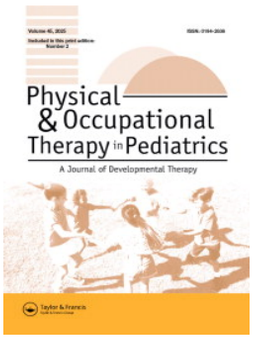

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Perceived Activity Competence and Participation in Everyday Activities of Children With and Without Neurodevelopmental Disorders

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ABSTRACT

Aim: To compare children with and without neurodevelopmental disorders (NDD) in self-rated activity competence, participation, and the associations between activity competence and participation.

Methods: This cross-sectional study included 126 children with NDD and 115 without NDD, aged 6–12 years, who completed interviews with the Perceived Efficacy and Goal Setting System (PEGS) and Picture My Participation (PmP). Independent *t*-tests or Mann–Whitney U tests examined group differences in the PEGS and PmP scores. Correlation and regression analyses examined associations between the PEGS and PmP scores.

Results: Children with NDD perceived lower physical competence than children without NDD, particularly in self-care ($d = 0.80$) and leisure ($d = 0.66$). The two groups did not differ in participation. Both groups demonstrated significant correlations between perceived activity competence and attendance ($r = 0.21$–0.49) and involvement ($r = 0.19$–0.53); significantly lower correlations were observed in children with NDD than those without ($d = 0.22$–0.28). Perceived activity competence significantly influenced attendance ($\beta = 0.365$) and involvement ($\beta = 0.391$).

Conclusions: Children with NDD perceived less competency than peers without NDD. Children's perceived activity competence is correlated bi-directionally with perceived participation. Clinicians can support competence to promote participation, or by supporting participation, the competence can be enhanced.

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Attendance; competence; involvement; neurodevelopmental disorders; participation; self-report

Participation in meaningful everyday activities is critical for optimizing the health and well-being of children with neurodevelopmental disorders (NDD) (Granlund et al., 2021). A trend for supporting the participation of children with NDD emphasizes doing things "meaningfully" rather than doing things "normally or correctly" (Anaby et al., 2022). This focus emphasizes whether the child's actions (doing) are functionally

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meaningful for the child in the activity rather than whether the child performs actions in an activity in a typical manner. Therefore, children's competence while participating in activities is probably more adequately assessed in a way that is functionally meaningful to the child. In this view, assessing participation and related constructs, such as activity competence, from children's own perceptions is imperative to understand their desired outcomes and support.

Research based on parent proxy-reports consistently indicates the participation restrictions in children with NDD (e.g., Andrews et al., 2023; Coster et al., 2011), and personal (such as age and sex) and environmental factors (such as parenting behaviors and therapy services) are correlated with participation (e.g., Brugnaro et al., 2024). However, parental ratings of their child's participation do not always agree with their child's ratings (Dada et al., 2020). Emerging studies based on child self-reports indicate differences in perceived participation frequency and/or involvement between children with and without NDD. For example, autistic children reported engaging less frequently and being less involved in family and social recreational activities than neurotypical peers (Li et al., 2023). Children with intellectual disabilities reported engaging less frequently in social activities and family activities than peers without disabilities, but not school or community activities (Samuels et al., 2020). Children with physical disabilities reported engaging in a smaller variety of leisure activities that involved fewer social interactions than peers without disabilities (Schreuer et al., 2014). Adolescents with NDD reported lower participation frequency than adolescents without NDD, but the perceived importance of activities did not differ between groups (Augustine et al., 2022).

Participation is defined as one's involvement in life situations by the International Classification of Functioning, Disability, and Health (ICF) (World Health Organization, 2001). The family of participation-related constructs (fPRC) framework, aligned with the ICF, further conceptualizes participation as attendance and involvement (Imms et al., 2017). The fPRC differentiates participation and participation-related constructs (i.e., child-related and environmental factors related to participation but not a direct element of participation) (Imms et al., 2017). Attendance is defined as "being there" in activities and can be evaluated by measuring the frequency of attending and the diversity of activities attended. Involvement is the experiences while "being there" in activities that may include engagement, motivation, persistence, social relationships, sense of belonging, and affect (Imms et al., 2017).

Activity competence is one of the participation-related constructs in fPRC as it focuses on how persons perform an activity (skills level) rather than the experience of participation (Imms et al., 2017). In this study, we have focused on activity competence and the associations between activity competence and participation from the children's perspectives. The other participation-related constructs named in fPRC are beyond the focus of this study considering the type of information collected. Activity competence is the skills and abilities required to execute an activity following an expected cognitive, physical, and affective standard. Activity competence is measured as the best ability in a structured environment (capacity), the best skills in a daily environment (capability), or the skills used in daily settings (performance). Studies have revealed that children with NDD have lower activity competence than their peers (Emck et al., 2009; Fliers et al.,

2010), and that activity competence appears to be an essential determinant of participation (Pashmdarfard et al., 2021). Most studies, however, are based on norm-referenced tests or proxy reports (referring to "actual" competence in the literature) rather than on children's self-perceptions of competence (Emck et al., 2009). This may be because many measures for activity competence of children with NDD are based on being asked to perform a task or activity in a "typical manner," that is, using a typical form of behavior following a standard exhibited by typically developing children. Research rarely investigates how children with NDD rate their performance in an activity using a functional form of behavior, considering their impairments.

