Physical Education Theory and Methodology
Теорія та методика фізичного виховання

ISSN 1993-7989 (print)
ISSN 1993-7997 (online)
ISSN-L 1993-7989

Original Scientific Article

Building an Index System for Evaluating the Motor Health of Preschool-aged Children from the Perspective of Disciplinary Intersections: A Delphi Study

Dongxu Du[1ABCDE] and Chairat Choosakul[1CDE]

[1]Mahasarakham University

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Corresponding Author: Chairat Choosakul, e-mail: chairat.c@msu.ac.th
Accepted for Publication: December 19, 2024
Published: January 30, 2025

DOI: 10.17309/tmfv.2025.1.04

Abstract

Background. Sports health and the future of preschool children are urgent problems. However, a comprehensive and scientific evaluation index system (EIS) for assessing their sports health is lacking.

Objectives. The study aimed to elaborate an EIS for preschool children's motor health based on interdisciplinary subjects to solve the growth dilemma faced by children during their development.

Materials and methods. Sixteen interdisciplinary experts who have been engaged in sports and health education for more than 15 years participated in a Delphi study. They used a 5-point Likert scale twice to assess the importance of preset indicators and provided feedback to modify and allocate items to the EIS.

Results. After two rounds of expert consultation, a consensus was reached on the EIS, which included 6 primary and 26 secondary indicators. The coefficients for experts' familiarity (A_s), judgment (A_i), and authority (A_a) were all >0.7. The coefficients for opinion coordination (ω) were >0.7. The arithmetic mean (Mean) of the recognition and operability scores was ≥4, and the coefficients of variation (CV) were all <0.25. The harmonization coefficient (ω) for the primary indicators was 0.803, and the harmonization coefficient (ω) for the secondary indicators was 0.758 (all >0.75).

Conclusions. Accurate, reliable and scientific data were collected to develop an EIS in order to address the challenges of assessing children's motor health. The findings can serve as a reference for future instruction on preschoolers' motor health.

Keywords: Delphi technique, motor health, preschool children, evaluation research.

Introduction

In motor health, active health is the value orientation, focusing on the all-dimensional health of the entire population through scientific and regular exercise. Health is the core value, and motor is the driving force for individuals and society to seek a healthy lifestyle so as to improve bodily function, enhance the degree of psychological pleasure, enhance interpersonal relationships, and shape personality and other functions. In this manner, physiology, psychology, social adaptation, and even the morality of health can be sustained (Lu, 2022). We comprehensively controlled for the strength, endurance, speed, agility, flexibility, coordination, and balance of preschoolers in sports from the perspectives of mobility, object control, and stability skills. The World Health Organization (WHO) defines health as "not only the absence of physical disease, but also mental health, social adjustment and morality." Health promotion should be implemented at all ages because it may trigger benefits in terms of reducing the risk of, and preventing, disease (Razeghi, et al., 2020). Motor health behaviors involve issues such as a healthy diet, motor habits, sleep patterns, and exercise intensity (Anderson, et al., 2016). Physical and mental health appear to play key roles in children's typical development, with physical health encompassing cardiorespiratory fitness, flexibility, muscular strength, and muscular endurance, and mental health relating to self-esteem, anxiety, and stress (Cocca, et al., 2020). Sedentary behavior and physical inactivity are among the major modifiable risk factors for cardiovascular disease (CVD) and all-cause mortality globally. The promotion of physical activity across age groups, races, ethnicities, and

sexes is needed to improve cardiorespiratory fitness to prevent many chronic ailments, especially CVD (Lavie, et al., 2019). Family disruption – characterized by overcrowding, noise, and chaos at home – may hinder efforts to engage in a sufficient number of exercise behaviors (Kracht, et al., 2021).

In 2019, regarding children under 5 years of age, the WHO recommended in the 24th Guidelines on Physical Activity, Sedentary Behavior, and Sleep for Children that children between the ages of 3 and 4 be physically active for at least 180 minutes per day, of which at least 60 minutes should consist of moderate to vigorous physical activity. Further, children should not be sedentary for more than 1 hour per day, and they should be getting 10-13 hours of good quality sleep (WHO, 2019). Preschoolers' health-related quality of life (QoL) increases with compliance with the WHO guidelines for physical activity, sedentary behavior, and amount of sleep (Chia, et al., 2019). A comprehensive understanding of the correlations among these components will provide a foundation for protecting and improving health. Children's motor development shows a high degree of individual variability, with weight status significantly affecting motor trajectory (Coppens, et al., 2019). The emergence of individual behavior is closely tied to the environment in which it occurs and is susceptible to environmental factors (Yao, et al., 2021). Motor skills are usually categorized into two types: gross and fine motor skills. Fine motor skills include the movement of small muscles in the body, while gross motor skills encompass movement and object control (Robinson, 2010). Regular physical activity can prevent obesity and other chronic illnesses such as CVD, diabetes, cancer, hypertension, depression, and osteoporosis (Warburton, 2006). Physical activity and motor ability are closely related to preventing childhood obesity, and the relevance of motor ability to individuals, families, and the environment. Further, the socio-ecological correlates of children's mental health are multidimensional, and individual correlates are the most important predictors of mental health (Niemistö, et al., 2020). Initial competence in basic motor skills influences their acquisition and presents potential barriers to learning complex motor skills (Costa, et al., 2021). Sports coaching interventions improve the mental health, physical fitness, and physical activity levels of children and adolescents (Ho, et al., 2017). Active play also reduces stress and anxiety in children with psychological problems (Carlier et al., 2020). Exercise frequency is directly or indirectly linked to self-esteem, stress, school satisfaction, and well-being, but not depression; exercise frequency has an indirect effect on depression through stress, and increasing exercise frequency may reduce stress (Cheon & Lim, 2020). Regular physical activity can also prevent and treat non-communicable diseases (NCDs) such as heart disease, stroke, diabetes, and breast and colon cancer. It also helps prevent hypertension, overweight, and obesity and can improve mental health, QoL, and well-being (WHO, 2018).

In this study, we aimed to review current findings on children's motor health. We also intended to explore the internal contradictions caused by the ecological holism of evaluating preschool children's motor health and the reality of traditional child-rearing, as well as the external contradictions between the holistic evaluation of an idealized ecosystem and the reality of the environment. Moreover, we aimed to use the theory of the intersections of disciplines to build an evaluation index system (EIS). We should examine reasonable expectations of preschool children's motor skills for the development of their health, implement scientific motor and health education, and help teachers and parents grasp the basic laws and characteristics regarding preschool children's motor skills and health. We employed the Delphi method to construct the EIS and weight coefficients; this included calculating experts' degree of familiarity with the indicators, the basis of their judgment, their degree of authority, the extent of coordination, the consistency coefficient, and the estimation of weights (Jünger et al., 2017; Jones & Hunter, 1995).

The innovations addressed in this paper are as follows: For the challenges facing children's development in post-modern society, it is important to build a cross-disciplinary EIS for preschool children's motor health. This is significant for the future, and the global perspective advocates for continually transcending the limitations of human health and well-being. The promotion of children's health as part of the whole of humankind is impossible to disregard.

Materials and Methods

Participants

We used snowball sampling to select Delphi panel members from different regions and universities in China based on the following inclusion and exclusion criteria:

1. The inclusion criteria were as follows: (a) working in motor training, psychology, physical education, or public health; (b) more than 10 years of work experience; (c) title qualification of associate senior or higher; (d) bachelor's degree or higher; and (e) voluntary participation in this study and positive feedback.

2. The exclusion criteria were as follows: (a) unwillingness to participate for personal reasons, (b) lack of practical experience in motor health-related work, and (c) withdrawal from the study while in progress.

This study was approved by the Ethics Committee of Mahasarakham University (#497-453/2023).

