the PMA's constructs showed excellent levels of inter-rater agreement with the weighted Cohen's kappa $\kappa = 0.82\text{-}0.96$. The 95% confidence intervals indicated the statistical significance of the resulted values. Another example is the study by Joseph et al. (2020) that investigated the inter-rater reliability of WaKIDS, Washington Kindergarten Inventory of Developing Skills, used by all state-funded full-day kindergarten classrooms across Washington state, USA. The WaKIDS tool includes assessment of six developmental areas: Social-emotional, Physical, Language, Cognitive, Literacy, and Mathematics. The overall percentage of exact plus adjacent agreement was 78% whereas the percentage of exact agreement was 38%. A curious finding was that the level of raters' agreement varied by developmental domains. Physical domain showed 84% of inter-rater agreement, which was the highest percentage among the domains, along with the Language (82%) and Social-emotional (81%) domains. Golos & Weintraub (2020) examined the psychometric properties of the Structured Preschool Participation Observation (SPO) designed for measuring children's participation in daily routine preschool activities. an inter-rater reliability was examined between

the two occupational therapists who simultaneously observed the same ten children. The results indicated significant moderate-to-high coefficients (ranging from .69 to .93; $p < .05$) in all areas in each scale, except for a nonsignificant low coefficient for Frequency of Participation in Play (ICC = .20, $p > .05$). In the study by Sharp et al. (2017) observer step count was compared to accelerometry data. The last is believed to be a valid and reliable method for measuring physical activity in young children collecting objective, real-time data (Cliff & Janssen, 2019 in Tremblay et al., 2020). Concordance between the Fitbit Zips and observer counts was also high (r=0.77), with an acceptable absolute per cent error (6%–7%).

As the current study aims to measure psychometric properties of a new questionnaire, the internal consistency reliability analysis will be conducted. Thus, I expect the Cronbach's alpha coefficient to be at least acceptable ($a \geq 0.7$). Based on the previous findings, I expect the inter-rater reliability of assessments of two preschool educationalists to constitute moderate (κ = 0.41-0.60) to substantial (κ = 0.61-0.80) level of agreement, as interpreted by Cohen or moderate (κ = .60-.79) to strong (κ = .80-.90), as interpreted by McHugh (2012).

GENDER DIFFERENCES

I am also interested in exploring gender differences in physical development in total and its blocks in the CAT questionnaire (attitude to physical activity, control and coordination of gross and fine motor skills, responsibility for one's own health and physical well-being). To date, there is consistent scientific evidence that at an early age, males are more physically active than females ((Figueroa & An, 2017; Foweather et al., 2015; Hinkley & Salmon, 2011 in Tremblay et al., 2020; Oliver et al., 2007; Webster et al., 2019). More recent studies on young children's compliance with the national physical activity guidelines primarily support the notion with respect to physical activity levels and average sedentary time. (Santos et al., 2017). Particularly, boys showed higher minutes of total physical activity per hour than girls (Määttä et al., 2019) and spent less time in moderate-to-vigorous physical activity a day (McNeill et al., 2020). However, some studies revealed no significant gender differences in terms of activity-related behaviours (e.g. Chaput et al., 2017). Less consistence findings are provided in the research of gender differences in motor skill competence. Using MANOVA, Navarro-Patón et al. (2021) reported a significant main effect of gender factor in favor of girls for manual dexterity [F (1, 228) = 6.703, p = 0.010, η^2 = 0.03], balance [F (1, 228) = 26.712., p < 0.001, η^2 = 0.10], and total motor skill test score [F (1, 228) = 13.338, p < 0.001, η^2 = 0.05]. However, gender was not found a significant confounding factor for associations between motor skill competence (Loprinzi et al., 2015), preschool physical environment (Määttä et al., 2019) and physical activity. So far, there is no sufficient evidence for

gender differences in physical development as the holistic concept so far. As far as the CAT questionnaire involves various indicators of physical development, for which there is no unambiguous evidence in existing literature, I do not hypothesize anything in particular.

CONCLUSION

The vast majority of existing studies focus on finding associations between specific indicators of development (e.g., physical activity, gross and/or fine motor skills competence, compliance with existing guidelines for physical development) and children's cognitive (e.g., executive functions, inattention, response inhibition) and social-emotional outcomes (e.g., emotional understanding, emotional competence). However, very few of them merge these indicators (outcomes) to explore children's overall development by domains. Therefore, more studies need to explore the associations between the developmental domains in general. For instance, more unambiguous evidence of gender differences in physical development is required. So far, gender differences studies of different developmental indicators show contrasting results: e.g., boys were found to be more physically active during the day, whereas girls showed greater scores on motor skill competence tests. The current study is an attempt to examine such relationships, investigating presumable associations between both specific indicators of development and developmental domains in general.

The available literature provides evidence that specific physical development indicators (i.e., motor skill competence and physical activity) have significant beneficial effect on both social-emotional and cognitive outcomes in young children (e.g., attention shifting, emotional understanding, self-regulation and self-control), therefore the present study will explore the following research questions: examining associations between children's overall scores on physical, social-communicative and cognitive subscales, examining associations between organized sport participation and emotional regulation (self-regulation and self-control), daily physical activity and emotional understanding, daily physical activity and attention shifting, motor skill competence and cognitive development.

METHOD

The current research represents a secondary data analysis and is a part of a larger on-going study. The original data were obtained within the project «Development and Validation of the Standardised Instrument for Multi-Dimensional Assessment of Preschoolers' Developmental Trajectories» funded by RFBR. The project aims to develop a robust and easy-to-implement tool that allows capturing various aspects of child development in line with the educational areas identified in the Federal State Educational Standard for Preschool Education. To this end, a questionnaire targeting preschool educationalists was designed. It involves assessing development trajectories of preschool-age children in 6 specific domains: social and communicative, cognitive, artistic and aesthetic, physical, language development and individual differences in key activity types characteristic for preschool curriculum. As the tool is emerging and now is going through the pilot stage, I aim to analyze its psychometric properties. First of all, internal consistency reliability was measured with Cronbach's α coefficient. Second of all, for some children, two different preschool educators independently gave their assessments, therefore I was also interested in examining the inter-rater reliability of these assessments, so the Kappa statistic was calculated for this goal. For establishing relationships between physical and social-communicative, cognitive development domains, Spearman's rank correlation (Spearman's rho) analysis was carried out.

The participants are preschool education professionals working in kindergartens in different cities in Russia. The received responses constitute estimates given by preschool education professionals based on their prior pedagogical observation of children over the last 2 weeks. The children were divided into 3 age groups in complying with their kindergarten groups: junior (3-4 years), middle (4-5 years), senior (5-6 years). Before completing the subscales of development domains, preschool educationalists were asked if they have sufficient observational data to work with the assessing tool. That could happen due to the frequent non-attendance of a child at a preschool education institution. If so, the response was labelled as 'insufficient data' and then was excluded from the final sample.

Each child develops according to their individual characteristics; the dynamics of this development depends on many factors. The educator can contribute to the development of the child by providing appropriate conditions and formative support through the setting of educational tasks within the zone of proximal development. Therefore, the main objective of the CAT questionnaire is to identify the strengths and weaknesses of children development as the basis for developing efficient intervention programmes.

For the purpose of the present study the following variables were used: The questionnaire encompasses a demographics subscale (one of the three age groups, gender, ordinal number of preschool educator assessing the child – 2 or 3 if a child was assessed by two or three educators, respectively), three major subscales each representing a developmental realm: social and communicative, cognitive, physical, and an individual differences subscale (see Table 1). The latter targets children's individual differences manifesting in various types of activities, e.g., role-playing, sport and active games, exploring and experimenting with environmental objects. The questionnaire's items represent statements about child's behaviour (e.g. 1.1.1. Speaks about their own needs, preferences and interests). The participants, i.e., preschool educators, assess the frequency of manifesting such behaviour using a 3-point Likert scale: 'Rarely' = 1, 'Sometimes' = 2, 'Almost Always' = 3. Thus, all response variables constitute ordinal data. For most of the questions, a greater score indicates positive development, except for reverse-coded items, in which greater results indicate higher risks for development. They majorly constitute the individual differences subscale that includes 9 repeating items for each block: Role-playing, Sport and active games, Exploring and experimenting with environmental objects, Performing everyday routine duties, Construction of different materials, Artistic and aesthetic activities, Mastering various movements.

The tool can be used in the implementation of any basic and partial educational programs, since the indicators of child development presented in it meet the value-target guidelines of the Federal State Educational Standard for Preschool Education and do not depend on the thematic content of the educational programs being implemented. The universal nature of the tool ensures the continuity of information about various aspects of a child's development throughout the entire period of preschool education, during the transition from one educational program to another, and when a child changes an educational organization.