Research on the associations between self-rated activity competence and participation of children with and without NDD is limited. Some studies involving typically developing children demonstrated positive yet weak correlations between perceived motor competence and physical activity participation (Goto et al., 2023; Visser et al., 2020). Typically developing children who perceived themselves as more competent in gross and fine motor skills participated in more outdoor play and physical activities (Goto et al., 2023; Visser et al., 2020). Conversely, child-rated physical competence was not associated with teacher-rated school participation in children with NDD, but the study reported no child-rated participation (Missiuna et al., 2006). The associations between perceived physical competence and participation in physical activities may vary between children with and without NDD (Brian et al., 2019). To the best of our knowledge, no studies have investigated the associations between self-perceived activity competence and participation of children with and without NDD in a broader context of daily activities. Research is essential to emphasize children's unique perspectives, and it also necessitates a discussion of what is measured when assessing their activity competence and participation.

This study investigated how child ratings of activity competence in the physical domain relate to their ratings of attendance and involvement in everyday activities. We aimed to compare children with and without NDD in three aspects: (1) child-perceived activity competence; (2) child-rated participation, including attendance and involvement; and (3) the associations between child-rated activity competence and participation.

Methods

Study Design and Setting

This cross-sectional and comparative study included school-age children with and without NDD living in Northern Taiwan. Data were collected at home or nearby places in the community according to family preferences. The Center for Research Ethics at the National Taiwan Normal University approved this study (201812ES010). All parents signed written parent-version consent forms, children aged $\geq$7 years provided written child-version consent forms, and children aged six years gave verbal assent.

Participants

Convenience and snowball sampling methods were used to recruit two groups of children with and without NDD. Parents replied to the study invitations on social media.

Research staff contacted parents to identify their children's eligibility and forwarded study invitations to the enrolled parents to share within their social network. Eligibility of children with NDD was determined according to their medical records from the Disability Evaluation System in Taiwan, which indicated a condition associated with NDD. In the *International Classification of Disea*ses (11th ed.; ICD-11;World Health Organization, 2020), NDD is defined as "Mental, behavioral and neurodevelopmental disorders are syndromes characterized by clinically significant disturbance in an individual's cognition, emotional regulation, or behavior that reflects a dysfunction in the psychological, biological, or developmental processes that underlie mental and behavioral functioning." Diagnoses within the NDD spectrum can include autism spectrum disorder, intellectual disability, attention deficit hyperactivity disorder, cerebral palsy, and developmental speech and language disorders (Granlund et al., 2021). Participation is a functional transdiagnostic phenomenon where the diagnosis is a relatively weak predictor for participation (Almqvist & Granlund, 2005; Pinto et al., 2019). Thus, a mixed sample of children with different conditions within the NDD spectrum seemed relevant.

Additionally, children for both groups met the following inclusion criteria: aged 6–12 years (foundation phase of school in Taiwan); had a cognitive level of at least five years of developmental age; and can demonstrate understanding of simple verbal instructions and express their thoughts either verbally, in writing/typing or with augmentative and alternative communication based on parent report or research staff evaluation. The child's neurodevelopmental condition and cognitive level were obtained from their medical records. The child's cognitive level was also estimated by testing the Peabody Picture Vocabulary Test-Revised (PPVT-R). This study excluded children with unstable health conditions, progressive disease or degenerative disorders, or uncorrected visual or hearing impairments who could not see or hear. Children with progressive conditions were excluded as they might have experienced a decrease or loss of abilities and skills thus impacting their perception of competence and participation experiences in a different way from children with NDD.

The participants were 126 children with NDD and 115 children without NDD whose age and sex did not differ between the groups (Table 1). Children's neurodevelopmental conditions included autism spectrum disorder (47%), attention deficit hyperactivity disorder (11%), intellectual disability (17%), cerebral palsy (14%), and language impairments (12%). Compared to children without NDD, children with NDD exhibited lower cognitive levels of receptive vocabulary measured by PPVT-R, more impairments in mental/speech functioning and physical/sensory functioning measured by Children and Adolescent Factor Inventory-Chinese Version (CAFI-C) than children without NDD; some were more restricted in the ways of communication and mobility; and their parents also reported a lower level of household income (p *values* < 0.001), as shown in Table 1.

Measures

Peabody Picture Vocabulary Test-Revised (PPVT-R)

PPVT-R measures an individual's receptive vocabulary; the psychometric properties and norms for children 3–12 years old were established in Taiwan (Lu & Liu, 1998).

Table 1. Demographics of children.