Study Design

The Delphi method involves consulting experts and translates opinions into a group consensus (McPherson, et al., 2018). It is considered a flexible research technique for setting goals and organizing projects. The researcher communicates with experts by sending them online or offline questionnaires without considering their geographic location. The process of collecting experts' suggestions is independent and anonymous, ensuring that experts do not talk with each other or exchange opinions (Black, et al., 2018). We obtained accurate and reliable data through an iterative, multistage process.

Questionnaire Design

We edited the questionnaire and made it suitable for administering online using the Questionnaire Star platform, which consisted of three parts:

(1) Preamble: A brief description of the study's purpose, content, and requirements.

(2) Basic demographic information: sex, unit, title, years of experience, field of study, and highest level of education.

(3) EIS questionnaire: The experts used a 5-point Likert scale to provide feedback on the importance of each index, the basis for their judgment, their degree of familiarity, the extent of recognition, and their operability. In addition, experts could propose modifications for each index to enrich the content of the EIS.

In December 2023, we contacted the experts in different regions in person, via email, by WeChat®, or other means; the experts did not communicate with each other. We compiled the feedback from each expert and readjusted the questionnaire for the second round of consultations to further verify the accuracy of the EIS. After two rounds of expert consultation, a consensus was reached on how to improve the EIS.

Statistical Analysis

We used WPS Office 6.4 and IBM® SPSS® Statistics 26.0 to analyze the data, which we visualized using GraphPad Prism 9 software, with the level of significance set at $p < 0.05$. We measured the degree of concentration and dispersion of the experts' opinions according to the ratio of the full marks of the experts' scores (K%), the arithmetic mean (Mean), the standard deviation (s), the coefficient of variation (CV), and other indicators. We calculated the experts' positive coefficient (Cj), basis for judgment (Ai), familiarity (As), coefficient of authority (Aa), and coefficient of coordination (ω) according to the results of the consultation.

Quality Control

We strictly developed the criteria for selecting experts to ensure the scientific credibility and accuracy of the findings. The selection of experts from the same region may have led to some degree of bias in the results (Garnett, et al., 2015). Thus, we selected experts from different regions and fields of research for this study. They filled out the questionnaire online. They also carefully checked and identified problems in contacting the experts in time. We excluded incomplete questionnaires, and two researchers entered all data to ensure the quantity and quality of the completed questionnaires.

Results

Results of Analysis from the Expert Consultation

We used the Delphi method in this study and selected 14 experts in sports science, child health assessment, psychology, and education. We distributed the questionnaire for experts through WeChat®. The experts provided assessments for the 6 primary indicators and 26 secondary indicators. Their judgments were based on theoretical analyses, work experience, reference to the literature, peer knowledge, and intuitive perceptions. We categorized familiarity with each indicator into five levels: very familiar, quite familiar, moderately familiar, less familiar, and unfamiliar.

We constructed the framework of the indicator system using methods such as a literature review and group discussions with the experts. We chose indicators through consultation with 16 and 14 experts in the first and second rounds, respectively. We assigned the indicator values and established an evaluation method along with the specifications of the approach for calculating the total score. We computed the basic information of the experts, along with the positivity coefficient, level of familiarity, judgment coefficient, level of authority, degree of coordination, and coefficient of variation.

Expert Demographics

We selected experts who specialize in sports training, assessing physical fitness, psychology, physical education, school sports, and childhood sports. Among the 14 experts (who answered the second round of questionnaires), there were 10 males and 4 females, all with a minimum of a bachelor's degree and holding titles of associate professor or higher. They met the basic requirements of the relevant professional fields. Seven experts held senior positions, accounting for 50%, and seven held associate professor positions, comprising 50%. All experts had more than 15 years of work experience. Nine had doctoral degrees (64.3%), three had master's degrees (21.4%), and two had bachelor's degrees (14.3%). They engaged in research on children's medicine and educational psychology (42.9% of the sample), whereas those involved in physical education and sports training accounted for 57.1%. All 14 experts were familiar with the comprehensive assessment of children's sports and health, with 10 (71.4%) being very familiar with it.

The Coefficient of Expert Positivity

The coefficient of expert positivity reflects the degree of cooperation among experts on this research project. This can be evaluated using the response rate of expert consultation. To some extent, the magnitude of the coefficient for expert positivity reflects the reliability of the results from the consultation. The formula for calculating the coefficient is shown in Formula 1:

$$C_j = M_j / M \quad (1)$$

where M_j is the number of questionnaires recovered from the experts, and M is the number of questionnaires distributed.

In the first round of consultation with experts, 16 questionnaires were distributed; 14 effective ones were collected, resulting in a positivity coefficient of 87.5%. In the second round of consultation with experts, 14 questionnaires were distributed, and all 14 were collected, resulting in a positivity coefficient of 100%. The positivity coefficients for both rounds of consultation were relatively high, indicating a good level of cooperation among the experts.

Level of Authority: Experts' Opinions

An expert's level of authority is generally determined by two factors: his/her level of expertise and the basis for his/her judgments, denoted as Ai, and his/her familiarity with the problem, represented by As. The formula for calculating the degree of authority is displayed in Formula 2:

$$A_a = (A_i + A_s)/2 \quad (2)$$

where A_s is the coefficient for the expert's familiarity, A_i is the coefficient for the expert's judgment, and A_a is the coefficient for the expert's authority.

The expert's level of authority is primarily based on self-assessment and can sometimes be mutually evaluated. We adopted a self-assessment method in which experts rated their familiarity with and the basis for judging the evaluation indicators. Table 1 presents the criteria and the indicators for familiarity and the basis of judgment (Sun, 2005).

Table 1. Assignment table for experts' assessments

Level of familiarity	Scores	Basis of judgment	Scores
Extremely familiar	1.0	Theoretical foundation	1.0
More familiar	0.8	Working experience	0.8
Generally familiar	0.6	Bibliography	0.6
Less familiar	0.4	Peer understanding	0.4
Very unfamiliar	0.2	Intuitive feeling	0.2

(1) The coefficient for experts' familiarity

We used the coefficient for experts' familiarity, denoted by As, to represent the experts' level of familiarity with the primary indicators. According to the statistical results of familiarity scores for the primary indicators, experts' level of familiarity with the primary indicators was above 0.7 (see Table 2). Except for a few experts who rated themselves as being generally familiar, the rest described themselves as either extremely familiar or more familiar. This indicated that the experts were familiar with the primary indicators. The coefficients for their familiarity with the primary indicators, in descending order, are as follows: physical health, motor ability, mental health, motor health behavior, motor health environment, and social and emotional competence.

According to the statistical results of the familiarity scores for the secondary indicators, experts' familiarity with the secondary indicators was above 0.7 (see Table 3). There are two indicators rated as very unfamiliar, one as less familiar, and a few as generally familiar. However, most indicators are rated as extremely familiar and more familiar. This suggests that the experts were familiar with the secondary indicators.

(2) The coefficient for experts' judgment

We used the coefficient for experts' judgment, denoted by Ai, to represent the extent to which the judgment criteria influenced the experts. According to the statistical results of the scores of the judgment coefficient for the primary indicators (Table 2), all coefficients were greater than 0.7. This implies that the judgment criteria had a significant impact on the experts. The main basis for their judgment is theoretical analysis and work experience, with some input from the literature and peer understanding. Hence, we deemed the judgment criteria to be relatively reliable. The coefficients for expert judgment regarding the primary indicators, in descending order, are motor ability, physical health, social and emotional competence, mental health, motor health behavior, and motor health environment.

Based on the statistical results of the scores of the judgment coefficient for the secondary indicators (Table 3), all coefficients were greater than 0.7. This implies that the judgment criteria had a significant impact on the experts. The main basis for experts' judgment is theoretical analysis and work experience, with some input from the literature and peer understanding. Additionally, some judgments are based on intuitive feelings. This suggests that the judgment criteria were reliable.