Table 1

Description of subscales and items included in the "Comprehensive Assessment of the Trajectories of a child's development in preschool age" or CAT questionnaire

Subscale	Block of items	Number of items	Example of the questions	Reversed-scored items	Description of the indicators included
Demographics		8			Child's age, age group (based on the kindergarten group: junior or 3-4 years, middle or 4-5 years, senior 5-6 years), gender
Social and communicative development	«Autonomy»	8	1.1.1. Speaks about their own needs, preferences and interests; 1.1.3. Seeks the help of a caregiver in situations where he / she cannot cope with the task on his / her own.		self-acceptance, awareness and expression of one's own desires, aspirations, interests, the ability to communicate this to others, the ability to choose, express one's own attitude to something, the ability to independently engage in any activity
	«Interaction with others»	14	1.2.1. Shows interest, watches other children playing; 1.2.5. Cooperates with other children, participates in the coordination of roles and relationships in game episodes		the ability to cooperate with others, acceptance of diversity, the ability to take into account the interests and needs of other people, to work in a team
	«Self-regulation and self-control»	12	1.3.1. Expresses one's own emotions by means of words; 1.3.4. Understand that its	Item 1.3.2. Expresses your own emotions through facial	emotional self-regulation using the simplest techniques, the choice of culturally

			actions influence the feelings and/or behaviour of other children and caregivers	expressions, gestures, movements, and shouts	appropriate ways to meet needs, express emotions, solve problems and resolve conflicts
	«Social and emotional well-being»	15	1.4.1. Demonstrates confidence and trust in the surrounding world (for example, begins to establish contact with a previously unknown child or adult (a parent of other children, a kindergarten employee) on the territory of the kindergarten); 1.4.2. Continues to communicate with the caregiver and/or other children in situations of stress, embarrassment and frustration	1.4.7. Shows signs of anxiety in behaviour; 1.4.8. Exhibits inadequate physical aggression against other children; 1.4.9. Exhibits inadequate verbal aggression against other children; 1.4.12. Demonstrates the need for increased attention by the caregiver and continuous approval of their actions; 1.4.14. Rejected by other children in various interaction situations.	confidence and trust in the world around you, safe attachment to a significant adult, acceptance by other children and the ability to cope with situations of uncertainty and conflict resolution without aggression
Cognitive development	«Motivation for cognitive activity»	12	2.1.1. Holds the attention for a certain period of time to perform an action to solve a cognitive task; 2.1.8. Gets pleasure from achieving the set goal		involvement and concentration of attention, perseverance in achieving results, pleasure in achieving the goal
	«Strategies of cognitive activity»	19	2.2.1. Expresses his own ideas and hypotheses; 2.2.2. Suggests ways to solve the problem; 2.2.3. Correctly formulates open questions taking into account the semantic context of the communication situation		putting forward your own ideas, exploring the environment, choosing a way to solve the problem, willingness to take the initiative

	«Mathematics»	9	2.3.1. Uses the simplest mathematical concepts associated with measuring length, weight, quantity of objects, etc.; 2.3.3. Easily counts in direct order from 1 to 10	using the simplest mathematical concepts, numbers in everyday speech and to describe the properties of objects, the process and results of cognitive activity, understanding spatial relationships
Artistic and aesthetic development	«Attitude to creative activity»	7	3.1.1. Enjoys listening to music; 3.1.4. Enjoys studying fine arts; 3.1.6. Enjoys participating in story-role-playing games and theatrical perfomances	getting pleasure from art, music and movement; development of the need for creative self-expression
	«Music and movement»	11	3.2.1. Determines the tempo, volume of the music sound; 3.2.2. Listens to and detects the sounds of the surrounding world (wind, birdsong, siren)	recognition of rhythm, sounds of the surrounding world and musical instruments, reproduction of dance movements
	«Fine art and artistic design»	14	3.3.1. Recognizes the types of lines (e.g., straight, wavy, zigzag, dotted, thick, thin, etc.); colors, shapes (e.g., circle, triangle, square, etc.); 3.3.2. Recognizes textures (soft, hard, hard, etc.)	the use of various lines, colors, shapes and textures to create creative works, the skillful use of various tools and plastic materials to create creative works, the development of independence in the implementation of their own ideas in the products of creative activity
	«Plot-role-playing games and theatrical productions»	8	3.4.1. Mimics and moves the character’s character or mood; 3.4.2. Uses voice means to	the use of voice means, facial expressions, movements to convey the character or mood of the performed character,

			convey the character or mood of the character being played		the manifestation of initiative in determining their role in a theatrical production, active involvement in plot-role-playing games with other children
Physical development	«Attitude to physical activity»	4	4.1.1. Enjoys physical activity; 4.1.2. Enjoys success in mastering motor skills		getting pleasure from motor activity, success in mastering motor skills, participation in sports games and competitions
	«Control and coordination of gross and fine motor skills»	8	4.2.1. Well-oriented in space in outdoor games; 4.2.3. Skillfully and correctly holds and uses writing materials (pencil, brush, chalk); 4.2.5. Learns motor skills by repeating the actions of others		orientation in space, maintaining balance in outdoor games, mastering complex movements, skillful and correct use of cutlery, pencils, brushes, scissors, etc.
	«Responsibility for your own health»	6	4.3.1. Able to assess their physical capabilities; 4.3.2. Follows the instructions of the teacher, ensuring safety, in various situations in the kindergarten and public places (walk, excursion)		the ability to assess your own physical capabilities, compliance with the rules of personal hygiene and routine moments of stay in kindergarten, compliance with the requirements of safe behavior in various situations: while working with scissors, while walking, playing situations, etc
	«Physical well-being»	6	4.4.1. Correctly assesses their condition and answers the questions of the teacher about	4.4.6. Shows increased fatigue during the day	the ability to assess your physical condition and seek help if necessary, moderate

			their physical condition; 4.4.2. Reports on their physical condition (fatigue, malaise, pain)		activity and energy during the day
Language development	«Speech interaction»	8	5.1.1. Constructs a speech message with a specific purpose (a motivated statement); 5.1.2. Understands the meaning of the teacher's questions and answers them correctly	5.1.6. Uses more gestures, facial expressions and non-speech sounds when communicating with other children	constructing speech messages for a specific purpose, understanding the meaning of speech utterances, correct use of oral speech in communication with other children and for solving various tasks
	«Attitude to speech activity»	6	5.2.1. Enjoys playing with words; 5.2.2. Enjoys listening to texts (reading texts by the teacher, listening to audio recordings)		enjoying playing with words, listening to texts, drawing symbols, memorizing poems, participating in discussions and telling stories
	«Literacy»	25	5.3.1. Correctly indicates the author and the title of the book; 5.3.2. Attentively listens to the teacher reading stories, fairy tales, stories, etc.; 5.3.3. Demonstrates knowledge of the alphabet	5.3.13. The child gets tired quickly when writing.	interest in reading, reading technique, semantic interpretation of the text, writing, phonemic hearing, correct sound and word pronunciation, listening and understanding
Individual differences in behaviour*	Role-playing Sport and active games Exploring and experimenting with environmental objects	9 9 9	6.1.1. Shows interest; 6.1.8. Improves performance when the educator starts assisting; demonstrates learning ability.	6.1.2. Quickly gets tired, gets tired; reduces the pace of activity; 6.1.3. Gets distracted by any external stimuli (sounds, words, people, etc.) during the activities of interest; 6.1.4. Gets distracted by any external stimuli (sounds, words, people,	child’s individual characteristic during various activities: role-playing, sport and active games, exploring and experimenting with environmental objects, performing everyday routine duties, construction of

Performing everyday routine duties	9	etc.) during the activities that do NOT arise interest; 6.1.5. Shows hyperactivity (increased motor activity, makes unnecessary movements); 6.1.6. Shows impulsivity, (inconsistency, randomness); does not finish the activity; 6.1.7. Does not follow the instructions of the teacher in the course of activity, violates the rules; 6.1.9. It is difficult to switch from performing one action to another; "loops" on a certain action.	different materials, artistic and aesthetic activities, mastering various movements
Construction of different materials	9		
Artistic and aesthetic activities	9		
Mastering various movements	9		
Musical and rhythmic movements	9		

Note. *The *"Individual differences in behaviour"* subscale has nine repeating items for each of its block.

This tool can be used to compare and evaluate the effectiveness of various educational programs and methods of preschool education in order to improve them, as well as to build individual educational routes. The tool can be used to conduct large-scale research to monitor the development of the preschool education system. The tool «Comprehensive assessment of the trajectory of a child's development in preschool age» is not intended to evaluate the activities of a particular educator or educational organization.

Prior to the data collection, the project received approval from the interdisciplinary Ethics Committee. All information was handled anonymously using identification codes. The data collection was carried out via the online platform of the Russian Academy of Education. For each child, two different preschool education professionals completed the information in the questionnaire. Before completing the form, educationalists were presented with a full description of the project and its aims, as noticed above. Also, the participants were given a detailed description of every developmental domain (subscales). All the educationalists were provided with the questionnaire in advance and were able to raise any questions about their participation in the research. The following instruction was presented to the participants in the beginning of the questionnaire:

“The diagnostic tool contains statements describing: various aspects of the child's behavior during various types of activities (play, artistic and aesthetic, cognitive, etc.), communication with other children and the teacher; features of the child's compliance with regime moments, etc. The educationalist evaluates the frequency of the described behavior of the child, choosing one of the answer options «almost never», «sometimes» or «almost always» based on generalized observations of the child during the two weeks prior to the assessment. When working with the tool, it is recommended to take into account the child's portfolio, the diary entries of pedagogical observations to summarize pedagogical observations.