	With NDD ($n = 126$)	Without NDD ($n = 115$)	p
Child's age, years, *M* (SD)	9.02 (1.89)	8.72 (1.54)	0.178
Child's age by groups, *n* (%)			0.228
6–8 years	67 (53.2%)	70 (60.9%)	
9–12 years	59 (46.8%)	45 (39.1%)	
Child's biological sex			0.952
Boys	85 (67.5%)	78 (67.8%)	
Girls	41 (32.5%)	37 (32.2%)	
Birth order, *n* (%)			0.548
1	73 (57.9%)	77 (60.6%)	
2–4	53 (42.1%)	44 (38.3%)	
PPVT-R standard score[a], *M* (SD)	112.85 (19.38)	136.21 (10.85)	<0.001
CAFI-C impairment scores[b], *M* (SD)			
Mental/speech impairment	63.10 (14.29)	39.71 (7.59)	<0.001
Physical/sensory impairment	53.49 (12.61)	36.40 (6.57)	<0.001
Neurodevelopmental condition, *n* (%)			
Autism Spectrum Disorder	59 (46.8%)	–	
Attention Deficit Hyperactivity Disorder	14 (11.1%)	–	
Intellectual Disability	21 (16.7%)	–	
Cerebral palsy	17 (13.5%)		
Language impairments	15 (11.9%)	–	
Primary way of communication, *n* (%)			<0.001
Verbal, with sentences	74 (58.7%)	115 (100%)	
Verbal, with simple words and phrases	48 (38.1%)		
Using AAC	4 (3.2%)		
Primary way of moving, *n* (%)			0.001
Walking	112 (88.9%)	115 (100%)	
Mobility with assistive devices	11 (8.7%)		
Dependent on others	3 (2.4%)		
Annual household income[c], *n* (%)			<0.001
18,000 and below	50 (39.7%)	16 (13.9%)	
>18,000–35,000	43 (34.1%)	33 (28.7%)	
>35,000–50,000	22 (17.5%)	27 (23.5%)	
>50,000	11 (8.7%)	39 (33.9%)	

Note: Independent *t*-test was used for continuous variables and Chi-square tests for categorical variables to examine difference between groups.

Abbreviations: AAC, Augmentative and Alternative Communication; CAFI, Children and Adolescent Factor Inventory; NDD, neurodevelopmental disabilities; PPVT-R, Peabody Picture Vocabulary Test-Revised.

[a]PPVT-R standard score: Mean= 100, SD = 15; [b]higher CAFI-C score indicates more severe impairments; [c]$USD converted from $NTD.

PPVT-R provides an approximate estimate of cognition as its scores correlate ($r = 0.44$–0.69) with a global cognitive measure, Wechsler Intelligence Scale for Children-Revised (Lu & Liu, 1998). The PPVT-R was used to determine the child's eligibility for the study and characterize the study sample. The PPVT-R standard score (mean [*M*] = 100, standard deviation [SD] = 15) was reported in this study.

Children and Adolescent Factor Inventory-Chinese Version (CAFI-C)

CAFI-C is a 10-item parent-report measure of their children's physical, cognitive, and psychological functions that children with NDD may experience difficulty with (Chen et al., 2017). Each item is rated on a 3-point scale as no problem (1), little problem (2), and big problem (3). Scores were computed by averaging all applicable item responses and conformed to a 100-point scale. The score ranges from 33.33 to 100; a higher score indicates greater impairment. The CAFI-C was used to document the child's impairments and characterize the study sample. Structural validation in Taiwan demonstrated two factors (mental/speech impairment and physical/sensory impairment) with adequate

internal consistency ($\alpha = 0.80–0.90$) (Chen et al., 2017), and thus the factor scores were reported in this study.

Perceived Efficacy and Goal Setting (PEGS), Second Edition

PEGS is designed for children who have a chronological or developmental age of 5–9 years (Pollock & Missiuna, 2015) and also validated for children 5–12 years (Vroland-Nordstrand & Krumlinde-Sundholm, 2012). PEGS was modeled after All About Me, a measure of self-efficacy in the domain of motor performance. PEGS measures the perceived physical competence in performing 24 daily activities in three domains: self-care (7 activities), productivity (8 activities), and leisure (9 activities). Each item is presented as pairs of picture cards, with one picture illustrating a child performing the task well and the other demonstrating a child having difficulty performing the task. The child respondent is requested to select which picture most describes him/her and whether the picture is "a lot" or "a little" like him/her. The score of each item corresponds to "a lot less competent (1)" to "a lot more competent (4)" (Appendix A). The PEGS demonstrated acceptable internal consistency ($\alpha = 0.85–0.91$) and test–retest reliability (intraclass correlation coefficient [ICC] = 0.76–0.79) (Pollock & Missiuna, 2015). Internal consistency within our study sample was established for the total score ($\alpha = 0.87$), and self-care ($\alpha = 0.70$), productivity ($\alpha = 0.73$), and leisure ($\alpha = 0.76$) domain scores used in this study.

Picture My Participation (PmP)

PmP is a picture-supported measure of self-rated attendance and involvement in 20 home, school, and community activities for children 5 to 21 years of age designed to adapt to children and youth within the NDD spectrum (Arvidsson et al., 2020). PMP was inspired by the proxy report measure Participation and Environment Measure-Children and Youth (PEM-CY) (Coster et al., 2011). Each activity item is presented as a picture illustrating the activity context and rated by two response scales using text and symbols. Frequency of attendance is rated on a 4-point scale ranging from "never (1)" to "always (4)," and level of involvement is rated on a 3-point scale ranging from "no or minimally involved (1)" to "very involved (3)." Detailed information about this instrument is available on the website: https://ju.se/center/child-pmp.html. Content validity, structural validity, internal consistency, and test-retest reliability of PmP have been established for children with and without NDD (Arvidsson et al., 2020; 2021; Li et al., 2023; Shi et al., 2021). Cross-cultural translation of PmP into Chinese version and development into an application has been reported to support its utility in children with NDD in Taiwan (Kang et al., 2023). Structural validation using an international sample, including Taiwanese children, revealed a total scale on attendance with acceptable internal consistency ($\alpha = 0.85$) and four subscales, including organized activities ($\alpha = 0.72$), social interaction and taking care of others ($\alpha = 0.75$), family life activities ($\alpha = 0.57$) and personal care and development activities ($\alpha = 0.49$) (Arvidsson et al., 2021). One item (employment) not relevant to school-age children was excluded from the analysis based on the previous work (Arvidsson et al., 2021), resulting in 19 activity items used in this study (Appendix B). Internal consistency within our study sample

was established for the attendance and involvement scores, respectively, in the total ($\alpha = 0.76$ and 0.80), and organized activities ($\alpha = 0.50$ and 0.53), social interaction and taking care of others ($\alpha = 0.60$ and 0.61), family life activities ($\alpha = 0.44$ and 0.49) and personal care and development activities ($\alpha = 0.35$ and 0.56).