(3) The coefficient for experts' authority

Based on the coefficients for familiarity and judgment regarding the primary indicators, calculated according to Formula 2, we calculated the coefficients for experts' authority regarding the primary indicators (Table 2). The coefficients for experts' authority regarding the primary indicators were all greater than 0.7, indicating that the 14 experts had a high level of authority regarding the primary evaluation indicators. We deemed the experts' opinions to be highly reliable.

Table 2. Experts' familiarity, judgment, and authority regarding the first-level indicators

Indicators	A_i	A_s	A_a
A: MA	0.83	0.84	0.84
B: PH	0.83	0.86	0.84
C: MH	0.79	0.83	0.81
D: SEC	0.80	0.77	0.79
E: MHE	0.76	0.81	0.79
F: MHB	0.77	0.83	0.80

Note: A_s, coefficient for experts' familiarity; A_i, coefficient for experts' judgment; A_a, coefficient for experts' authority; MA = motor ability; PH = physical health; MH = mental health, SEC = social and emotional competencies; MHE = motor health environment, MHB = motor health behavior.

Table 3. Experts' familiarity, judgment, authority regarding the secondary indicators

Indicators	A_i	A_s	A_a
A1: Speed	0.83	0.83	0.83
A2: Strength	0.83	0.77	0.80
A3: Coordination	0.83	0.84	0.84
A4: Flexibility	0.81	0.81	0.81
A5: Balance	0.81	0.83	0.82
B1: Body shape	0.81	0.90	0.86
B2: PP	0.80	0.76	0.78
C1: EH	0.83	0.80	0.81
C2: Self-esteem	0.84	0.79	0.81
C3: Families	0.81	0.79	0.80
C4: SC	0.81	0.76	0.79
C5: Schools	0.86	0.83	0.84
D1: SO	0.77	0.76	0.76
D2: RS	0.77	0.76	0.76
D3: DM	0.83	0.74	0.79
D4: SA	0.77	0.79	0.78
D5: SM	0.81	0.77	0.79
E1: SP	0.79	0.74	0.76
E2: CE	0.77	0.76	0.76
E3: SI	0.76	0.73	0.74
E4: SE	0.83	0.84	0.84
E5: FE	0.86	0.86	0.86
F1: MB	0.79	0.83	0.81
F2: Lifestyle	0.83	0.76	0.79
F3: PB	0.86	0.77	0.81
F4: Adaptation	0.77	0.79	0.78

Note: A_s = coefficient for experts' familiarity; A_i = coefficient for experts' judgment; A_a = coefficient for experts' authority; CA = coordination ability; PP = physiological perception; EH = emotional health; SC = social contact; SO = social awareness; RS = relationship skills; DM = responsive decision-making; SA = self-awareness; SM = self-management; SP = sports policies; CE = community environment; SI = sports institutions; SE = school environment; FE = family environment; MB = motor behavior; PB = psychological behavior

Based on the coefficients of familiarity and judgment for the secondary indicators, calculated according to Formula 2, we calculated the coefficients for experts' authority regarding the secondary indicators (Table 3). The coefficients for

experts' authority regarding the secondary indicators were all greater than 0.7, implying that the 14 experts had a high level of authority regarding the secondary evaluation indicators. We deemed the experts' opinions to be highly reliable.

Consistency of experts' opinions

The degree of coordination of experts' opinions reflects the magnitude of disagreement among them and is crucial for assessing the credibility of the results from the consultation. The smaller the differences in experts' opinions on the indicators, the higher the degree of coordination, indicating stronger unity and guiding significance in the opinions. We measured the degree of coordination of experts' opinions by the coefficient for the consistency of experts' opinions, ω, which reflects the level of agreement among m experts on n indicators. The value of ω ranges from 0 to 1, and the closer ω is to 1, the better the degree of coordination of expert opinions.

(1) Calculation method for the coefficient of experts' consistency

We ranked and calculated the indicators as shown in Formula 3:

$$T_j = \sum_{i=1}^{m} R_{ij} \quad (3)$$

In this formula, T_j represents the sum of rankings for the j-th indicator; R_{ij} denotes the ranking given by the i-th expert to the j-th indicator, and the ranking is arranged in descending order of scores. We calculated the average rank sum of each evaluation indicator as seen in Formula 4:

$$\overline{T} = \sum_{i=1}^{n} T_j/n \quad (4)$$

In this formula, $\overline{T}$ is the average rank sum of each evaluation indicator, and T_j is the rank sum of the j-th indicator.

We calculated the sum of the squared deviations from the rank sum of all indicators based on Formula 5:

$$\sum_{j=1}^{n} d_j^2 = \sum_{j=1}^{n} (T_j - \overline{T})^2 \quad (5)$$

In this formula, $\sum_{j=1}^{n} d_j^2$ represents the sum of the squared deviations from the mean of the sum of the ranks of all indicators. We calculated the coefficient for consistency of opinions based on Formula 6:

$$\omega = \frac{12}{m^2(n^3 - n)} \sum_{j=1}^{n} d_j^2 \quad (6)$$

ω denotes the coefficient for consistency of opinions among m experts on n indicators, where m is the number of experts participating in the assessment of indicators, and n is the number of evaluation indicators. When there is the same rank, ω is corrected, as seen in Formula 7:

$$\omega = \frac{12}{m^2(n^3 - n) - m\sum_k (t_k^3 - t_k)} \sum_{j=1}^{n} d_j^2 \quad (7)$$

In this formula, t_k represents the number of identical ranks.

(2) Results of the coefficient for coordination among experts' opinions

The coefficient for coordination has values between 0 and 1. The closer it is to 1, the better the coordination among all experts in their ratings for all evaluation indicators. Conversely, a value closer to zero implies poorer coordination among experts in their ratings of all evaluation indicators, suggesting significant inconsistency among experts regarding the relative importance of various evaluation indicators. We calculated the coefficients of coordination for both the primary and secondary indicators based on the results of the two rounds of consultation with the experts. After these two rounds, the coefficient of coordination for the primary indicators was 0.803, and that for the secondary indicators was 0.758. Both ω values were greater than 0.7, implying good consistency among the experts' opinions and stable evaluation outcomes (see Table 4). A coefficient for experts' authority >0.7 is considered reliable (Long et al., 2016).

Table 4. Coefficients of coordination among experts on various evaluation indicators

Indicator	Coefficients of coordination (ω)
Primary indicators	0.803
Secondary indicators	0.758

Constructing the framework of the EIS

Principles of system integrity

Following the principles of the ecosystem, Fig. 1 indicates that motor ability, physical health, psychological health, social and emotional competence, the motor health environment, and motor health behavior are form ecological chain of elements that are interdependent, mutually influencing, mutually constraining, and mutually reinforcing. We held two rounds of consultation with experts in sports science, the assessment of children's health, medical psychology, and pedagogy using symposiums, brainstorming, discussions, multiple interviews, and other forms of addressing the topic. We explored the initial proposed indicators at all levels article by article. Combined with views on the indicators (whether there is a different opinion or proposal), we put forward the modification, deletion, or replacement of the proposal and made adjustments accordingly in order to establish the preliminary expert consultation for the proposed EIS.