If the choice of an option for any of the indicators causes difficulties, the teacher chooses the most appropriate option and supplements the comments in the «comment» response option. Also, in the «comment» field, you can offer a clarification of the statement wording. This is a very important stage of the teacher's work at the stage of pilot testing of the tool.

Each educator working on a group of children conducts a comprehensive assessment of the development trajectory of each child independently, without discussing or consulting with another educator working on the same group, or specialized specialists (a teacher of fine arts, a music worker, a speech therapist, a physical education instructor).

If you have any questions about working with the tool, educators and specialized specialists contact the coordinator of the study on the basis of a preschool educational institution."

RESULTS

The data analysis was carried out using the statistical packages IBM SPSS Statistics 28.0 (190) and JASP 0.14.1 software for Windows 64-bit.

DESCRIPTIVE STATISTICS

Of the 3329 responses, 496 were excluded due to the child's frequent absence from the educational institution, in this case, the participants were asked to report that pedagogical observation was not sufficient for completing the questionnaire (item *"Due to the frequent non-attendance of the child at the educational institution, pedagogical observations are not sufficient to work with the tool"*, Table 2). Five more cases were not reported as insufficient data by the participants but were missing more than 50% of the variables (including gender and most of the test items) and therefore were also excluded from the final sample. This resulted in 2828 observations each presenting a preschool educator's responses to the CAT questionnaire.

Table 2

Summary of insufficient data (*"ID-INSUF-DATA")*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	2829	85,0	85,1	85,1
	1	496	14,9	14,9	100,0
	Total	3325	99,9	100,0	
Missing	System	4	,1		
Total		3329	100,0		

Note. Variable *'ID-INSUF-DATA'* encodes item *"Due to the frequent non-attendance of the child at the educational institution, pedagogical observations are not sufficient to work with the tool"*, 0 – no, 1 – yes (if 'yes' selected, the participants were asked to finish their work with the tool).

The original dataset comprised all the test items as separate variables. To analyze the CAT test's scores by subscales and blocks within the subscales, new merged variables were created by calculating each item's mean scores (see Table 3). Some of the children in the sample were assessed by two (or three) different educators working with the same children's group at the kindergarten. For the purposes of the further analyses the original dataset was divided into three subsamples: children assessed by one (Subsample 1, n = 1610, mean age 4,46 years, SD = 0,90, 50,99% females), two (Subsample 2, n = 1199, mean age 2,58 years, SD = 0,91, 51% females) and three (Subsample 3, n = 18, mean age 3,0 years, SD = 0,36, 44,4% females) preschool educators. The descriptive statistics summary for all six subscales is presented in Table 3.

Table 3

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Subsample 1 (children assessed by one preschool educator)					
EDU NUM	1610	1	1	1,00	,000
UNIT	1610	1	36	16,55	10,364
INF-GROUP	1610	1	3	1,99	,797
AGE (years)	1610	2,42	7,08	4,4622	,90042
INF-DAYS-SKIPPED	1593	0	90	13,92	11,814
SUBSC-1	1610	1,17	2,94	2,3572	,33030
SUBSC-2	1610	1,00	3,00	2,2235	,46301
SUBSC-3	1610	1,00	3,00	2,2290	,46777
SUBSC-4	1610	1,08	3,00	2,6231	,34481
SUBSC-5	1610	1,03	3,00	2,0892	,35678
SUBSC-6	1610	1,08	3,00	2,4772	,36954
Valid N (listwise)	1593				
Subsample 2 (children assessed by two preschool educators)					
EDU NUM	1199	2	2	2,00	,000
UNIT	1199	2	37	18,58	9,593
INF-GROUP	1199	1	4	2,03	,835
AGE (y,m)	1199	2,58	7,00	4,5349	,90761
INF-DAYS-SKIPPED	1199	0	90	14,23	11,420
SUBSC-1	1199	1,23	2,94	2,3358	,33574
SUBSC-2	1199	1,00	3,00	2,2288	,45583
SUBSC-3	1199	1,00	3,00	2,2404	,46363
SUBSC-3	1199	1,08	3,00	2,6192	,35475
SUBSC-5	1199	1,03	2,95	2,0848	,35760
SUBSC-6	1199	1,18	3,00	2,4752	,35427
Valid N (listwise)	1199				
Subsample 3 (children assessed by three preschool educators)					
EDU NUM	18	3	3	3,00	,000
UNIT	18	5	16	14,78	3,557
INF-GROUP	18	1	1	1,00	,000
INF-GENDER	18	1	2	1,44	,511
AGE (y,m)	18	3,00	4,42	3,3306	,36195
INF-DAYS-SKIPPED	18	0	47	21,61	12,761
SUBSC-1	18	1,44	2,40	1,9861	,26927
SUBSC-2	18	1,10	2,38	1,8653	,36844
SUBSC-3	18	1,00	2,21	1,7164	,30803
SUBSC-3	18	1,42	2,58	2,1644	,30734
SUBSC-5	18	1,26	2,21	1,7749	,24884
SUBSC-6	18	1,47	2,67	2,3302	,35222
Valid N (listwise)	18				

Note. *Subsample 1* – children assessed by one, *Subsample 2* – by two, *Subsample 3* – by three preschool educators. EDU NUM – the number of preschool educators, UNIT – the number of

preschool education institution, INF-GROUP – the age group (1 – 3-4 years, 2 – 4-5 years, 3 – 5-6 years), INF-DAYS-SKIPPED – the number of days missed by a child at the kindergarten in the last 3 months (including the current month), SUBSC-1 – Social-communicative development, SUBSC-2 – Cognitive development, SUBSC-3 – Artistic and aesthetic development, SUBSC-4 – Physical development, SUBSC-5 – Language development, SUBSC-6 – Individual differences in behaviour.

Tables 4.1, 4.2, 4.3 and 4.4 present frequency distribution by the following variables, respectively: gender, preschool education institution's number, educator's number, age group (based on the kindergarten groups). Overall, educators from 37 different preschool education institutions were included in the sample. The proportion of children assessed by three preschool educators is substantially smaller than in children assessed by two educators: 0,6% as opposed to 42,4%, respectively. Hence, in the further inter-rater reliability analysis only assessments given by two preschool educators will be included. The frequency table for children's age groups is presented for Subsample 1 only, as it will be used for further examination of research questions. The proportions of children in age groups 1 to 3 were approximately equal: 31,6% in age group 1 (3-4 years), 36,2% in age group 2 (4-5 years), 30,2% in age group 3 (5-6 years). The maximum values for child's age in subsample 1 and subsample 2 are 7,08 and 7,0, respectively. Although age group 3 primarily include children under 7 age, four children aged 7,0 were also included in the sample, as they were still from the senior groups at the kindergarten. The small number of observations of 7-year-old children do not provide any significant limitations to the study.

Table 4.1

Frequency table for gender (INF-GENDER)

	Total		Subsample 1		Subsample 2		Subsample 3	
	N	%	N	%	N	%	N	%
M	1387	49,0%	789	49,0%	587	49,0%	10	55,6%
F	1441	51,0%	821	51,0%	612	51,0%	8	44,4%

Note. *Subsample 1* – children assessed by one, *Subsample 2* – by two, *Subsample 3* – by three preschool educators.

Table 4.2

Frequency table for preschool education institution number (UNIT)

	N	%
1	88	3,1%
2	47	1,7%
3	82	2,9%
4	100	3,5%
5	87	3,1%
6	40	1,4%
7	73	2,6%
8	47	1,7%

9	95	3,4%
10	124	4,4%
11	89	3,1%
12	102	3,6%
13	256	9,1%
14	82	2,9%
15	41	1,4%
16	124	4,4%
17	207	7,3%
18	18	0,6%
19	23	0,8%
20	49	1,7%
21	29	1,0%
22	77	2,7%
23	69	2,4%
24	77	2,7%
25	187	6,6%
26	39	1,4%
27	42	1,5%
28	19	0,7%
29	63	2,2%
30	37	1,3%
31	60	2,1%
32	79	2,8%
33	15	0,5%
34	39	1,4%
35	49	1,7%
36	171	6,0%
37	2	0,1%

Note. *Subsample 1* – children assessed by one, *Subsample 2* – by two, *Subsample 3* – by three preschool educators.

Table 4.3

Frequency table for preschool educator's number (EDU NUM)

	N	%
1	1611	57,0%
2	1199	42,4%
3	18	0,6%

Note. 1 – first educator assessing a child, 2 – second, 3 – third.