Procedure

The children were first evaluated with PPVT-R; to be included, children had to score at the 5-year age level or higher. Parents filled out the demographics and CAFI-C to provide information on their child's health-related problems. PEGS and PmP administration involved face-to-face interviews with each child by a trained interviewer. PEGS was administered using paper-based picture cards (Pollock & Missiuna, 2015), and PmP was administered *via* a tablet (Kang et al., 2023). There was no fixed order for the administration of the PEGS and PmP, but the interviewers mostly administered the PmP first as the tablet format facilitated the child's interest in starting a conversation. The interviewer sat with the child in a comfortable position that allowed them to see each other's faces to maintain good interaction. Two trial questions on the PEGS and three trial questions on the PmP were administered to ensure that the child understood the scales. The interviewers provided verbal explanations or physical assistance when required to support the child's comprehension and response. Each of the PEGS and PmP interviews took approximately 20–30 min.

Data Analysis. The PEGS scores were calculated by summing the individual scores of the total items and items under each domain (i.e., self-care, productivity, and leisure) (Pollock & Missiuna, 2015). The PmP attendance and involvement scores were calculated by averaging scores of total items and items under each subscale (i.e., organized activity, social interaction, family life, and personal care) (Arvidsson et al., 2021). Among these scores, the PEGS total score and the PmP attendance and involvement scores for total, organized activity, and social interaction presented normal distribution based on the Kolmogorov–Smirnov test. Between-group differences in the PEGS and PmP scores were analyzed with independent *t*-tests or Mann–Whitney U tests depending on data normality, and thus, both mean (SD) and median (interquartile range) were reported. Effect sizes (parametric or nonparametric Cohen's *d*) were calculated from the test statistics of *t*-tests or Mann–Whitney U tests accordingly (Fritz et al., 2012). Effect sizes were interpreted as small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$) (Cohen, 1988). We did not use the Analysis of covariance to adjust for potential confounders such as age, sex, and household income for the following reasons: not all scores met the assumption of normality and homogeneity of variance for using the parametric analyses; age and sex did not differ between the groups; and household income differs between the groups but was not associated with the PmP and PEGS scores. As the PmP is suitable for item-level analysis, post hoc analyses at the item level add interpretability to the data. Between-group differences on the single items of the PmP were analyzed with independent *t*-tests and effect sizes (Cohen's *d*).

Correlations between PEGS total scores and PmP total and subscale scores for each group were investigated by Pearson's or Spearman's rank correlation coefficients based on data normality. Correlations were interpreted as weak ($r = 0.10$–0.29), moderate

($r = 0.30$–0.49), and strong ($r > 0.50$) relationship (Cohen, 1988). The differences between the two groups in the magnitude of the correlations of PEGS and PmP scores were investigated by Zobs value with the formula: $(z_1\text{-}z_2)/(\text{square root of } [(1/n_1-3) + (1/n_2-3)])$, where z_1 and z_2 are the two correlations converted to z scores, and n_1 and n_2 are the sample sizes associated with the two correlations (Dunn & Clark, 1969). Effect sizes (Cohen's q) associated with the two correlations were calculated and interpreted as small ($q = 0.1$), medium ($q = 0.3$), and large ($q = 0.5$) (Cohen, 1988). Multiple linear regression analysis was used to examine the contribution of age, the presence of NDD, and PEGS total scores in explaining the variance of PmP total attendance and involvement scores. The level of significance was set at 0.05.

Results

The PEGS total scores and the self-care and leisure domain scores demonstrated significant between-group differences ($p < 0.001$). Children with NDD had lower perceived activity competence than those without NDD. Effect sizes indicated moderate to large effects on the differences ($d = 0.66$–0.80) (Table 2).

The PmP attendance and involvement scores demonstrated no significant between-group differences. A trend indicated that children with NDD had lower attendance and involvement in social interaction activities with small effects of differences ($d = 0.20$–0.25) than those without NDD (Table 3); yet, it did not reach statistical significance. The item-level analyses showed significant between-group differences for attendance in 9 activities and involvement in 7 activities. Effect sizes indicated small to moderate effects on the differences ($d = 0.25$–0.51) (Table 4).

Correlations were computed between the PEGS total scores and PmP attendance scores and between the PEGS total scores and PmP involvement scores for the total scale and subscales (Table 5). The PEGS total scores were used but not the three domain scores because participation in various areas of activities involves a combination of skills and competencies covered by the PEGS total scale. Significant positive and weak-to-moderate associations were observed in children with NDD between perceived activity competence and attendance ($r/r_s = 0.24$–0.29) and involvement ($r/r_s = 0.19$–0.31) in the total scale and subscales, except family life attendance showing no

Table 2. Perceived activity competence in children with and without neurodevelopmental disabilities (NDD).