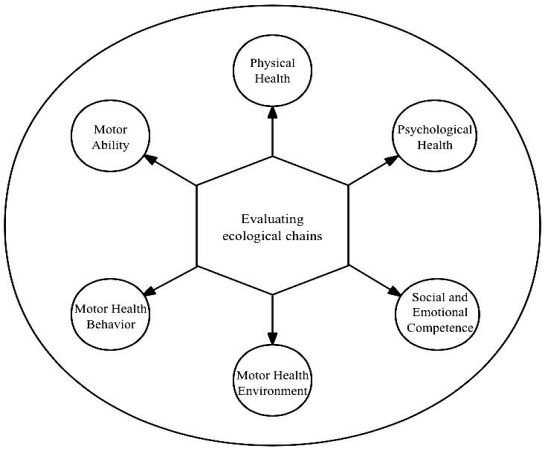

Fig. 1. Principles of system integrity

Following the principles of feasibility and emphasis on key aspects, we initially proposed categorizing an EIS for the motor health of preschool children. This system includes six primary indicators: motor ability, physical health, mental health, social and emotional abilities, the motor health environment, and motor health behavior. Motor ability is comprised of seven secondary indicators: speed, strength, endurance, flexibility, coordination, balance, and agility. Physical health includes three secondary indicators: body shape, physical function, and physiological perception. Mental health comprises five secondary indicators: emotional health, self-esteem, family interactions, social functioning, and school roles. Social and emotional abilities consist of five secondary indicators: social awareness, relationship skills, responsible decision-making, self-awareness, and self-management. The motor health environment includes six secondary indicators: sports policies, the community environment, sports facilities, the school environment, parent-child activities, and the family environment. Motor behavior includes seven secondary indicators: outdoor activities, sports behavior, hobbies, lifestyle, psychological behavior, exercise intensity, and social adaptation.

The selection of the evaluation indicators

We identified evaluation indicators for the motor health of preschool children aged 3-6 years using a questionnaire administered to experts. Based on the experts' opinions regarding the degree of acceptance, operability, and importance of each indicator, they could choose from a scoring standard of 1–5 points. As for the degree of acceptance and operability, 5 = strongly agree, 4 = somewhat agree, 3 = neutral, 2 = somewhat disagree, and 1 = strongly disagree. We evaluated the results from the consultation and assessment for each indicator based on the concentration, dispersion, and coordination of experts' opinions. We evaluated the concentration and dispersion of experts' opinions based on indicators such as the percentage of full marks (K), the arithmetic mean (Mean), the standard deviation (s), and the coefficient of variation (CV). The indicator screening procedure (Cao, et al., 2017) is as follows:

(1) Percentage of full marks (K), i.e., the proportion of experts who strongly endorsed a particular indicator among the total number of experts. K ≥ 50 % indicates a high level of endorsement by experts for that indicator.

(2) Arithmetic (Mean) of the score of a particular indicator. If Mean ≥ 4, it indicates a high level of endorsement by the experts. If 3 ≤ Mean < 4, we made a judgment in conjunction with other indicators to determine whether to exclude the indicator; a Mean < 3 resulted in excluding the indicator.

(3) Coefficient of variation ($CV = s/\overline{X}$). If the CV of the score for a specific indicator is ≤ 0.25, it implies fairly good consistency among experts' opinions. If CV > 0.25, we made a comprehensive judgment based on K and $\overline{X}$ to decide whether to retain or discard a particular indicator.

(4) When two or more indicators simultaneously reflected experts' non-acceptance or difficulty with operations, or when there was significant disagreement among experts, we considered excluding that particular indicator.

Based on the acceptance and feasibility of the primary indicators from the first round of consultation with experts, we calculated the screening percentages (K), arithmetic means (Mean), and coefficients of variation (CV) of the primary indicators (Fig. 2). For the acceptance of primary indicators in the first round of consultation – except for the percentage of acceptance (42.86 %) for environmental health, which was less than 50 % – the percentages of acceptance for other primary indicators were all ≥50 %, with arithmetic means all >4 and coefficients of variation all <0.20. The feasibility and acceptance of the six primary indicators were reliable, so we did not consider indicators for deletion.

Based on the acceptance and feasibility of the secondary indicators in the first round of consultations with experts, we calculated the screening percentages (K), arithmetic means (Mean), and coefficients of variation (CV) (Table 5). In the evaluation outcomes for the operability of the secondary indicators in the first round of consultations with experts, the indicators that did not meet the criteria for evaluation of the consultation (K < 50 %) included: endurance (A3: K = 21.43 %), sensitivity (A7: K = 28.57 %), physical function (B2: K = 14.29 %), self-esteem (C2: K = 42.86 %), self-awareness (D4: K = 35.71 %), self-management (D5: K = 42.86 %), sports policy (E1: K = 42.86 %), community environment (E2: K = 35.71 %), parent-child activities (E5: K = 42.86 %), outdoor activities (F1: K = 42.86 %), hobbies (F3: K = 35.71 %), psychological behavior (F5: K = 42.86 %), and exercise intensity (F6: K = 42.86 %). Other indicators had acceptance percentages K ≥ 50 %. Endurance (A3: Mean = 2.93) and physical function (B2: Mean = 2.64) were indicators that did not meet the criteria for evaluation of the consultation regarding the arithmetic mean (Mean < 3). The indicators that met the criteria (3 ≤ Mean < 4) were sensitivity (A7: Mean = 3.29), parent-child activities (E5: Mean = 3.50), outdoor activities (F1: Mean = 3.29), hobbies (F3: Mean = 3.64), and exercise intensity (F6: Mean = 3.93). We considered deleting these five indicators based on the other indicators. The remaining indicators had arithmetic means >4. The indicators that did not meet the criteria for the coefficient of evaluation of the consultation (CV ≥ 0.25) were endurance (A3: CV = 0.41), sensitivity (A7: CV = 0.39), physical function (B2: CV = 0.46), parent-child activities (E5: CV = 0.40), outdoor activities (F1: CV = 0.50), hobbies (F3: CV = 0.33), and exercise intensity (F6: CV = 0.32). The remaining indicators had coefficients of variation of <0.25.

In the results for the recognition of secondary indicators in the first round of consultation with the experts, the indicators that did not meet the criteria (K < 50 %) included: endurance (A3: K = 14.29 %), social awareness (D1: K = 42.86 %), responsible decision-making (D3: K = 35.71 %), self-awareness (D4: K = 42.86 %), sports policy (E1: K = 42.86 %), sports institutions (E3: K = 42.86 %), parent-child activities (E5: K = 28.57 %), outdoor activities (F1: K = 35.71 %), and hobbies (F3: K = 42.86 %). Other indicators had percentages of acceptance ≥50 %. The indicator that did not meet the criterion of the arithmetic mean (Mean < 3) was endurance (A3: Mean = 2.43). The indicators that met the criteria for the arithmetic mean (3≤Mean<4) were physical function (B2: Mean = 3.93), parent-child activities (E5: Mean = 3.57), outdoor activities (F1: Mean = 3.93), and hobbies (F3: Mean = 3.86). We considered these four indicators for deletion based on the other indicators. The remaining indicators had arithmetic mean scores >4. The indicators that did not meet the criteria for the coefficient of variation