Table 4.4

Frequency table for children's age groups (INF-GROUP)

	N	%
1	918	32,5%
2	1022	36,1%
3	888	31,4%

Note. '1' – 3-4 years, '2' – 4-5 years, '3' – 5-6 years

In order to examine the data's normality of distribution Kolmogorov-Smirnov and Shapiro-Wilk tests were used. Both tests result for all the subscales reached significance, indicating non-normal distribution for all the subscales (Table 5). The normality analysis results determined the use of non-parametric tests in further investigation of research questions.

Table 5

Tests of Normality by test subscales

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SUBSC-1	,080	1610	<,001	,967	1610	<,001
SUBSC-2	,060	1610	<,001	,977	1610	<,001
SUBSC-3	,061	1610	<,001	,975	1610	<,001
SUBSC-3	,148	1610	<,001	,891	1610	<,001
SUBSC-5	,062	1610	<,001	,989	1610	<,001
SUBSC-6	,090	1610	<,001	,954	1610	<,001

a. Lilliefors Significance Correction

Note. SUBSC-1 – Social-communicative development, SUBSC-2 – Cognitive development, SUBSC-3 – Artistic and aesthetic development, SUBSC-4 – Physical development, SUBSC-5 – Language development, SUBSC-6 – Individual differences in behaviour.

RELIABILITY ANALYSIS

In total, the CAT questionnaire included 264 items merged into 26 blocks in 6 thematic subscales each representing a developmental domain (e.g., social-communicative, cognitive development). The first step of examining the psychometric properties of the "Comprehensive Assessment of the Trajectories of child development in preschool age" questionnaire was conducting the internal consistency reliability analysis. The Cronbach's alpha coefficients were calculated for each subscale and the composite test score (see Table 6). The values of Cronbach's alpha test of reliability analysis ranged from 0.934 to 0.777. (0.943 for Social-Communicative; 0.972 for Cognitive; 0.970 for Artistic and aesthetic; 0.934 for Physical; 0.949 for Language; 0.977 for Individual differences in behaviour), all indicating the excellent level of internal consistency. 95% confidence intervals indicated the significance of the findings. The complete test scores also

showed excellent level of internal consistency ($a = 0.991$). The reverse-scored items were taken into account.

Table 6

Internal consistency reliability analysis results

Subscale	Block	N of items	Cronbach's alpha (a)	95% CI lower bound	95% CI upper bound
Social-communicative development		49	a = 0.943	0.940	0.946
	1.1 «Autonomy»	8	a = 0.872	0.865	0.879
	1.2 «Interaction with others»	14	a = 0.931	0.927	0.935
	1.3 «Self-regulation and self-control»	12	a = 0.788	0.776	0.799
	1.4 «Social and emotional well-being»	15	a = 0.815	0.805	0.825
Cognitive development		40	a = 0.972	0.970	0.973
	2.1 «Motivation for cognitive activity»	12	a = 0.913	0.908	0.917
	2.2 «Strategies of cognitive activity»	19	a = 0.958	0.956	0.961
	2.3 «Mathematics»	9	a = 0.927	0.922	0.931
Artistic and aesthetic development		40	a = 0.970	0.969	0.972
	3.1 «Attitude to creative activity»	7	a = 0.896	0.890	0.902
	3.2 «Music and movement»	11	a = 0.931	0.927	0.935
	3.3 «Fine art and artistic design»	14	a = 0.944	0.941	0.947
	3.4 «Plot-role-playing games and theatrical productions»	8	a = 0.914	0.909	0.919
Physical development		24	a = 0.934	0.930	0.937
	4.1 «Attitude to physical activity»	4	a = 0.910	0.905	0.916
	4.2 «Control and coordination of gross and fine motor skills»	8	a = 0.892	0.886	0.898
	4.3 «Responsibility for your own health»	6	a = 0.834	0.824	0.844
	4.4 «Physical well-being»	6	a = 0.765	0.751	0.778
Language development		39	a = 0.949	0.946	0.951

	5.1 «Speech interaction»	8	a = 0.856	0.848	0.863
	5.2 «Attitude to speech activity»	6	a = 0.871	0.863	0.878
	5.3 «Literacy»	25	a = 0.916	0.912	0.920
Individual differences in behaviour		72	a = 0.977	0.976	0.978
	6.1 Role-playing	9	a = 0.824	0.814	0.833
	6.2 Sport and active games	9	a = 0.814	0.804	0.824
	6.3 Exploring and experimenting with environmental objects	9	a = 0.846	0.838	0.855
	6.4 Performing everyday routine duties	9	a = 0.865	0.858	0.873
	6.5 Construction of different materials	9	a = 0.834	0.825	0.843
	6.6 Artistic and aesthetic activities	9	a = 0.865	0.857	0.872
	6.7 Mastering various movements	9	a = 0.839	0.830	0.848
	6.8 Musical and rhythmic movements	9	a = 0.865	0.857	0.872
Overall			a =0.991	0.990	0.991

Note. Of the observations, pairwise complete cases were used

The CAT questionnaire suggested that two (or more) preschool educators can give their assessments of the same child's development. 42% of the children involved in the ongoing CAT project were assessed by two educators simultaneously. Thus, one of the current study's objective was to examine the inter-rater reliability as part of the psychometric properties' analysis. For this purpose, the Cronbach's Kappa statistic for all the test's items was calculated, the results of the analysis are reported in Table 7. Particularly, two educators from one preschool institution (Unit 2) and their assessments of children from the first age group (3-4 years) were chosen. The inter-rater consistency level for the test overall was found to be $k = .766, p < 001$, indicating a substantial level of agreement between the educators' assessments.

Table 7

Summary of the inter-rater reliability analysis

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Measure of Agreement	Kappa	,766	,015	137,575	,000
N of Valid Cases		16383			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

For examining gender differences in physical development (Physical Development subscale) the non-parametric Mann-Whitney U test was conducted. The rationale behind the analysis type choice is the ordinal level of data measurement, as each item represented a Likert-scale type of data. Thus, the Mann-Whitney U criterion was calculated for the overall physical development subscale scores ("SUBSC-4"), four blocks within the subscales ("SUBSC-4-1", "SUBSC-4-2", "SUBSC-4-3", "SUBSC-4-4"), and each item of the physical development subscale, as reported in Table 8.1 and Table 8.2, respectively. The Mann-Whitney U test result for overall Physical Development subscale scores indicated significant gender differences U = 792170,5, p < .001. Comparing the mean ranks of the overall subscale's scores demonstrated that females scored significantly higher on the physical development subscale than males (see Table 7.1). Similar results were found in three out of four blocks in the Physical development subscale: U = 764018, p < .001 for block 4.2 Control and coordination of gross and fine motor skills, U = 815635, p < .001 for block 4.3 Responsibility for one's own health, U = 850142,500 p < .001 for block 4.4 Physical well-being. The Mann-Whitney U test results for these three blocks reached significance, with females showing greater development scores than males. However, block 4.1 Attitude to physical activity did not indicated any significant gender differences (p = ,982).

Table 8.1

Mann-Whitney U test. Ranks

	INF-GENDER	N	Mean Rank	Sum of Ranks
SUBSC-4	M	1387	1265,14	1754748,50
	F	1441	1558,26	2245457,50
	Total	2828		
SUBSC-4-1	M	1387	1414,31	1961645,50
	F	1440	1413,70	2035732,50
	Total	2827		
SUBSC-4-2	M	1387	1244,84	1726596,00
	F	1441	1577,80	2273610,00
	Total	2828		
SUBSC-4-3	M	1387	1282,06	1778213,00
	F	1441	1541,98	2221993,00
	Total	2828		
SUBSC-4-4	M	1387	1306,94	1812720,50
	F	1441	1518,03	2187485,50
	Total	2828		

Note. SUBSC-1 – Social-communicative development, SUBSC-2 – Cognitive development, SUBSC-3 – Artistic and aesthetic development, SUBSC-4 – Physical development, SUBSC-5 – Language development, SUBSC-6 – Individual differences in behaviour, SUBSC-4-1 – block 4.1 Attitude to physical activity, SUBSC-4-2 – block 4.2 Control and coordination of gross and fine motor skills, SUBSC-4-3 – block 4.3 Responsibility for one's own health, SUBSC-4-4 – block 4.4 Physical well-being.

Table 8.2

Mann-Whitney U test statistics[a]

	SUBSC-4	SUBSC-4-1	SUBSC-4-2	SUBSC-4-3	SUBSC-4-4
Mann-Whitney U	792170,500	998212,500	764018,000	815635,000	850142,500
Wilcoxon W	1754748,500	2035732,500	1726596,000	1778213,000	1812720,500
Z	-9,560	-,023	-10,985	-8,792	-6,998
Asymp. Sig. (2-tailed)	<,001	,982	<,001	<,001	<,001

a. Grouping Variable: INF-GENDER

Note. SUBSC-1 – Social-communicative development, SUBSC-2 – Cognitive development, SUBSC-3 – Artistic and aesthetic development, SUBSC-4 – Physical development, SUBSC-5 – Language development, SUBSC-6 – Individual differences in behaviour, SUBSC-4-1 – block 4.1 Attitude to physical activity, SUBSC-4-2 – block 4.2 Control and coordination of gross and fine motor skills, SUBSC-4-3 – block 4.3 Responsibility for one's own health, SUBSC-4-4 – block 4.4 Physical well-being.