	With NDD ($n = 126$)		Without NDD ($n = 115$)			
PEGS score	Mean (SD)	Median (IRQ)	Mean (SD)	Median (IRQ)	p	ES
Total	73.4 (13.4)	75.0 (63.8–84.3)	81.6 (7.9)	81.0 (76.0–88.0)	<0.001[a]	0.70[c]
Self-care	21.3 (4.5)	22.0 (18.8–24.3)	24.4 (2.6)	25.0 (22.0–27.0)	<0.001[b]	0.80[d]
Productivity	25.0 (5.1)	25.5 (22.0–29.0)	26.2 (3.9)	26.0 (24.0–30.0)	0.100[b]	0.21[d]
Leisure	27.2 (6.1)	28.0 (23.0–32.0)	31.0 (3.7)	32.0 (28.0–34.0)	<0.001[b]	0.66[d]

Note: PEGS score ranges: Total (24–96), Self-care (7–28), Productivity (8–32), and Leisure (9–36).
[a]p values resulting from Independent t-tests; [b]p values resulting from Mann-Whitney U tests; [c]Effect size estimate (Cohen's d) calculated from pooled standard deviation in t-tests, [d]Effect size estimate (Cohen's d) calculated from $r = z/\sqrt{N}$ from Mann-Whitney U tests than transposed to $d = 2r/\sqrt{1 - r^2}$. The effect size was interpreted as small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$) effects.
Abbreviations: ES, effect size; IQR, interquartile range; NDD, neurodevelopmental disabilities; PEGS, Perceived efficacy and Goal Setting System; SD, standard deviation.

Table 3. Attendance and involvement in children with and without neurodevelopmental disabilities (NDD).

	With NDD ($n = 126$)		Without NDD ($n = 115$)			
PmP score	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	p	ES
Attendance (1–4)						
Total	2.8 (0.5)	2.7 (2.5–3.0)	2.9 (0.3)	2.8 (2.6–3.1)	0.147[a]	0.18[c]
Organized activity	2.6 (0.6)	2.5 (2.2–3.0)	2.6 (0.5)	2.7 (2.3–3.0)	0.338[a]	0.12[c]
Social interaction	2.4 (0.6)	2.4 (2.0–2.7)	2.6 (0.5)	2.6 (2.3–2.9)	0.116[a]	0.20[c]
Family life	3.3 (0.6)	3.3 (3.0–4.0)	3.3 (0.5)	3.3 (3.0–3.7)	0.169[b]	0.18[d]
Personal care	3.4 (0.6)	3.7 (3.0–4.0)	3.6 (0.4)	3.7 (3.3–4.0)	0.133[b]	0.19[d]
Involvement (1–3)						
Total	2.2 (0.4)	2.3 (2.0–2.5)	2.3 (0.3)	2.3 (2.1–2.5)	0.298[a]	0.13[c]
Organized activity	2.1 (0.5)	2.2 (1.8–2.5)	2.2 (0.4)	2.2 (1.8–2.5)	0.533[a]	0.08[c]
Social interaction	2.1 (0.5)	2.1 (1.7–2.4)	2.2 (0.4)	2.1 (1.9–2.4)	0.055[a]	0.25[c]
Family life	2.4 (0.5)	2.3 (2.0–3.0)	2.4 (0.4)	2.3 (2.0–2.7)	0.605[b]	0.07[d]
Personal care	2.4 (0.5)	2.7 (2.0–3.0)	2.4 (0.5)	2.7 (2.0–2.7)	0.926[b]	0.01[d]

[a]p values resulting from Independent t-tests; [b]p values resulting from Mann-Whitney U tests; [c]Effect size estimate (Cohen's d) calculated from pooled standard deviation in t-tests, [d]Effect size estimate (Cohen's d) calculated from $r = z/\sqrt{N}$ from Mann-Whitney U tests than transposed to $d = 2r/\sqrt{1 - r^2}$. The effect size was interpreted as small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$) effects.

Abbreviations: ES, effect size; IQR, interquartile range; NDD, neurodevelopmental disabilities; PmP, Picture my Participation; SD, standard deviation.

Table 4. Item-level results of the PmP in children with and without neurodevelopmental disabilities (NDD).

