

## RESEARCH ARTICLE

# Factor structure of FUNDES-Child-SE measuring the participation and independence of children with disabilities

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## Funding information

Swedish Research Council, Grant/Award Number: 2018-05824\_VR; Stiftelsen Sunnerdahls handikappfond; Futurum Academy for Health and Care, Region Jönköping County

## Abstract

**Background:** FUNDES-Child-SE is a proxy rating questionnaire for measuring participation and independence in children with disabilities in a Swedish context. It includes the components of frequency of attendance, engagement and independence. The original, Taiwanese FUNDES-Child 7.0, has previously been found to have a four-factor structure for frequency of participation and a two-factor structure for independence. The aim of this study was to test the factor structure in FUNDES-Child-SE. The factor structure is an important part of construct validity.

**Methods:** Caregivers of 163 children with disabilities aged 6–18 years participated in this cross-sectional study. Exploratory factor analysis was used to find the factor structure for Engagement. Confirmatory factor analysis was used to test the factor structure for all three components.

**Results:** The proposed factor structure for frequency of participation (daily living participation frequency, mobility participation frequency, learning participation frequency and community participation frequency) and independence (daily living independence and social participation independence) fit with data from FUNDES-Child-SE after excluding three to five items and adding two to five covariances of residuals. In the engagement component, two factors, named engagement in informal activities and engagement in formal activities, were found. After excluding one item and adding 10 covariances of residuals, the factor structure had an acceptable fit to data.

**Conclusions:** Differences in components' factor structure indicate that attendance and engagement are separate aspects of participation. Before using numeric scores from FUNDES-Child-SE in clinical settings, responsiveness and interpretability should be evaluated.

## KEYWORDS

daily activities, habilitation, psychometrics, questionnaire, rehabilitation, validity

## 1 | INTRODUCTION

Participation in daily activities is important for a child's development and well-being (King, Lawm, et al., 2009; King, Petrenchik, et al., 2009). The family of participation-related constructs (fPRC) defines participation as constructed by attendance and involvement, where involvement is operationalised as engagement, in activities (Imms et al., 2017). Attendance is necessary but not sufficient for participation. Full participation also requires engagement, that is, the internal state of individuals involving focus or effort, while attending a formal or informal activity (Imms et al., 2017). Formal activities have structure, rules, organisation and leaders or require planning (King, Lawm, et al., 2009), while informal activities are spontaneous or without specific structural parameters (Willis et al., 2017). The fPRC also sees preference, activity competence and sense of self as intrinsic factors influencing participation. Independence is described as possessing adequate competence, sense of self and self-regulation to engage in activities unassisted (Imms et al., 2017).

Reliable instruments with validated structures are vital for quality research on participation and evaluating intervention outcomes (Flake & Fried, 2020). While certain participation instruments like PEM-CY include frequency of attendance, involvement and resources for participation (Coster et al., 2011), to our knowledge, there are no validated participation instruments that capture all three aspects such as attendance, engagement and independence available in Swedish (Adair et al., 2018; Rainey et al., 2014).

The Taiwanese Functioning Scale of the Disability Evaluation System-Child (FUNDES-Child 7.0) is a questionnaire on children's frequency of participation (attendance) and independence across 20 activity areas at home and school and in society. The factor structure is an important aspect of the construct validity (Mokkink, Terwee, Patrick, et al., 2010a). The factor structure of the FUNDES-Child 7.0 instrument suggests that participation is a construct with four factors, namely, *daily living participation frequency*, *mobility participation frequency*, *learning participation frequency* and *community participation frequency*, while the two-factor structure for independence consists of the factors *daily living independence* and *social participation independence* (Hwang et al., 2020).

The Swedish adaptation, FUNDES-Child-SE, has been adjusted to the fPRC framework, and the component of engagement has been added to the components frequency of attendance and independence. FUNDES-Child-SE has been culturally adapted to a Swedish context and has good reliability (Axelsson et al., 2022; Gothilander et al., 2023). Although factor structures for FUNDES-Child 7.0 have been proposed, the factor structure for a Swedish context and the added engagement component necessitate further investigation to deepen the knowledge of the validity of the participation construct.

### 1.1 | Aim

The aim was to test the factor structure of FUNDES-Child-SE in children with disabilities aged 6–18 years. The research questions were:

### Key Messages

- FUNDES-Child-SE is a participation and independence questionnaire with two to four factors within each of the three components.
- The factor structure indicates that attendance and engagement are separate aspects of participation.
- After adaptations, the factor structure for independence proposed in FUNDES-Child 7.0 fit with data from FUNDES-Child-SE.
- Interpretability and responsiveness are important aspects for further investigation of psychometric properties.