As shown in Table 8.3, the Mann-Whitney U statistics for 19 out of 24 physical development scale items reached significant levels ($p < .001$): *4.2.1. Well-oriented in space in outdoor games; 4.2.2. Skillfully and correctly holds and uses cutlery; 4.2.3. Skilfully and correctly holds and uses writing materials (pencil, brush, chalk); 4.2.4. Skillfully and correctly uses scissors, glue and other tools and materials in the process of creating creative works; 4.2.5. Learns motor skills by repeating the actions of others; 4.2.6. Learns motor skills by following verbal instructions; 4.2.7. Performs complex movements involving the coordination of large and small motor skills, maintains balance in outdoor games, dances, theater productions; 4.2.8. It is well oriented and moves safely in the space of a kindergarten (group), a playground for walking; 4.3.1. Able to assess their physical capabilities; 4.3.2. Follow the instructions of the teacher, ensuring safety, in various situations in kindergarten and public places (walk, excursion); 4.3.3. Readily observes the regime moments of eating; 4.3.4. Readily observes the regime moments of the walk; 4.3.5. Readily observes the regime moments of daytime sleep; 4.3.6. Readily observes the rules of personal hygiene and takes care of himself (washes his hands; uses a comb, handkerchiefs); 4.4.1. Correctly assesses their condition and answers the questions of the teacher about their physical condition; 4.4.2. Reports on his physical condition (fatigue, malaise, pain); 4.4.3. Answers questions about your physical needs; 4.4.4. Reports on their physical needs (thirst, hunger, cold, heat); 4.4.5. Shows moderate activity*

and energy during the day. If analyzed by blocks within the Physical Development subscale, significant gender differences were found for block 4.2. "Control and coordination of gross and fine motor skills", block 4.3. "Responsibility for one's own health" and 5 of 6 items of block 4.4. "Physical well-being" with females showing significantly higher development scores, than males. No significant differences between males and females were found in the block 4.1. "Attitude to physical activity" and item *4.4.6. Shows increased fatigue during the day*.

Table 8.3

Results of Mann-Whitney U test examining gender differences in physical development

	W	df	p	Hodges-Lehmann Estimate	Rank-Biserial Correlation
ID-4-1-1	984588.500		0.370	-4.817e -6	-0.014
ID-4-1-2	1.019e +6		0.188	1.198e -5	0.021
ID-4-1-3	999057.000		0.913	4.411e -5	0.002
ID-4-1-4	988543.500		0.551	-1.963e -5	-0.011
ID-4-2-1	1.068e +6		< .001	7.220e -5	0.069
ID-4-2-2	1.157e +6		< .001	1.175e -5	0.157
ID-4-2-3	1.194e +6		< .001	4.461e -5	0.195
ID-4-2-4	1.205e +6		< .001	4.082e -6	0.205
ID-4-2-5	1.107e +6		< .001	2.376e -5	0.108
ID-4-2-6	1.166e +6		< .001	4.118e -5	0.167
ID-4-2-7	1.195e +6		< .001	1.710e -5	0.196
ID-4-2-8	1.118e +6		< .001	7.121e -6	0.118
ID-4-3-1	1.076e +6		< .001	4.027e -5	0.076
ID-4-3-2	1.199e +6		< .001	2.209e -5	0.200
ID-4-3-3	1.082e +6		< .001	4.671e -5	0.083
ID-4-3-4	1.091e +6		< .001	1.707e -5	0.092
ID-4-3-5	1.071e +6		< .001	1.506e -5	0.071
ID-4-3-6	1.110e +6		< .001	4.386e -6	0.110
ID-4-4-1	1.085e +6		< .001	1.916e -6	0.086
ID-4-4-2	1.118e +6		< .001	3.279e -5	0.119
ID-4-4-3	1.070e +6		< .001	5.207e -6	0.071
ID-4-4-4	1.055e +6		0.001	6.290e -5	0.055
ID-4-4-5	1.122e +6		< .001	1.009e -5	0.122
ID-4-4-6	962246.000		0.048	-2.422e -5	-0.037

Note. For the Mann-Whitney test, effect size is given by the rank biserial correlation.

Note. Mann-Whitney U test.

Note. ID-X-X-X variables encode the number of corresponding items in the questionnaire: *4.2.1. Well-oriented in space in outdoor games; 4.2.2. Skillfully and correctly holds and uses cutlery; 4.2.3. Skilfully and correctly holds and uses writing materials (pencil, brush, chalk); 4.2.4. Skillfully and correctly uses scissors, glue and other tools and materials in the process of creating creative works; 4.2.5. Learns motor skills by repeating the actions of others; 4.2.6. Learns motor skills by following verbal instructions; 4.2.7. Performs complex movements involving the coordination of large and small motor skills, maintains balance in outdoor games, dances, theater productions; 4.2.8. It is well oriented and moves safely in the space of a*

Table 8.3

Results of Mann-Whitney U test examining gender differences in physical development

	W	df	p	Hodges-Lehmann Estimate	Rank-Biserial Correlation
kindergarten (group), a playground for walking; 4.3.1. Able to assess their physical capabilities; 4.3.2. Follow the instructions of the teacher, ensuring safety, in various situations in kindergarten and public places (walk, excursion); 4.3.3. Readily observes the regime moments of eating; 4.3.4. Readily observes the regime moments of the walk; 4.3.5. Readily observes the regime moments of daytime sleep; 4.3.6. Readily observes the rules of personal hygiene and takes care of himself (washes his hands; uses a comb, handkerchiefs); 4.4.1. Correctly assesses their condition and answers the questions of the teacher about their physical condition; 4.4.2. Reports on his physical condition (fatigue, malaise, pain); 4.4.3. Answers questions about your physical needs; 4.4.4. Reports on their physical needs (thirst, hunger, cold, heat); 4.4.5. Shows moderate activity and energy during the day					

In order to trace the patterns of gender differences across the ages, a cross-sectional analysis was conducted within three age groups (see Table 9.1 and 9.2).

Table 9.1

Results of Mann-Whitney U test examining gender differences in physical development across three age groups

	3-4 years				4-5 years				5-6 years			
	INF-GENDER	N	Mean Rank	Sum of Ranks	INF-GENDER	N	Mean Rank	Sum of Ranks	INF-GENDER	N	Mean Rank	Sum of Ranks
SUBSC-4	M	15	11,83	177,50	M	15b	10,67	160,00	M	22	15,02	330,50
	F	11	15,77	173,50	F	9	15,56	140,00	F	19[b]	27,92	530,50
	Total	26			Total	24			Total	41		
SUBSC-4-1	M	15	14,30	214,50	M	15b	12,67	190,00	M	22	18,84	414,50
	F	11	12,41	136,50	F	9	12,22	110,00	F	19[b]	23,50	446,50
	Total	26			Total	24			Total	41		
SUBSC-4-2	M	15	11,30	169,50	M	15b	9,60	144,00	M	22	15,27	336,00
	F	11	16,50	181,50	F	9	17,33	156,00	F	19[b]	27,63	525,00
	Total	26			Total	24			Total	41		
SUBSC-4-3	M	15	14,10	211,50	M	15b	11,07	166,00	M	22	17,25	379,50
	F	11	12,68	139,50	F	9	14,89	134,00	F	19[b]	25,34	481,50
	Total	26			Total	24			Total	41		
SUBSC-4-4	M	15	12,63	189,50	M	15b	11,17	167,50	M	22	17,64	388,00
	F	11	14,68	161,50	F	9	14,72	132,50	F	19[b]	24,89	473,00
	Total	26			Total	24			Total	41		

Note. SUBSC-4 – Physical development, SUBSC-4-1 – block 4.1 Attitude to physical activity, SUBSC-4-2 – block 4.2 Control and coordination of gross and fine motor skills, SUBSC-4-3 – block 4.3 Responsibility for one's own health, SUBSC-4-4 – block 4.4 Physical well-being.

Table 9.2

Mann-Whitney U Test Statistics[a,b]

	SUBSC-1	SUBSC-2	SUBSC-4	SUBSC-4-1	SUBSC-4-2	SUBSC-4-3	SUBSC-4-4
			3-4 years				
Mann-Whitney U	41,500	47,500	57,500	70,500	49,500	73,500	69,500
Wilcoxon W	161,500	167,500	177,500	136,500	169,500	139,500	189,500
Z	-2,130	-1,819	-1,304	-,734	-1,751	-,493	-,724
Asymp. Sig. (2-tailed)	,033	,069	,192	,463	,080	,622	,469
Exact Sig. [2*(1-tailed Sig.)]	,032[c]	,069[c]	,198[c]	,540[c]	,087[c]	,646[c]	,507[c]
			4-5 years				
Mann-Whitney U	49,500	55,000	40,000	65,000	24,000	46,000	47,500
Wilcoxon W	169,500	175,000	160,000	110,000	144,000	166,000	167,500
Z	-1,077	-,748	-1,648	-,155	-2,625	-1,323	-1,207
Asymp. Sig. (2-tailed)	,282	,454	,099	,877	,009	,186	,227
Exact Sig. [2*(1-tailed Sig.)]	,290[c]	,482[c]	,108[c]	,907[c]	,008[c]	,215[c]	,238[c]
			5-6 years				
Mann-Whitney U	175,000	175,500	77,500	161,500	83,000	126,500	135,000
Wilcoxon W	428,000	428,500	330,500	414,500	336,000	379,500	388,000
Z	-,891	-,876	-3,662	-2,186	-3,819	-2,627	-2,293
Asymp. Sig. (2-tailed)	,373	,381	<,001	,029	<,001	,009	,022
Exact Sig. [2*(1-tailed Sig.)]	,571[c]	1,000[c]	1,000[c]	,393[c]	,571[c]	,393[c]	,393[c]

a. Split by INF-GROUP

b. Grouping Variable: INF-GENDER

c. Not corrected for ties.