	Attendance						Involvement					
	With NDD		Without NDD				With NDD		without NDD			
Item	Mean	SD	Mean	SD	p	d	Mean	SD	Mean	SD	p	d
Personal care	3.4	0.9	3.7	0.6	<0.001	0.39	2.5	0.7	2.5	0.6	0.861	0.02
Family mealtime	3.5	0.8	3.4	0.7	0.618	0.13	2.5	0.6	2.5	0.6	0.621	0.06
My own health	3.1	1.0	3.2	0.8	0.203	0.11	2.2	0.8	2.3	0.6	0.385	0.11
Gathering supplies	1.6	1.0	1.8	1.1	0.157	0.19	1.5	0.8	1.6	0.8	0.594	0.07
Meal preparation	2.1	1.1	2.4	0.9	0.014	0.30	1.9	0.9	2.2	0.8	0.002	0.38
Cleaning at home	2.7	1.1	2.7	0.8	0.918	0.01	2.1	0.8	2.1	0.7	0.786	0.03
Caring for family	2.6	1.2	2.6	1.1	0.927	0.01	2.1	0.8	2.2	0.8	0.472	0.09
Caring for animals	1.9	1.2	2.0	1.2	0.495	0.08	1.6	0.9	1.7	0.9	0.423	0.09
Interaction with family	3.0	1.1	3.0	0.9	0.680	0.05	2.3	0.8	2.4	0.7	0.317	0.12
Celebrations	3.3	0.9	3.3	0.8	0.695	0.05	2.7	0.6	2.7	0.5	0.546	0.07
Playing with others	2.7	1.2	3.0	1.0	0.039	0.25	2.3	0.9	2.5	0.7	0.040	0.25
Organized leisure	2.3	1.3	2.9	1.2	<0.001	0.46	1.9	0.9	2.3	0.8	0.002	0.38
Quiet leisure	3.4	0.8	3.4	0.7	0.563	0.07	2.7	0.5	2.7	0.5	0.518	0.08
Spiritual activities	2.7	1.1	2.3	0.8	0.007	0.34	2.2	0.8	2.0	0.6	0.012	0.31
Shopping	3.1	0.9	2.8	0.9	0.018	0.29	2.6	0.9	2.3	0.8	0.002	0.39
Social activities in community	1.9	1.1	2.4	1.0	<0.001	0.42	1.7	0.9	2.2	0.8	<0.001	0.51
Visiting health center	3.1	1.0	2.7	0.7	<0.001	0.51	2.2	0.8	2.2	0.7	0.599	0.06
Formal learning at school	3.8	0.6	3.9	0.3	0.382	0.11	2.5	0.7	2.6	0.6	0.540	0.08
Trips and visits	2.6	1.0	2.9	0.8	0.005	0.35	2.5	0.7	2.7	0.5	0.005	0.35

d denotes Cohen's d calculated from pooled standard deviation in t-tests, the effect size was interpreted as small ($d = 0.2$), medium ($d = 0.5$), and large ($d = 0.8$) effects.

association. Significant positive and weak-to-strong associations were observed in children without NDD between perceived activity competence and attendance (r/r_s = 0.21–0.49) and involvement (r/r_s = 0.38–0.53) in the total and all subscales. Significantly lower correlations in children with NDD were observed in total attendance and involvement, family life attendance, and personal care involvement than in those without NDD ($p = 0.017$–0.044), with small effect sizes on the differences ($d = 0.22$–0.28). In the

Table 5. Correlations between perceived activity competence total scores and attendance and involvement scores and comparative analyses by groups.

	With NDD ($n = 126$) r / r_s (95% CI)	Without NDD ($n = 115$) r / r_s (95% CI)	Z (p)	ES
Attendance				
Total[a]	0.28** (0.11–0.43)	0.49** (0.32–0.63)	−1.858 (0.032*)	0.24
Organized activities[a]	0.24** (0.04–0.41)	0.32** (0.12–0.48)	−0.623 (0.267)	0.08
Social interaction[a]	0.29** (0.13–0.43)	0.43** (0.26–0.58)	−1.290 (0.099)	0.17
Family life[b]	−0.01 (−0.17–0.16)	0.21** (0.02–0.40)	−1.708 (0.044*)	0.22
Personal care[b]	0.24** (0.05–0.40)	0.37** (0.20–0.52)	−1.073 (0.142)	0.14
Involvement				
Total[a]	0.30** (0.14–0.44)	0.53** (0.38–0.66)	−2.130 (0.017*)	0.28
Organized activities[a]	0.22** (0.05–0.39)	0.39** (0.21–0.54)	−1.390 (0.082)	0.18
Social interaction[a]	0.31** (0.14–0.45)	0.42** (0.25–0.56)	−0.927 (0.177)	0.12
Family life[b]	0.19* (0.03–0.37)	0.38** (0.20–0.55)	−1.629 (0.052)	0.20
Personal care[b]	0.28** (0.12–0.43)	0.48** (0.330.62)	−1.887 (0.040*)	0.23

Z (p) denotes the Zobs values and corresponding *p*-value (single-sided test).
ES denotes the effect size calculated by Cohen's *q for two correlations*. The effect size was interpreted as small ($q = 0.1$), medium ($q = 0.3$), and large ($q = 0.5$) effects.
*$p < 0.05$; **$p < 0.01$
[a]Pearson's correlation correlations (r) and associated 95% CI
[b]Spearman's correlation correlations (r_s) and associated 95% CI
Abbreviations: CI, confidence interval; NDD, neurodevelopmental disabilities.

regression analyses, the PEGS total score was found to be a significant factor associated with the total scores of attendance ($\beta = 0.365$, $p < .001$, explaining 12.4% of the variance) and involvement ($\beta = 0.391$, $p < .001$, explaining 12.9% of the variance) (Table 6). Age and the presence of NDD were not significant factors.

Discussion

This study revealed that children with and without NDD differed in how they rated their activity competence but not their attendance and involvement. Children with NDD perceived less physical competency, particularly in performing self-care and leisure-related skills. The results align with the current literature indicating lower perceived motor competence in children with NDD than their peers (Emck et al., 2009; Fliers et al., 2010). Meaningful participation involves a child's perceived competence, reflecting a belief that they can perform an activity with mastery and achieve satisfactory performance (Missiuna et al., 2006; Pollock & Missiuna, 2015; Vänskä et al., 2020). Children with NDD who had lower perceived activity competence may relate to their less successful experiences in executing everyday tasks or less satisfactory outcomes. This may be because children with NDD are usually asked to perform tasks in a typical way like other typically developing children in daily life. When measuring children's

Table 6. Regression analysis to explain participation attendance and involvement total scores.