- i. How well does the factor structure of frequency of participation and independence of FUNDES-Child 7.0 fit data from FUNDES-Child-SE?
- ii. What is the factor structure for the engagement component of FUNDES-Child-SE?

## 2 | METHODS

### 2.1 | Participants and procedure

This study analysed data from the first wave of the CHILD-PMH study on participation and mental health in children with disability across five central Swedish regions and a cross-sectional study in another region. The regions were a convenience sample. Both studies used the same instruments.

The CHILD-PMH project invited caregivers of 2891 children with disabilities aged 5–7 and 11–13 years to participate. The ages of 8–10 years were not included due to the study's design. Meanwhile, caregivers of 410 children with disabilities aged 16–18 years were invited for the cross-sectional study. Eligibility required caregivers to read Swedish, English, Arabic or Somali and have a child (in the ages stated above) registered in a child and youth habilitation centre. These centres offer service and support to children and youths with congenital or early-acquired disabilities and their families. Invitations were sent through the habilitation centres. Participants could choose a language (Swedish, English, Somali or Arabic) and method (web-based or paper) of the survey. Surveys were distributed from December 2020 to April 2021, with reminders for non-responders. No incentives for participation were provided. Out of 3301 invited caregivers, 341 (10%) agreed to participate, and 200 (6%) completed the study. Informed consent was obtained from caregivers.

### 2.2 | Instruments

Data on the child's age, gender and disability and the caregivers' gender and education level were collected. The child's disability was

assessed by four binary questions regarding physical ability and mental comprehension from the Ten Question Screen instrument (Durkin et al., 1995).

The FUNDES-Child-SE includes 20 activity items done at home, outside the home, in school and in society. For each activity, the caregiver rates the child's frequency of attendance, independence and engagement on a numeric rating scale (see Table 1).

The adaptation of FUNDES-Child-SE to the Swedish context, and the addition of the Engagement component, has been described previously (Axelsson et al., 2022). The adaptation process was guided by COSMIN procedure (Mokkink et al., 2009) and Beaton et al. (2000), which included 11 cognitive interviews with children with disabilities and their caregivers. It led to modification of certain examples and simplification and modernisation of language and concepts. The refined version was validated through five cognitive interviews with previous and new participants (Axelsson et al., 2022). Authorised translators undertook translations to English, Arabic and Somali, with the English and Arabic versions subsequently back-translated to Swedish. FUNDES-Child-SE has acceptable internal consistency (Cronbach's alpha 0.8–0.95) and marginal to excellent test–retest intra-class correlation (0.73–0.95) in 6- to 18-year-old children with disabilities in Sweden (Gothilander et al., 2023).

## 2.3 | Data analysis

Confirmatory factor analysis (CFA) was used to test how well the previously proposed factors for frequency of attendance and independence in FUNDES-Child 7.0 fit with data from FUNDES-Child-SE. The factor structure of the added engagement component was tested with both an exploratory factor analysis (EFA) and CFA. Data analyses were performed using the RStudio version 2022.02.01 + 461 (RStudio, 2022), R program version 4.1.2 (R Core Team, 2021) and R packages dplyr (Wickham et al., 2018), summarytools (Comtois, 2021), psych (Revelle, 2021), lavaan (Rosseel, 2012) and mice (Sv & Groothuis-Oudshoorn, 2011).

In the FUNDES Child-SE, in the components of frequency of attendance and engagement, the *not relevant/not applicable* response

was transformed into the ratings *never do it* or *not at all engaged*, respectively. These response alternatives have the same implication, that is, if something is not relevant or applicable, it is not done or not engaging. In the independence component, *not relevant/not applicable* was transformed into missing data as it does not imply total dependence. The transformation did not affect the amount of missing data for the components frequency of attendance (2.6%) and engagement (3.7%) but increased the missing data for independence from 4.1% to 15.6%. After transformation, surveys with  $\geq 50\%$  missing data within the three components separately were excluded, meaning that a survey with  $\geq 50\%$  missing data in one component could remain in analyses of other components with less missing data. Multivariate imputation of chained equations (mice) function in R package mice was used to impute data in the included surveys (Schouten & Vink, 2018).

The one-order models of factor structure for frequency of participation and independence from FUNDES-Child 7.0 (Hwang et al., 2020) were tested using the cfa function from the R package lavaan. After testing the proposed factor structure, items with all thresholds above or below 0 or the smallest or largest threshold being  $< -0.1$  or  $> 0.1$  were excluded. Post hoc modifications were done by sequentially adding residual covariance of items suggested by the modindices function in lavaan (Sörbom, 1989). Each modification resulted in a new model iteration, and these adjustments continued until no further significant improvements in model fit could be achieved or an acceptable fit was found (Sörbom, 1989). Model improvements were assessed using the anova function in the R package stats with significance levels set at  $< 0.05$ . Chi-square statistics (ratio of chi-square to degrees of freedom)  $< 2$ , comparative fit index (CFI) and Tucker–Lewis index (TLI)  $> 0.95$  and root mean square error of approximation (RMSEA)  $< 0.06$  were considered to show acceptable model fit (Prinsen et al., 2016; Schreiber et al., 2010). As the data were ordinal, the diagonally weighted least squares estimator was used (Li, 2016). Standardised parameter estimates, standard error and confidence intervals in the final models were derived from the standardizedSolution function in the R package lavaan (Rosseel, 2012).