Table 5. Results of the assessment of the secondary indicators

Secondary indicators	Operability				Recognition			
	K (%)	Mean	s	CV	K (%)	Mean	s	CV
A1: Speed	57.14	4.57	0.51	0.11	57.14	4.50	0.65	0.14
A2: Strength	64.29	4.50	0.76	0.17	50.00	4.14	1.03	0.25
A3: Endurance	21.43*	2.93*	1.21	0.41*	14.29*	2.43*	1.28	0.53*
A4: CA	85.71	4.79	0.58	0.12	85.71	4.79	0.58	0.12
A5: Flexibility	57.14	4.43	0.76	0.17	57.14	4.50	0.65	0.14
A6: Balance	78.57	4.71	0.61	0.13	85.71	4.86	0.36	0.07
A7: Agility	28.57*	3.29	1.27	0.39*	57.14	4.21	1.19	0.28*
B1: Body shape	50.00	4.50	0.52	0.12	57.14	4.57	0.51	0.11
B2: Physical function	14.29*	2.64*	1.22	0.46*	50.00	3.93	1.14	0.29*
B3: PP	50.00	4.29	0.83	0.19	50.00	4.29	0.83	0.19
C1: EH	57.14	4.57	0.51	0.11	50.00	4.43	0.65	0.15
C2: Self-esteem	42.86*	4.14	0.86	0.21	50.00	4.29	0.83	0.19
C3: Families	71.43	4.57	0.76	0.17	71.43	4.57	0.76	0.17
C4: SC	57.14	4.57	0.51	0.11	50.00	4.43	0.65	0.15
C5: Schools	57.14	4.50	0.65	0.14	64.29	4.64	0.50	0.11
D1: SO	50.00	4.36	0.74	0.17	42.86*	4.29	0.73	0.17
D2: RS	57.14	4.50	0.65	0.14	50.00	4.36	0.74	0.17
D3: DM	57.14	4.43	0.76	0.17	35.71*	4.00	0.88	0.22
D4: SA	35.71*	4.00	0.88	0.22	42.86*	4.21	0.89	0.21
D5: SM	42.86*	4.07	0.92	0.23	50.00	4.29	0.91	0.21
E1: SP	42.86*	4.29	0.73	0.17	42.86*	4.29	0.73	0.17
E2: CE	35.71*	4.07	0.73	0.18	57.14	4.57	0.51	0.11
E3: SI	50.00	4.14	0.95	0.23	42.86*	4.07	0.92	0.23
E4: SE	64.29	4.57	0.65	0.14	64.29	4.57	0.65	0.14
E5: Parent-child activities	42.86*	3.50	1.40	0.40*	28.57*	3.57	1.09	0.31*
E6: FE	78.57	4.71	0.61	0.13	85.71	4.71	0.61	0.13
F1: Outdoor activities	42.86*	3.29	1.64	0.50*	35.71*	3.93	1.00	0.25
F2: MB	50.00	4.43	0.65	0.15	57.14	4.57	0.51	0.11
F3: Hobbies	35.71*	3.64	1.22	0.33*	42.86*	3.86	1.03	0.27*
F4: Lifestyle	57.14	4.50	0.65	0.14	57.14	4.50	0.65	0.14
F5: PB	42.86*	4.29	0.73	0.17	64.29	4.64	0.50	0.11
F6: Exercise intensity	42.86*	3.93	1.27	0.32*	50.00	4.07	1.27	0.31*
B2: Adaptation	50.00	4.29	0.83	0.19	50.00	4.29	0.83	0.19

Note: K (%) represents the acceptance rate, Mean is the arithmetic mean, s = variance, CV = the coefficient of variation, * implies that the indicator parameters did not meet the criteria for consultation assessment, CA = coordination ability; PP = physiological perception; EH = emotional health; SC = social contact; SO = social awareness; RS = relationship skills; DM = responsible decision-making; SA = self-awareness; SM = self-management; SP = sports policies; CE = community environment; SI = sports institutions; SE = school environment; FE = family environment; MB = motor behavior; PB = psychological behavior

(CV ≥ 0.25) were endurance (A3: CV = 0.53), sensitivity (A7: CV = 0.28), physical function (B2: CV = 0.29), parent-child activities (E5: CV = 0.31), hobbies (F3: CV = 0.27), and exercise intensity (F6: CV = 0.31). The remaining indicators had coefficients of variation of <0.25.

The secondary indicators, all seven of which we considered for exclusion, were endurance (A3), agility (A7), physical function (B2), parent-child activities (E5), outdoor activities (F1), hobbies and interests (F3), and intensity of exercise (F6). The eight indicators – whether within the range of consideration for exclusion or not – were self-esteem (C2), social awareness (D1), responsible decision-making (D3), self-awareness (D4), self-management (D5), physical activity policy (E1), community environment (E2), institutions for physical training (E3), and psychological behavior (F5). Based on the results of the current round of scores

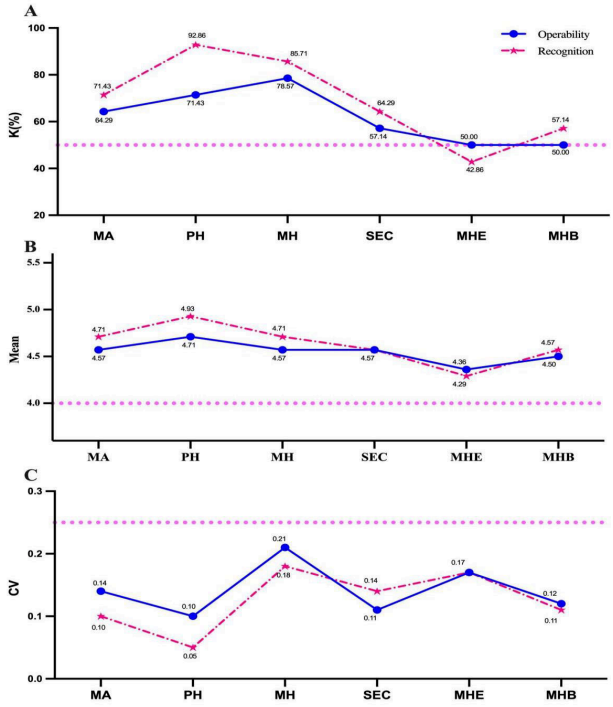

Fig. 2. Assessment map for the primary indicators

for consultation with the experts, and in accordance with the principle that "if two or more screening indicators do not meet the criteria for consultation and evaluation, consider removing the indicator," we organized the indicators by considering experts' opinions on the indicators. We excluded endurance (A3), considered to be an inappropriate indicator for preschool children. We merged parent-child activities (E5) into family environment (E6). We merged outdoor activities (F1) into exercise behavior (F2). We eliminated hobbies (F3), which we deemed an unsuitable index for motor health evaluation. We also eliminated indicators that were difficult to obtain, such as sensitivity (A7), physical function (B2), and exercise intensity (F6). We retained the rest of the indicators.

We conducted the first round of consultations with experts based on the EIS. The arithmetic mean of the scores for experts' approval and feasibility was ≥4, and the coefficient of variation was <0.25, indicating the reliability of the results and the strong feasibility of the obtained indicators. Based on these adjustments, we developed a new EIS. We proposed an EIS for motor health in preschool children aged 3-6 years. This EIS includes six primary and 26 secondary indicators (as shown in Fig. 3).

Discussion

American psychologist Urie Bronfenbrenner proposed ecological systems theory to explain how the social environment affects children's development. This theory stresses the importance of studying children in multiple environments or ecosystems in order to understand their development. According to Bronfenbrenner, children often find themselves in a variety of ecosystems, from the most intimate family setting to the larger school context,