Model	B (95% CI)	β	p	R^2	SEE
Attendance[a]					
Constant	1.618 (1.177; 2.059)		<.001		
Age	0.025 (−0.003; 0.052)	0.105	0.084		
NDD	0.020 (−0.083; 0.123)	0.025	0.703		
PEGS	0.012 (0.008; 0.017)	0.365	<.001	0.124	0.379
Involvement[b]					
Constant	1.276 (0.899; 1.654)		<.001		
Age	0.008 (−0.016; 0.031)	0.038	0.536		
NDD	0.045 (−0.043; 0.134)	0.065	0.310		
PEGS	0.012 (0.008; 0.015)	0.391	<.001	0.129	0.324

[a]$F(3, 237) = 12.296$, $p<.001$, [b]$F(3, 237) = 12.685$, $p<.001$.

B denotes unstandardized regression coefficients; β denotes standardized regression coefficients; R^2 denotes adjusted coefficient of determination; SEE denotes standard error of estimate. NDD was dummy coded (0 = without NDD, 1 = with NDD).

Abbreviations: CI, confidence interval; PEGS, Perceived efficacy and Goal Setting System; NDD, neurodevelopmental disabilities.

self-perceived competence, children with NDD are often asked to rate their performance by comparing it to the performance of children without NDD, e.g., playing a ball game, rather than rating their competence based on their own solutions or adaptions to achieve the task, e.g., playing a ball game in a wheelchair. Further investigation is warranted to probe how children's activity experiences shape the confidence and judgment in their own abilities and competencies (Stroobach et al., 2023).

Our findings that children's participation ratings did not differ between groups were unexpected and inconsistent with previous studies using PmP, adding more knowledge of using this instrument in different countries. Children with intellectual disabilities in South Africa reported a lower frequency of attendance than peers (Samuels et al., 2020) but did not report the level of involvement. Parents of children with cerebral palsy in Uganda reported a lower frequency of attendance and level of involvement for their children than that of children without cerebral palsy (Andrews et al., 2023). Children with long-term health conditions in China reported a lower frequency of attendance than healthy peers, but the level of involvement did not differ between groups (Zheng et al., 2023). The studies mentioned above reported between-group differences on the single items of PmP and did not compare the subscale scores. The internal consistency reliability coefficients in our sample were considered relatively lower than those in the previous validation study (Arvidsson et al., 2021), drawing a concern about using the subscale scores. The item-level results, therefore, enhanced the interpretability of the PmP data. Significant between-group differences were identified primarily for attendance and involvement in activities outside the family and school, such as organized leisure, shopping, social activities in community, and trips and visits, a pattern seen in several previous studies (Andrews et al., 2023; Hwang et al., 2015; Li et al., 2023; Samuels et al., 2020; Zheng et al., 2023). This finding has implications for future research to focus more on item-level analyses and put less emphasis on total and subscale scores of PmP.

The associations between perceived activity competence and attendance and involvement were confirmed in the correlation and regression analyses. Notably, the perceived activity competence of children with NDD demonstrated weak-to-moderate associations with their self-rated attendance and involvement while correlations were weak to

moderate to strong for children without NDD. The results affirm that activity competence and participation are related but not equivalent constructs within the fPRC (Imms et al., 2017). The result suggests that children's sense of competence and confidence in performing certain tasks may relate to their frequency of activities and engagement level, persistence, or amount of effort committed to activities, which are consistent with the literature (Goto et al., 2023; Missiuna et al., 2006; Visser et al., 2020). However, participation requires an extensive range of skills and abilities more than that related to the physical demands of completing the activity (Stroobach et al., 2023). Additionally, participation is related to the available support in the activity settings. Completing an activity with external support or activity adaptations can be meaningful even if the child is unable to perform the required tasks competently using typical forms of behavior (Stroobach et al., 2023).

Children with NDD demonstrated weaker associations between self-perceived competence and participation than those without NDD, but the differences were small. The PEGS measures perceived physical competence as compared to children their age; the drawings and descriptions of the "more competent" child indicate that the child can do the task independently and do well without other's assistance and environmental modifications (Missiuna et al., 2006; Pollock & Missiuna, 2015), that is, a typical way expected for children with typical functioning to participate in everyday activities. Thus, a stronger correlation for children with typical functioning can be expected when measuring a match between competencies and activities participated. Children with NDD may use different sets of skills or competencies other than those measured, such as using compensated movement, assistive devices, or specialized equipment to complete tasks in daily living and participate in adapted sports or leisure. Therefore, we reason that the associations would have been higher if children with NDD were provided with examples that match their life experiences.

Implications for Practices

This study provides insight that children's perceived activity competence is an important focus for supporting the perceived participation of children with NDD, or by supporting participation their competence can be enhanced. We argue that instruments used for measuring self-perceptions of activity competence need to reflect the lived experiences of individuals with NDD. Activity performance is affected by impairment and also depends on the availability of support (Imms et al., 2017). A child's performance using alternate or compensatory strategies to achieve functional tasks can be considered successful or competent rather than judging the performance based on a typical way of acting. Adaptation for administration procedures or redesigning the content can make child-rated instruments, like PEGS, more accessible to children with NDD (Kramer & Schwartz, 2017). For example, the administration procedure can allow flexibility in encouraging children with NDD to think about their solutions or support when completing a task. Examples of illustrations can be given on activity competence mirroring a child performing an activity in a functional way, such as using assistive devices. Individual photo-elicitation interviews using a child's selected pictures can be used to capture the child's perspectives on real-life experiences (Vänskä et al., 2020).