Note. SUBSC-4 – Physical development, SUBSC-5 – Language development, SUBSC-6 – Individual differences in behaviour, SUBSC-4-1 – block 4.1 Attitude to physical activity, SUBSC-4-2 – block 4.2 Control and coordination of gross and fine motor skills, SUBSC-4-3 – block 4.3 Responsibility for one's own health, SUBSC-4-4 – block 4.4 Physical well-being.

CORRELATIONAL ANALYSIS

RELATIONSHIPS BETWEEN PHYSICAL, SOCIAL-COMMUNICATIVE AND COGNITIVE DEVELOPMENTAL DOMAINS

A subsample of children assessed only by the first preschool educator was used for the Spearman's correlation analysis. To examine associations between the overall scores on developmental subscales, new variables were calculated: "SUBSC-1" for Social-communicative development, "SUBSC-2" for Cognitive development, and "SUBSC-4" for Physical development. The variables were composed of each item's mean values. For examining the associations between physical, social-communicative and cognitive development in preschool-age children the non-parametric Spearman's correlation test was used. The rationale behind the analysis type choice is the ordinal level of data measurement, as each item represented a Likert-scale type of data. Therefore, the Spearman's rho coefficients were calculated to explore the relationship between overall Physical development and Social-communicative development subscales' scores. The received results are reported in Table 9.

The Spearman's correlation test results demonstrated a significant strong correlation between the Physical development ("SUBSC-4") and Social-communicative development ("SUBSC-1") subscales: $r = 0.77, p < .001$. Table 10.2 summarizes the Spearman's correlational analysis for overall subscales' score across three age groups (3-4, 4-5 and 5-6 years). The correlation between Physical development ("SUBSC-4") and Social-communicative development ("SUBSC-1") subscales reached significance in all age groups, although the correlation was strong only in group of 3-4- and 4-5-year-olds: $r = 0.679$ and $r = 0.659$, respectively ($p < .001$). Children at 5-6 years demonstrated only a moderate correlation between physical and social-communicative development $r = 0.432, p < .005$.

Table 10.1

Results of correlational analysis between overall subscales scores

			SUBSC-1	SUBSC-2	SUBSC-4
Spearman's rho	SUBSC-1	Correlation Coefficient	1,000	,799**	,770**
		Sig. (2-tailed)	.	,000	,000
		N	1610	1610	1610
	SUBSC-2	Correlation Coefficient	,799**	1,000	,756**
		Sig. (2-tailed)	,000	.	<,001
		N	1610	1610	1610
	SUBSC-4	Correlation Coefficient	,770**	,756**	1,000
		Sig. (2-tailed)	,000	<,001	.
		N	1610	1610	1610

**. Correlation is significant at the 0.01 level (2-tailed).

Note. SUBSC-1 encodes Social-communicative development subscale, SUBSC-2 – Cognitive development subscale, SUBSCL-4 – Physical development subscale.

Table 10.2

Results of correlational analysis between overall subscales scores across three age groups

			3-4 years			4-5 years			5-6 years		
			SUBSC-1	SUBSC-2	SUBSC-4	SUBSC-1	SUBSC-2	SUBSC-4	SUBSC-1	SUBSC-2	SUBSC-4
Spearman's rho	SUBSC-1	Correlation Coefficient	1,000	,884**,*	,679**,*	1,000	,921**,*	,659**,*	1,000	,771**,*	,432**,*
		Sig. (2-tailed)	.	<,001	<,001	.	<,001	<,001	.	<,001	,005
		N	26	26	26	24	24	24	41	41	41
	SUBSC-2	Correlation Coefficient	,884**,*	1,000	,643**,*	,921**,*	1,000	,723**,*	,771**,*	1,000	,532**,*
		Sig. (2-tailed)	<,001	.	<,001	<,001	.	<,001	<,001	.	<,001
		N	26	26	26	24	24	24	41	41	41
	SUBSC-4	Correlation Coefficient	,679**,*	,643**,*	1,000	,659**,*	,723**,*	1,000	,432**,*	,532**,*	1,000
		Sig. (2-tailed)	<,001	<,001	.	<,001	<,001	.	,005	<,001	.
		N	26	26	26	24	24	24	41	41	41

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Note. SUBSC-1 – Social-communicative development, SUBSC-2 – Cognitive development, SUBSC-4 – Physical development, SUBSC-4-1 – block 4.1 Attitude to physical activity, SUBSC-4-2 – block 4.2 Control and coordination of gross and fine motor skills, SUBSC-4-3 – block 4.3 Responsibility for one's own health, SUBSC-4-4 – block 4.4 Physical well-being.

RELATIONSHIPS BETWEEN SPECIFIC INDICATORS OF PHYSICAL AND SOCIAL-COMMUNICATIVE DEVELOPMENT

The correlation of emotional understanding (item *1.3.4. Demonstrates an understanding that their actions have an impact on the feelings and/or behavior of other children and the caregiver*) and daily physical activity (item *4.4.5. Shows moderate activity and energy during the day*) indicators was examined. The Spearman's correlation test results of the items reached significance ($p < .001$) but showed a weak effect size ($r = 0.210$), as presented in Table 11.1. Similar significant results of weak effect were found in 5-6-year-olds only $r = 0.261$, $p < 0.001$ (see Table 11.2). Two other age groups showed significant but negligible correlations: $r = 0.200$ in 3-4-year-olds, $r = 0.161$ in 4-5-year-olds ($p < 0.001$). Another association was examined between organized sport participation indicator (item *4.1.3. Enjoys participating in sports games*) and block 1.3. Self-regulation and self-control. As shown in Table 12.1, the results indicated a moderate significant correlation $r = 0.411, p < 0.001$. The correlation's effect size was less when analyzed by age groups (see Table 12.2): the correlation was weak at age 3-4 years ($r = 0.403, p < 0.001$) and 4-5 years ($r = 0.373, p < 0.001$), the results of 5-6-year-olds was on the lower border of moderate effect size ($r = 0.41, p < 0.001$), so can also be interpreted as a weak correlation.

Table 11.1

Summary of Spearman's correlations analysis for emotional understanding and daily physical activity indicators

			ID-1-3-4	ID-4-4-5
Spearman's rho	ID-1-3-4	Correlation Coefficient	1,000	,210**
		Sig. (2-tailed)	.	<,001
		N	1610	1610
	ID-4-4-5	Correlation Coefficient	,210**	1,000
		Sig. (2-tailed)	<,001	.
		N	1610	1610

**. Correlation is significant at the 0.01 level (2-tailed).

Note. ID-1-3-4 encodes item *1.3.4. Demonstrates an understanding that their actions have an impact on the feelings and/or behavior of other children and the caregiver*, ID-4-4-5 encodes item *4.4.5. Shows moderate activity and energy during the day*

Table 11.2

Results of correlational analysis for emotional understanding and daily physical activity indicators across three age groups

			3-4 years		4-5 years		5-6 years	
			ID-1-3-4	ID-4-4-5	ID-1-3-4	ID-4-4-5	ID-1-3-4	ID-4-4-5
Spearman's rho	ID-1-3-4	Correlation Coefficient	1,000	,200**	1,000	,161**	1,000	,261**
		Sig. (2-tailed)	.	<,001	.	<,001	.	<,001
		N	521	521	588	588	501	501
	ID-4-4-5	Correlation Coefficient	,200**	1,000	,161**	1,000	,261**	1,000
		Sig. (2-tailed)	<,001	.	<,001	.	<,001	.
		N	521	521	588	588	501	501

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Note. ID-1-3-4 encodes item *1.3.4. Demonstrates an understanding that their actions have an impact on the feelings and/or behavior of other children and the caregiver*, ID-4-4-5 encodes item *4.4.5. Shows moderate activity and energy during the day*

Table 12.1

Summary of Spearman's correlations analysis for organized sport participation and emotional regulation indicators

			ID-4-1-3	SUBSC-1-3
Spearman's rho	ID-4-1-3	Correlation Coefficient	1,000	,411**
		Sig. (2-tailed)	.	<,001
		N	1608	1608
	SUBSC-1-3	Correlation Coefficient	,411**	1,000
		Sig. (2-tailed)	<,001	.
		N	1608	1610

**. Correlation is significant at the 0.01 level (2-tailed).

Note. ID-4-1-3 encodes item *4.1.3. Enjoys participating in sports games*, SUBSC-1-3 encodes block 1.3. Self-regulation and self-control.