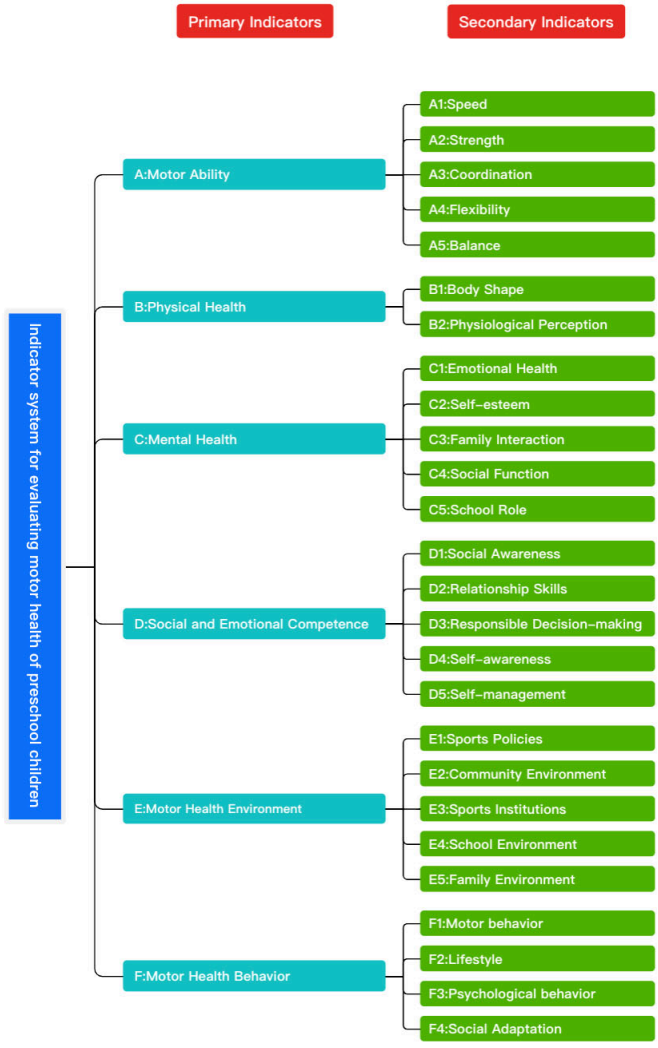

Fig. 3. Framework diagram of the EIS for the motor health of preschool children aged 3-6 years

to the broadest ecosystems that include society and culture. Human development occurs in one's immediate external environment through a process of progressively more complex interactions between active and evolving biopsychological organisms, people, objects, and symbionts (Bronfenbrenner, 2006). Hence, we followed the principle of the ecosystem, forming an ecological chain according to the cross-disciplines of athletic ability, physical health, mental health, social-emotional competence, the athletic health environment, and athletic health behaviors, which are interdependent, interact, and promote each other. We used symposia, brainstorming, focused discussions, multiple interviews, and other forms of consultations with experts to establish a preliminary EIS. Several studies have identified many factors affecting sports health (Bremner et al., 2020; Hamer et al., 2012). We compiled a relatively comprehensive EIS comprising six primary indicators of preschool children: exercise ability, physical and mental health, social and emotional competence, the motor health environment, and motor health behavior, in addition to 26 secondary indicators.

Motor ability is an important component of child development. The acquisition of basic motor skills is a prerequisite for participation in physical activity, sports, and exercise, and proficiency in motor ability contributes to an active lifestyle (Rokicka-Hebel, 2013). Children aged 2-6 years have the best opportunity to learn motor skills (LeGear et al., 2012). The development of motor skills in children is closely linked to their health (Ho et al., 2017; Lubans et al., 2010; Sorensen & Zarrett, 2014). Physical and mental health play a key role in children's typical growth (Razeghi et al., 2020; Cocca et al., 2020; Lavie et al., 2019). There is a positive correlation between nutritional-exercise behaviors and the level of health knowledge (Ayaz & Kulakçı, 2021). Moreover, problems with physical and mental health can have many negative effects on individuals, families, and society (Correll et al., 2017; Hailemichael et al., 2019), so having physical and mental health is a core element of preschoolers' development that cannot be ignored. Motor health behaviors involve topics such as healthy eating habits, exercise habits, sleep patterns, and exercise intensity (Anderson et al., 2016; Prichard et al., 2020; Reed et al., 2013). A growing body of evidence suggests that motor health behaviors not only contribute to improved physical health but can also have a significant, positive impact on children's psychology (Herring et al., 2019; Lewis et al., 2021). Social-emotional competence is a key developmental task in early childhood that significantly predicts educational and occupational achievement, health, and well-being (Rhoades et al., 2009; Schoon, 2021) and contributes to children's social success (Denham et al., 2001). The environment is an important contributor to children's motor health development (Kracht et al., 2021; Armstrong et al., 2019), and better living and learning environments give preschoolers a vital source of physical activity, leading to more physical and mental health benefits as well as better overall competence (Christian et al., 2022; Ng M et al., 2020). Hence, we constructed an EIS to assess preschool children's motor health from a cross-disciplinary perspective. In this way, we have created an opportunity to solve the theoretical challenges of assessing preschool children's motor health and to provide a reference for the future development of education regarding their motor health. In this way, we aim to improve the level of preschool children's motor health in practical teaching.

The EIS we constructed is characterized by scientific, comprehensive, and diverse features. First, we consulted experts in exercise science, the assessment of children's health, medical psychology, pedagogy, and other fields related to the topic. We did so via symposia, brainstorming, discussions on the preliminary indicators at all levels one by one, and exploring the views on the indicators (whether there are different opinions or suggestions). We proposed modifying, deleting, or replacing the proposal and made adjustments accordingly to establish the EIS. We developed the framework of the EIS by combining the cross-disciplinary knowledge of motor ability, psychology, social and emotional ability, ecosystem, and health. We also established the EIS based on a large amount of literature (Ayaz & Kulakçı, 2021; Niemistö et al., 2020; Denham et al., 2014), which implies that the EIS has a certain degree of scientific authority. Second, the experts' qualifications are reliable, and they all met the basic requirements of their professional fields by having a bachelor's degree or above, titles of associate professor or above, and more than 15 years of work experience. The experts engage in research on pediatric medicine and educational psychology (42.9 % of the sample); those engaged in physical education and athletic training comprise 57.1 %. Fourteen experts were familiar with the comprehensive evaluation of children's motor health in general or above, and ten were very familiar with it (71.4 % of the experts). This denotes that their suggestions and comments were based on rich theoretical knowledge and practical experience, making the EIS more reliable. Finally, we carried out two rounds of consultation with the experts according to the EIS; there were 16 experts in the first round and 14 experts in the second round, with positive coefficients of 80 % and 100 %, respectively. The coefficients for experts' familiarity, judgment, and authority regarding the primary and secondary indicators were >0.7. The coefficients for coordination of opinions were all >0.7. The arithmetic mean of the scores for recognition and operability was ≥4, and the coefficients of variation were all <0.25. This demonstrates that our results are reliable and that the final indicators obtained are operational. The coefficient of coordination for the primary indicators was 0.803, and that of the secondary indicators was 0.758, both of which were greater than 0.75. This implies that the consistency of the experts' opinions was good, and the estimation of the indicators' weights was stable and reliable.

This study has several limitations. First, we relied on multidisciplinary intersections and used convenience sampling to recruit only 16 experts in different fields from 10 universities in different regions. This may have led to sampling bias. In future studies, stratified random sampling should be considered to increase the authority of representative experts. Second, we constructed an EIS, which led to an unclear method for collecting data. To capture the characteristics and current status of preschool children's motor health, future studies should measure the indicator system for their motor health or develop appropriate scales to obtain reliable data for analysis. Third, we could not determine a causal relationship between the indicators. Thus, to explore the relationship between the factors affecting preschool children's motor health, future studies need to establish a structural equation model of it, validate the model's scientific validity, and use regression analysis to establish a linear functional relationship between the indicators of preschool children's motor health. Fourth, future research should simultaneously assign weights to decision-making indicators based on the intrinsic laws between the indicator data and experts' experience, which can be more reasonably applied to the practice of evaluating preschool children's motor health.

Conclusions

In sum, through the cross-disciplinary construction of an EIS for preschool children's motor health, the indicators are more operable and have better consistency from a scientific standpoint and based on experts' opinions. This creates an opportunity to solve the problem using the theory on the evaluation of preschool children's motor health. This study provides a reference for the future development of education on preschool children's motor health to improve motor health in practical teaching.

Acknowledgments

We appreciate the commitment and involvement of the experts who participated in the Preschool Children's Motor Health Indicator system survey. We would like to thank Editage (www.editage.cn) for English language editing.