Supportive guidance and instruction can foster children's beliefs in skills and competence through an experience of succeeding in meaningful activities (Brian et al., 2022). Healthcare professionals are encouraged to collaborate with the child, together with their caregivers, to create a learning experience that helps build the child's positive beliefs toward the ways they perform everyday activities (Vänskä et al., 2020). This study supports the use of participation-focused approaches to engage children and families in problem-solving and decision-making about desired and attainable outcomes (Granlund & Imms, 2024). Healthcare professionals have a role in providing support and resources such as activity accommodation and environmental modification to enable meaningful participation (Anaby et al., 2022).

Study Strengths and Limitations

A strength of this study is the focus on children's perspectives using child-rated instruments that conceptually match evidence-based constructs. Attendance and involvement are two essential constructs of participation, while activity competence is a core participation-related construct (Imms et al., 2017). Children in this study were engaged in an interactive interview process through picture-supported conversation. Children were supported in understanding and then talking about their stories. This method also helped obtain valid responses and reduce the chance of missing data.

There are several study limitations. As children were the primary respondents and their cognition is important to report, using PPVT-R only provided an estimate of cognition by measuring receptive vocabulary. However, we obtained information from various sources (e.g., medical records, developmental screening, and parent reports) to ensure that the children had the ability to complete the measures. We used the original version of the PEGS without making adaptations to fit the Taiwan context. However, we piloted the PEGS and found that the picture cards and sorting system were explicit to children with and without NDD. Children mostly completed the PEGS following the PmP, which might increase the possibility of being tired or losing focus during the administration of the PEGS. The solutions were to allow appropriate break time as the child needed and encourage the children to complete the study procedures. Random assignment of the order of the tests would have further minimized the potential bias from administration sequence affecting children's responses.

The sample was a convenience sample recruited from northern Taiwan, a relatively resourceful area, which may limit the generalizability of the results to other areas, particularly low-resource areas. This study includes a small sample with uneven participant numbers among different disability conditions. However, this sample covered the major disability conditions based on a national sample of school-age children on the Disability Evaluation System in Taiwan (Hwang et al., 2015). Our design of a non-categorical approach to disability is aligned with the recent amendment of the *Special Education Act* in Taiwan, which aims to diminish categorizing school-age children based on their diagnosis and instead emphasize functioning and inclusion through services and support. Considering our earlier argument that diagnosis probably is not a strong predictor of participation, data on children's co-morbidities was not presented. However, this is still considered a limitation in characterizing our sample as the complexity of a child's

condition may affect participation. Furthermore, participation is a complex concept that can be influenced by many factors, examining the correlation of the presence of NDD and self-perceived competence with participation is limited, as it does not include other child or environment-related constructs on participation.

Conclusion

Children with NDD demonstrated lower self-perceived activity competence than children without NDD but with no difference in attendance and involvement in everyday activities between groups. Children with NDD demonstrated weaker associations between child-rated activity competence and participation than those without NDD. The characteristics of instruments used for comparisons between children with and without NDD warrant further investigation regarding how activity competence is illustrated. The study revealed that perceived competence may be an important correlate to participation; a future study is planned to investigate the effects of perceived competence and other child, family, and environmental correlates on the children's participation.

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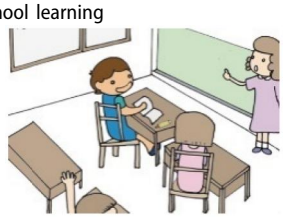
Appendix A. Perceived Efficacy and Goal Setting System (PEGS) Domain Items and Scoring[a]

Domain	Item	Score range	Scoring
Total	All 24 items	24–96	The child's choices are scored as follows: 1 = a lot like the less competent child 2 = a little like the less competent child 3 = a little like the more competent child 4 = a lot like the more competent child
Self-care (7 items)	Cutting food	7–28	
	Managing things independently		
	Tying shoes		
	Doing up buttons and snaps		
	Dressing		
	Zipping up coats		
	Managing self-care routines		
School/Productivity (8 items)	Finishing school work on time	8–32	
	Cutting with scissors		
	Working on the computer		
	Organizing work on the page		
	Writing		
	Organizing things		
	Arts and crafts		
	Drawing and coloring		
Leisure (9 items)	Catching balls	9–36	
	Being good at sports		
	Playing video games		
	Participating in games		
	Trying new things on the playground		
	Riding a bicycle		
	Playing ball games		
	Skipping		
	Keeping up		

[a]Extracted from the PEGS manual: Pollock and Missiuna (2015).

Appendix B. Picture my Participation (PmP) Subscale Items and Example Pictures Used in Taiwan

Scale/subscale Total	Item (brief) All the following 19 items[a]	Example picture
Organized activities (6 items)	Gathering supplies Cleaning at home Organized leisure Shopping Visiting to a health center Trips and visits	Trips and visits 
Social interaction and taking care of others (7 items)	Meal preparation Caring for family Caring for animals or pets Celebrations Playing with others Spiritual activities Social activities (in the community)	Playing with others 
Family life activities (3 items)	Family mealtime Family time Quiet leisure	Family mealtime 
Personal development and care activities (3 items)	Personal care Own health School learning	School learning 

[a]Item #20 in the original version of PmP (Employment) was not included in the subscales based on the results of Arvidsson et al. (2021).