Table 12.2

Results of correlational analysis for organized sport participation and emotional regulation indicators across three age groups

			3-4 years		4-5 years		5-6 years	
			ID-4-1-3	SUBSC-1-3	ID-4-1-3	SUBSC-1-3	ID-4-1-3	SUBSC-1-3
Spearman's rho	ID-4-1-3	Correlation Coefficient	1,000	,403**	1,000	,373**	1,000	,410**
		Sig. (2-tailed)	.	<,001	.	<,001	.	<,001
		N	521	521	588	588	499	499
	SUBSC-1-3	Correlation Coefficient	,403**	1,000	,373**	1,000	,410**	1,000
		Sig. (2-tailed)	<,001	.	<,001	.	<,001	.
		N	521	521	588	588	499	501

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Note. ID-4-1-3 encodes item *4.1.3. Enjoys participating in sports games*, SUBSC-1-3 encodes block 1.3. Self-regulation and self-control.

RELATIONSHIPS BETWEEN SPECIFIC INDICATORS OF PHYSICAL AND COGNTIVE DEVELOPMENT

Another relationship explored within the current study was between children's physical (Physical development subscale or "SUBSC-4") and cognitive (Cognitive Development subscale or "SUBSC-2") development. As shown in Table 10.1, the overall scores on the two subscales correlated significantly $r = .756, p < .001$, indicating a strong correlation effect size. The correlation of daily physical activity (item *4.4.5. Shows moderate activity and energy during the day*) and attention shifting (item *6.2.9. Struggles to switch from performing one action to another; "loops" on a certain action*) indicators reached significance ($p < .001$) but showed a weak correlation ($r = 0.275$), as shown in Table 13.1. The age group-based analysis indicated the same results, i.e., a significant weak correlation for all three groups (see Table 13.2). Table 14.1 summarizes the Spearman's correlation test results for the block of gross and fine motor skills and the overall score on Cognitive development subscale. The association reached significance and showed a strong effect size $r = .711, p < .001$. Across all age groups, the results showed consistent results – daily physical activity and attention shifting strongly correlated in children at 3 to 6 years ($p < 0.001$).

Table 13.1

Summary of Spearman's correlations analysis for daily physical activity and attention shifting indicators

			ID-4-4-5	ID-6-2-9
Spearman's rho	ID-4-4-5	Correlation Coefficient	1,000	,275**
		Sig. (2-tailed)	.	<,001
		N	1610	1610
	ID-6-2-9	Correlation Coefficient	,275**	1,000
		Sig. (2-tailed)	<,001	.
		N	1610	1610

**. Correlation is significant at the 0.01 level (2-tailed).

Note. ID-4-4-5 encodes item *4.4.5. Shows moderate activity and energy during the day,* ID-6-2-9 encodes item *6.2.9. Struggles to switch from performing one action to another; "loops" on a certain action*

Table 13.2

Results of correlational analysis for daily physical activity and attention shifting indicators across three age groups

			3-4 years		4-5 years		5-6 years	
			ID-6-2-9	ID-4-4-5	ID-6-2-9	ID-4-4-5	ID-6-2-9	ID-4-4-5
Spearman's rho	ID-6-2-9	Correlation Coefficient	1,000	,327**	1,000	,218**	1,000	,267**
		Sig. (2-tailed)	.	<,001	.	<,001	.	<,001
		N	521	521	588	588	501	501
	ID-4-4-5	Correlation Coefficient	,327**	1,000	,218**	1,000	,267**	1,000
		Sig. (2-tailed)	<,001	.	<,001	.	<,001	.
		N	521	521	588	588	501	501

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Note. ID-4-4-5 encodes item *4.4.5. Shows moderate activity and energy during the day,* ID-6-2-9 encodes item *6.2.9. Struggles to switch from performing one action to another; "loops" on a certain action*

Table 14.1

Summary of Spearman's correlations analysis for specific development indicators and overall development subscale scores

			SUBSC-4-2	SUBSC-2
Spearman's rho	SUBSC-4-2	Correlation Coefficient	1,000	,711**
		Sig. (2-tailed)	.	<,001
		N	1610	1610
	SUBSC-2	Correlation Coefficient	,711**	1,000
		Sig. (2-tailed)	<,001	.
		N	1610	1610

**. Correlation is significant at the 0.01 level (2-tailed).

Note. SUBSC-4-2 encodes the block *4.2. Control and coordination of gross and fine motor skills* in Physical development subscale, SUBSC-2 encodes the Cognitive development subscale

Table 14.2

Results of correlational analysis for daily physical activity and attention shifting indicators across three age groups

			3-4 years		4-5 years		5-6 years	
			SUBSC-4-2	SUBSC-2	SUBSC-4-2	SUBSC-2	SUBSC-4-2	SUBSC-2
Spearman's rho	SUBSC-4-2	Correlation Coefficient	1,000	,649**	1,000	,702**	1,000	,688**
		Sig. (2-tailed)	.	<,001	.	<,001	.	<,001
		N	521	521	588	588	501	501
	SUBSC-2	Correlation Coefficient	,649**	1,000	,702**	1,000	,688**	1,000
		Sig. (2-tailed)	<,001	.	<,001	.	<,001	.
		N	521	521	588	588	501	501

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Note. SUBSC-4-2 encodes the block *4.2. Control and coordination of gross and fine motor skills* in Physical development subscale, SUBSC-2 encodes the Cognitive development subscale

DISCUSSION AND CONCLUSIONS

Early childhood development (0-5 years) is a critical and sensitive period that plays a crucial role in later-life outcomes. During this period, major developmental trajectories are formed, so there is an emerging need for a developmental screening tool that would identify the strengths and weaknesses of a child's development trajectories, taking into account the child's individual characteristics. The information of meeting developmental milestones is not sufficient to follow children's development trajectories, since they are not adjusting to the child's individual differences (e.g., prematurity, SES, family and preschool education context) and can serve rather as baseline checklists. The project "Comprehensive Assessment of the Trajectories of child development in preschool age" or CAT is an attempt to develop a universal tool that allows tracing preschoolers' individual development trajectories in five major developmental realms: social-communicative, cognitive, artistic and aesthetic, physical, language development. A universal questionnaire for both educationalists and researchers was developed to assess the development trajectory of a preschool-aged child, to identify its strong and weak aspects for designing individualized development or intervention programmes. The tool is robust and easy-to-implement, which allows capturing various aspects of child development in line with the educational areas identified in the Federal State Educational Standard for Preschool Education. Therefore, the present study was aiming to (1) measure psychometric properties of the "CAT" questionnaire and (2) investigate the relationships between physical development, cognitive and social-communicative domains of child development in preschool age based on the data collected with the tool "Comprehensive Assessment of the Trajectories of child development in preschool age".

The first step in examining psychometric properties of the CAT questionnaire was conducting reliability analysis. All the questionnaire's subscales showed excellent levels of internal consistency, ranging from 0.934 to 0.777. (a =0.943 for Social-Communicative; a =0.972 for Cognitive; a =0.970 for Artistic and aesthetic; a =0.934 for Physical; a = 0.949 for Language; a =0.977 for Individual differences in behaviour). The highest internal consistency was shown by Cognitive, Artistic and aesthetic and Individual differences in behaviour subscales with Cronbach's coefficient a =0.97. The overall test reliability was just as high (a =0.991). 95% confidence intervals supported the significance of the findings. The excellent internal consistency of the questionnaire was in line with previous assessments of development screening tool for preschoolers (Heo et al., 2008) and demonstrated that the CAT questionnaire is reliable and suitable for use in future studies. Hence, the expectations with regard to reliability analysis outcome have been wholly fulfilled, as it was assumed to be at least acceptable ($a \geq 0.7$).

The second step in examining psychometric properties of the CAT questionnaire was examining the level of inter-rater agreement between the preschool educators. For this aim, the Cohen's Kappa statistics was calculated. The results supported the hypothesis about the significant inter-rater agreement between preschool educators: the Kappa statistics was $\kappa = 0.77$ interpreted as substantial ($\kappa = 0.61$-0.80) level of agreement by Cohen or moderate level by McHugh (2012). The emerged evidence was consistent with the previous studies measuring inter-rater agreement between preschool education professionals: $\kappa = 0.82$-0.96 in Lindsay et al. (2018); overall $\kappa = 0.78$ and 0.84 for physical development in Joseph et al. (2020); and 0.69-0.93 in Golos & Weinstraub (2020). Such findings support the universal nature of the CAT questionnaire, available for use to any preschool education professional.

Overall, the reliability analysis results provide evidence that the CAT questionnaire is a reliable tool to measure children's development within specific domains (social-communicative, cognitive, artistic and aesthetics, physical, language). Also, the results contribute to CAT's universality as a children's assessment tool, as the inter-rater agreement between two educationalists showed substantial levels.