Funding

This project was funded by the Zunyi Normal University Scientific Research Fund (#2023SKZD01) and the Humanities and Social Sciences Project of the Guangxi Colleges and Universities (#2023QGRW053).

Conflicts of interest

We declare that there are no conflicts of interest.

References

Lu, S. H., & Cao, K. Q. (2022). Research on community governance of sports and health in China under the background of healthy China. *Journal of Shenyang Sports Institute, 41*(6), 14-20.

Razeghi, S., Amiri, P., Mohebbi, S. Z., & Kharazifard, M. J. (2020). Impact of health promotion interventions on early childhood caries prevention in children aged 2–5 years receiving dental treatment under general anesthesia. *Frontiers in Public Health,* 8. https://doi.org/10.3389/fpubh.2020.00006

Anderson, P. J., Bovard, R. S., Wang, Z., Beebe, T. J., & Murad, M. H. (2016). A survey of social support for exercise and its relationship to health behaviours and health status among endurance Nordic skiers. *BMJ Open, 6*(6). https://doi.org/10.1136/bmjopen-2015-010259

Cocca, A., Espino Verdugo, F., Ródenas Cuenca, L. T., & Cocca, M. (2020). Effect of a game-based physical education program on physical fitness and mental health in elementary school children. *International Journal of Environmental Research and Public Health, 17*(13), 4883. https://doi.org/10.3390/ijerph17134883

Lavie, C. J., Ozemek, C., Carbone, S., Katzmarzyk, P. T., & Blair, S. N. (2019). Sedentary behavior, exercise, and cardiovascular health. *Circulation Research, 124*(5), 799-815. https://doi.org/10.1161/circresaha.118.312669

Kracht, C. L., Katzmarzyk, P. T., & Staiano, A. E. (2021). Household chaos, family routines, and young child movement behaviors in the U.S. during the COVID-19 outbreak: A cross-sectional study. *BMC Public Health, 21*(1). https://doi.org/10.1186/s12889-021-10909-3

World Health Organization. (2019). *Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age.* Geneva, Switzerland: World Health Organization.

Chia, M. Y., Tay, L. Y., & Chua, T. B. (2019). Quality of life and meeting 24-hour WHO guidelines among preschool children in Singapore. *Early Childhood Education Journal, 48*(3), 313-323. https://doi.org/10.1007/s10643-019-00987-9

Coppens, E., Bardid, F., Deconinck, F. J., et al. (2019). Developmental change in motor competence: A latent growth curve analysis. *Frontiers in Physiology,* 10. https://doi.org/10.3389/fphys.2019.01273

Yao, L., Lu, Y., & Zhang, Y. (2021). Change and development law of adolescents' physical health exercise behavior. *Revista Brasileira de Medicina do Esporte, 27*(4), 386-389. https://doi.org/10.1590/1517-8692202127042021_0078

Robinson, L. E. (2010). The relationship between perceived physical competence and fundamental motor skills in preschool children. *Child: Care, Health and Development, 37*(4), 589-596. https://doi.org/10.1111/j.1365-2214.2010.01187.x

Warburton, D. E. R. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal, 174*(6), 801-809. https://doi.org/10.1503/cmaj.051351

Niemistö, D., Finni, T., Cantell, M., Korhonen, E., & Sääkslahti, A. (2020). Individual, family, and environmental correlates of motor competence in young children: Regression model analysis of data obtained from two motor tests. *International Journal of Environmental Research and Public Health, 17*(7), 2548. https://doi.org/10.3390/ijerph17072548

Costa, C. L. A., Cattuzzo, M. T., Stodden, D. F., & Ugrinowitsch, H. (2021). Motor competence in fundamental motor skills and sport skill learning: Testing the proficiency barrier hypothesis. *Human Movement Science,* 80, 102877. https://doi.org/10.1016/j.humov.2021.102877

Ho, F. K., Louie, L. H., Wong, W. H., et al. (2017). A sports-based youth development program, teen mental health, and physical fitness: An RCT. *Pediatrics, 140*(4). https://doi.org/10.1542/peds.2017-1543

Carlier, S., Van der Paelt, S., Ongenae, F., De Backere, F., & De Turck, F. (2020). Empowering children with ASD and their parents: Design of a serious game for anxiety and stress reduction. *Sensors, 20*(4), 966. https://doi.org/10.3390/s20040966

Cheon, H., & Lim, S. (2020). Pursuing sustainable happiness through participation in exercise for South Korean students: Structural relationships among exercise, mental health factors, school satisfaction, and happiness. *Sustainability, 12*(9), 3797. https://doi.org/10.3390/su12093797

World Health Organization. (2018). *Global action plan on physical activity 2018–2030: More active people for a healthier world.* Geneva, Switzerland: World Health Organization.

Jünger, S., Payne, S. A., Brine, J., Radbruch, L., & Brearley, S. G. (2017). Guidance on conducting and reporting Delphi studies (CREDES) in palliative care: Recommendations based on a methodological systematic review. *Palliative Medicine, 31*(8), 684-706. https://doi.org/10.1177/0269216317690685

Jones, J., & Hunter, D. (1995). Qualitative research: Consensus methods for medical and health services research. *BMJ, 311*(7001), 376-380. https://doi.org/10.1136/bmj.311.7001.376

McPherson, S., Reese, C., & Wendler, M. C. (2018). Methodology update. *Nursing Research, 67*(5), 404-410. https://doi.org/10.1097/nnr.0000000000000297

Black, M., Matthews, L. R., & Millington, M. J. (2018). Using an adapted Delphi process to develop a survey evaluating employability assessment in total and permanent disability insurance claims. *Work, 60*(4), 539-548. https://doi.org/10.3233/wor-182761

Garnett, C., Crane, D., West, R., Brown, J., & Michie, S. (2015). Identification of behavior change techniques and engagement strategies to design a smartphone app to reduce alcohol consumption using a formal consensus method. *JMIR mHealth and uHealth, 3*(2). https://doi.org/10.2196/mhealth.3895

Sun, Z. Q. (2005). *Comprehensive medical evaluation methods and their applications.* Beijing, China: Chemical Industry Press.

Long, Y., Zhou, X., Deng, P., Liao, X., Wu, L., Zhou, J., et al. (2016). Construction of a physiological aging scale for healthy people based on a modified Delphi method. *Zhong Nan Da Xue Xue Bao Yi Xue Ban, 41*(4), 422-426. https://doi.org/10.11817/j.issn.1672-7347.2016.04.014

Cao, P. Y., Zhao, Q. H., Xiao, M. Z., & Gan, P. (2017). A study on long-term care demand assessment indicators for the disabled elderly in nursing home. *Chinese Journal of Nursing, 52*(8), 980-985.

Bronfenbrenner, U. (2006). The ecology of human development: Experiments by nature and design. Cambridge, MA: Harvard University Press.