The gender differences in physical development (the overall subscale's score) and across the subscale's items were examined using Mann-Whitney U test. The results showed significant gender differences in overall subscale score (differences $U = 792170{,}5$, $p < .001$) with females having significantly higher scores than males. If analyzed by the blocks within the Physical development subscale, the same results were found for block 4.2. "Control and coordination of gross and fine motor skills" ($p < .001$), block 4.3. "Responsibility for one's own health" ($p < .001$) and block 4.4. "Physical well-being" ($p < .001$) with females scoring significantly higher development scores, than males. Block 4.1 Attitude to physical activity did not indicated any significant gender differences ($p = ,982$), indicating that boys and girls at preschool age do not significantly differ in their attitude to physical activity. The results calculated for test items also support the findings. The results for motor skill competence support previous findings that girls tend to outperform boys in motor skill proficiency tests in early childhood (Navarro-Patón et al., 2021). No evidence of gender differences was found in block 4.1. "Attitude to physical activity", which could be a matter of interest for further studies. Gender differences in physical development were further analyzed across three age groups ('junior' or 3-4 years, 'middle or 4-5 years and 'senior' or 5-6 years). According to the test's results, a robust trend towards increasing gender differences with the age was found. Particularly, boys and girls at age 3-4 years did not significantly differ neither in the overall Physical development subscale's nor each block's (Attitude to physical activity, Control and coordination of gross and fine motor skills,

Responsibility for one's own health, Physical well-being) score. Only one Physical development block reached significance in gender differences at 4-5 years: block 4.2 Control and coordination of gross and fine motor skills, whereas at age oof 5-6 years males and females were different both in the overall Physical development subscale's scores and scores by block. In all cases of significance (both at 4-5 and 5-6 years), females outperform males. The evidence related to girls showing higher motor skills proficiency than boys both at age of 4-5 and 5-6 years indicated a continuous trend and was consistent with previous findings (Loprinzi et al., 2015; Määttä et al., 2019; Navarro-Patón et al., 2021). The results, however, were limited by the cross-sectional design of the analysis. More longitudinal studies are needed to further explore trends of gender differences in preschoolers' physical development.

The results of Spearman's correlational analysis supported the hypotheses assuming correlations between the overall scores in Physical, Social-communicative and Cognitive subscales. Both of the associations were significant and indicated a strong correlation effect size: physical-social-communicative $r = 0.770, p < .001$, physical-cognitive $r = 0.756, p < .001$. The finding was in line with the existing research examining associations between specific indicators of physical, social-communicative (Biber, 2016; Cliff et al., 2017; Harlow et al., 2020) and cognitive (Cook et al., 2019; Haapala, 2013; Ludyga et al., 2021; McNeill et al., 2020) development. The correlation between Physical development ("SUBSC-4") and Social-communicative development ("SUBSC-1") subscales reached significance in all age groups, although the correlation was strong only in group of 3-4- and 4-5-year-olds: $r = 0.679$ and $r = 0.659$, respectively ($p < .001$). Children at 5-6 years demonstrated only a moderate correlation between physical and social-communicative development $r = 0.432, p < .005$. The results suggest that the correlation persists, but weakens with age, although the findings were limited by the cross-sectional design. Furthermore, significant moderate correlation was found between motor skills competence and cognitive development $r = .57, p < .001$, which supports the existing evidence of their interrelation (Ali et al., 2017; Barnett et al., 2009; Peyre et al., 2019). A significant correlation was also found between emotional understanding and daily physical activity indicators ($r = 0.210, p < .001$), although the effect size indicated weak correlation. Despite the weak effect size, the finding is consistent with previous evidence suggesting that physical activity has significant beneficial effect on children's social skills (Cliff et al., 2017). The organized sports participation was significantly associated with self-regulation and self-control, the correlation was interpreted as moderate $r = 0.411, p < .001$. The finding was in line with the scoping review of papers describing the effect of participation in organized sport on a range of social outcomes (e.g., teamwork, cooperation, friendship) in children by Harlow et al. (2020) and supported the hypothesis. The correlation of

daily physical activity and attention shifting indicators reached significance (p < .001) but showed a weak correlation ($r = 0.275$). The Spearman's correlation test results for the block of gross and fine motor skills and the overall score on Cognitive development subscale reached significance and showed a strong correlation effect size $r = .711, p < .001$. The findings support the existing evidence of the interrelation between physical and cognitive development in preschool-age children. The existing research also suggests a positive relationship between physical development and executive functions (in particular, attention shifting), also supported by the present study's findings. Across age groups, consistent evidence was found.

The study contributes valuable scientific evidence that can be further used by both researchers and policy makers for designing efficient intervention programs targeting children of preschool age. Since the CAT questionnaire aims to identify the strengths and weaknesses of child development trajectories, it can also be used by practitioners in order to design and implement individualized development programmes. Particularly, the knowledge of significant correlates that have positive effect on developmental outcomes is necessary so that interventions to increase physical activity can target those factors. The tool can be used in the implementation of any basic and partial educational programs, since the indicators of child development presented in it meet the value-target guidelines of the Federal State Educational Standard for Preschool Education and do not depend on the thematic content of the educational programs being implemented. The universal nature of the tool ensures the continuity of information about various aspects of a child's development throughout the entire period of preschool education, during the transition from one educational program to another, and when a child changes an educational organization.

The CAT tool can be used to compare and evaluate the effectiveness of various educational programs and methods of preschool education in order to improve them, as well as to build individual educational routes. The tool can be used to conduct large-scale research to monitor the development of the preschool education system. The tool «Comprehensive assessment of the trajectory of a child's development in preschool age» is not intended to evaluate the activities of a particular educator or educational organization.

A major strength of the current study is that it provides analysis of the development domains in preschoolers in general, rather than using specific indicators. This became possible since the CAT tool encompasses various development factors merging them in a holistic assessment of the overall child's development. Additionally, the method of direct observation in preschool educational settings has been characterized in the literature as one of the most objective in relation to studies of young children. Another strength was the sample size of 2828 preschool-age children.

Main limitation of the study is that all variables were measured subjectively. The data collected using the CAT questionnaire present educators-proxy reports and like any subjectively reported data provides inherent bias. The limitation though is partly controlled through analyzing the inter-rater reliability between the educationalists' assessments. Another limitation of the study is related to the broad number of positive development indicators included in the questionnaire, which make it difficult to explore direct relationships between developmental domains as whole concepts.

The current study provides a range of prospective research fields for further investigation. One direction for future studies is including parental assessments of preschool-age children development using the CAT questionnaire. Exploring the inter-rater agreement between parents' and preschool education professionals' assessments will be required for investigating the universality of the CAT tool. Furthermore, more studies of associations between developmental domains and specific indicators are needed. For example, research identifying risk factors for positive development in the major domains can be conducted using the CAT questionnaire. A role of confounding factors, such as age (or age group), gender, the number of days missed at the kindergarten, can add up more details in exploring associations between children's development domains. Also, the present study provides cross-sectional evidence of gender differences in preschooler's physical development. However, more longitudinal studies are needed to further explore trends of gender differences in preschoolers' physical development.

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АНТИПЛАГИАТ
ОБНАРУЖЕНИЕ ЗАИМСТВОВАНИЙ

Отчет о проверке на заимствования №1

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Отчет предоставлен сервисом «Антиплагиат» - users.antiplagiat.ru

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ЗАИМСТВОВАНИЯ	САМОЦИТИРОВАНИЯ	ЦИТИРОВАНИЯ	ОРИГИНАЛЬНОСТЬ
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Источник — документ, проиндексированный в системе и содержащийся в модуле поиска, по которому проводится проверка.
Оригинальность — доля фрагментов текста проверяемого документа, не обнаруженных ни в одном источнике, по которым шла проверка, по отношению к общему объему документа
Заимствования, самоцитирования, цитирования и оригинальность являются отдельными показателями и в сумме дают 100%, что соответствует всему тексту проверяемого документа
Обращаем Ваше внимание, что система находит текстовые пересечения проверяемого документа с проиндексированными в системе текстовыми источниками. При этом система явл
вспомогательным инструментом, определение корректности и правомерности заимствований или цитирований, а также авторства текстовых фрагментов проверяемого документа ос
в компетенции проверяющего.

№	Доля в отчете	Источник	Актуален на	Модуль поиска
[01]	0,78%	Etude épidémiologique des activités sportives : évolution de la participation des adolescents et détection des sous-groupes à risque de blessure : approche locale et culturelle; Epidemiological study of sports activities : evolution of adolescent partic... http://theses.fr	14 Авг 2019	Интернет
[02]	0,51%	Sedentary behavior in youth: assessment, correlates and relationship with health-related fitness https://core.ac.uk	30 Окт 2020	Интернет
[03]	0,37%	http://doras.dcu.ie/19378/1/Wesley_O'_Brien_PhD_Thesis_(Final_Version).pdf http://doras.dcu.ie	02 Янв 2021	Интернет