Bremner, J., Moazzami, K., Wittbrodt, M., et al. (2020). Diet, stress and mental health. Nutrients, 12(8), 2428. https://doi.org/10.3390/nu12082428

Hamer, M., Endrighi, R., & Poole, L. (2012). Physical activity, stress reduction, and mood: Insight into immunological mechanisms. *Methods in Molecular Biology,* 89-102. https://doi.org/10.1007/978-1-62703-071-7_5

Rokicka-Hebel, M. (2013). Preschool attendance as a factor in the motor skill development of children. *Human Movement, 14*(4). https://doi.org/10.2478/humo-2013-0037

LeGear, M., Greyling, L., Sloan, E., et al. (2012). A window of opportunity? Motor skills and perceptions of competence of children in kindergarten. *International Journal of Behavioral Nutrition and Physical Activity, 9*(1), 29. https://doi.org/10.1186/1479-5868-9-29

Lubans, D. R., Morgan, P. J., Cliff, D. P., Barnett, L. M., & Okely, A. D. (2010). Fundamental movement skills in children and adolescents. *Sports Medicine, 40*(12), 1019-1035. https://doi.org/10.2165/11536850-000000000-00000

Sorensen, C., & Zarrett, N. (2014). Benefits of physical activity for adolescents with autism spectrum disorders: A comprehensive review. *Review Journal of Autism and Developmental Disorders, 1*(4), 344-353. https://doi.org/10.1007/s40489-014-0027-4

Ayaz-Alkaya, S., & Kulakçı-Altıntaş, H. (2021). Nutrition-exercise behaviors, health literacy level, and related factors in adolescents in Turkey. *Journal of School Health, 91*(8), 625-631. https://doi.org/10.1111/josh.13057

Correll, C. U., Solmi, M., Veronese, N., et al. (2017). Prevalence, incidence and mortality from cardiovascular disease in patients with pooled and specific severe mental illness: A large-scale meta-analysis of 3,211,768 patients and 113,383,368 controls. *World Psychiatry, 16*(2), 163-180. https://doi.org/10.1002/wps.20420

Hailemichael, Y., Hailemariam, D., Tirfessa, K., et al. (2019). Catastrophic out-of-pocket payments for households of people with severe mental disorder: A comparative study in rural Ethiopia. *International Journal of Mental Health Systems, 13*(1). https://doi.org/10.1186/s13033-019-0294-7

Prichard, I., Kavanagh, E., Mulgrew, K. E., Lim, M. S. C., & Tiggemann, M. (2020). The effect of Instagram #fitspiration images on young women's mood, body image, and exercise behaviour. *Body Image,* 33, 1-6. https://doi.org/10.1016/j.bodyim.2020.02.002

Reed, K., Wood, C., Barton, J., Pretty, J. N., Cohen, D., & Sandercock, G. R. (2013). A repeated measures experiment of green exercise to improve self-esteem in UK school children. *PLoS ONE, 8*(7). https://doi.org/10.1371/journal.pone.0069176

Herring, M. P., Monroe, D. C., Gordon, B. R., Hallgren, M., & Campbell, M. J. (2019). Acute exercise effects among young adults with analogue generalized anxiety disorder. *Medicine & Science in Sports & Exercise, 51*(5), 962-969. https://doi.org/10.1249/mss.0000000000001860

Lewis, B. A., Schuver, K., Dunsiger, S., et al. (2021). Randomized trial examining the effect of exercise and wellness interventions on preventing postpartum depression and perceived stress. *BMC Pregnancy and Childbirth, 21*(1). https://doi.org/10.1186/s12884-021-04257-8

Rhoades, B. L., Greenberg, M. T., & Domitrovich, C. E. (2009). The contribution of inhibitory control to preschoolers' social–emotional competence. *Journal of Applied Developmental Psychology, 30*(3), 310-320. https://doi.org/10.1016/j.appdev.2008.12.012

Schoon, I. (2021). Towards an integrative taxonomy of social-emotional competences. *Frontiers in Psychology,* 12. https://doi.org/10.3389/fpsyg.2021.515313

Denham, S., Mason, T., Caverly, S., et al. (2001). Preschoolers at play: Co-socialisers of emotional and social competence. *International Journal of Behavioral Development, 25*(4), 290-301. https://doi.org/10.1080/016502501143000067

Armstrong, G., Maitland, C., Lester, L., et al. (2019). Associations between the home yard and preschoolers' outdoor play and physical activity. *Public Health Research & Practice, 29*(1). https://doi.org/10.17061/phrp2911907

Christian, H., Wenden, E. J., Ng, M., & Maitland, C. (2022). Association between preschooler movement behaviours, family dog ownership, dog play and dog walking: Findings from the PLAYCE Study. *Preventive Medicine Reports,* 26, 101753. https://doi.org/10.1016/j.pmedr.2022.101753

Ng, M., Rosenberg, M., Thornton, A., et al. (2020). The effect of upgrades to childcare outdoor spaces on preschoolers' physical activity: Findings from a natural experiment. *International Journal of Environmental Research and Public Health, 17*(2), 468. https://doi.org/10.3390/ijerph17020468

Denham, S. A., Bassett, H. H., Zinsser, K., & Wyatt, T. M. (2014). How preschoolers' social-emotional learning predicts their early school success: Developing theory-promoting, competency-based assessments. *Infant and Child Development, 23*(4), 426-454. https://doi.org/10.1002/icd.1840

Побудова індексної системи щодо оцінки стану рухового розвитку дітей дошкільного віку з точки зору дисциплінарних взаємозв'язків: Дельфійське дослідження

Дунсю Ду[1ABCDE], Чайрат Чусакул[1CD]

[1]Махасаракхамський університет

Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 12 с., 5 табл., 3 рис., 47 джерел.

Історія питання. Питання стану спортивної підготовки та майбутнього розвитку дітей дошкільного віку є актуальними проблемами. Однак бракує комплексної та науково обґрунтованої індексної системи оцінювання (ІСО) для визначення рівня їхнього стану спортивної підготовки.

Мета дослідження. Це дослідження мало на меті розробити ІСО щодо стану рухового розвитку дітей дошкільного віку на основі міждисциплінарних предметів для розв'язання проблематики зростання, з якою стикаються діти в процесі свого розвитку.

Матеріали та методи. Шістнадцять міждисциплінарних експертів, які понад 15 років залучені до сфери спортивної та оздоровчої освіти, взяли участь у дослідженні за методом Дельфі. Вони двічі використовували 5-бальну шкалу Лайкерта для оцінки важливості попередньо встановлених показників і надавали зворотний зв'язок з метою модифікації та розподілу пунктів в ІСО.

Результати. Після проведення двох раундів експертних консультацій було досягнуто консенсусу щодо ІСО, яка включала 6 первинних та 26 вторинних показників. Коефіцієнти обізнаності експертів (A_s), судження (A_i) та авторитетності (A_a) становили >0,7. Коефіцієнти узгодженості думок (ω) становили >0,7. Середнє арифметичне значення (Mean) балів щодо розпізнавання та функціональності склало ≥4, а коефіцієнти варіації (CV) дорівнювали <0,25. Коефіцієнт гармонізації (ω) для первинних показників становив 0,803, а коефіцієнт гармонізації (ω) для вторинних показників склав 0,758 (всі > 0,75).

Висновки. Для розроблення ІСО було зібрано достовірні, надійні та науково обґрунтовані дані, спрямовані на розв'язання проблеми щодо оцінки стану рухового розвитку дітей дошкільного віку. Отримані результати дослідження можуть слугувати основою для подальших інструкцій щодо вивчення стану рухового розвитку дошкільнят.

Ключові слова: метод Дельфі, стан рухового розвитку, діти дошкільного віку, оцінювальне дослідження.

Information about the authors:

Du, Dongxu: 726303420@qq.com; https://orcid.org/0009-0000-6732-6206; Department of Health and Sport Science, Faculty of Education,Mahasarakham University, Mahasarakham Province, 44000, Thailand.

Choosakul, Chairat: chairat.c@msu.ac.th; https://orcid.org/0000-0002-0850-142X; Department of Health and Sport Science, Faculty of Education, Mahasarakham University, Mahasarakham Province, 44000, Thailand.

Cite this article as: Du, D., & Choosakul, C. (2025). Building an Index System for Evaluating the Motor Health of Preschool-aged Children from the Perspective of Disciplinary Intersections: A Delphi Study. *Physical Education Theory and Methodology, 25*(1), 32-43. https://doi.org/10.17309/tmfv.2025.1.04

Received: 19.11.2024. Accepted: 19.12.2024. Published: 30.01.2025