For the EFA of the engagement component, the fa function from the R package psych was used. Due to the high proportion of missing or *not relevant/not applicable* responses, the items *using transportation*

**TABLE 1** Dimensions and rating scales in FUNDES-Child-SE.

Dimension	Frequency of attendance	Engagement	Independence
Question	How often the child/youth participate in different activities compared to children/young people without disabilities (with or without aids or other equipment)	How engaged/involved you think the child/youth is in activities without comparing with other children/youths	How independent the child/youth is in activities (regardless of whether he/she uses technical aids or not)
Scale	<p>0 = the same as or more than what is expected for the age</p> <p>1 = a bit less than what is expected for the age</p> <p>2 = much less than what is expected for the age</p> <p>3 = never do it</p> <p>9 = not relevant/not applicable</p>	<p>0 = very engaged</p> <p>1 = rather engaged</p> <p>2 = little/somewhat engaged</p> <p>3 = not engaged at all</p> <p>9 = not relevant/not applicable</p>	<p>0 = independent, does not need any guidance or assistance</p> <p>1 = need guidance or a little assistance</p> <p>2 = medium assistance</p> <p>3 = total assistance</p> <p>9 = not relevant/not applicable</p>

in order to move around in society and work and responsibility were excluded before the EFA. The sampling and correlation adequacy assumptions for EFA were determined by Kaiser–Meyer–Olkin (KMO) < 0.8 and Bartlett's test being significant on level < 0.05 (Field, 2018). The number of factors was examined by eigenvalues > 0.7 (Field, 2018), scree plot and very simple structure (VSS) (Revelle, 2022). Various numbers of factors were examined, and factors were extracted if they were interpretable (Revelle, 2022). Given the anticipated correlation among factors, an oblique rotation (oblimin) was used (Field, 2018). Factor loadings > 0.4 were considered salient loadings (Stevens, 2002). Factor loadings, the proportion of variance explained by the factors and the correlation of factors were presented (Field, 2018). The model fit of the factor structure was tested with a CFA as described above.

The internal consistency of the factors confirmed by CFA was examined by Cronbach's alpha using the alpha function from the R package psych. A Cronbach's alpha of 0.75–0.95 was considered acceptable (Prinsen et al., 2016).

### 3 | RESULT

After exclusions (wrong age, eight respondents; 100% missing data in at least one component, 29 respondents), 163 of the dataset's 200 respondents were included in the analyses. Children's mean age was 10.7 years, and 68% were boys, while 68% of the respondent caregivers were women, and 46% had a university education (see Table 2 for more descriptive characteristics of children and caregivers).

#### 3.1 | Factor structure of the frequency of attendance component

The original one-order, four-factor structure for frequency of attendance proposed in FUNDES-Child 7.0 did not have an acceptable fit to the data (Table 3). After inspection of thresholds and subsequent exclusion of six items, 14 items remained in the factor structure of FUNDES-Child-SE (Figure 1). Five covariances were added, after which the factor structure showed an acceptable fit to the data from FUNDES-Child-SE (Table 3).

#### 3.2 | Factor structure of the independence component

The original one-order, two-factor structure for Independence proposed in FUNDES-Child 7.0 was not an acceptable fit with the data (Table 4). Four items were subsequently excluded due to thresholds and 16 items remained in the factor structure for FUNDES-Child-SE (Figure 2). Two covariances were added, after which the factor structure showed an acceptable fit with the data from FUNDES-Child-SE (Table 4). In the final adjusted factor structure, all items had standardised parameter estimates > 0.7 (Figure 2).

**TABLE 2** Demographic data of children and caregivers.

	Population (n = 163)
Children	
Age	
Age in years (m, [SD])	10.7 (3.83)
Cohort born 2013–2015	41.1%
Cohort born 2007–2009	42.9%
Cohort born 2003–2006	16.0%
Gender	
Boy	63.8%
Girl	35.0%
Other	1.2%
Physical disability	
Has serious delay in sitting, standing or walking	36.2%
Has difficulty walking or moving arms or is weak or rigid in arms or legs	19.6%
Intellectual disability	
Comprehends when parent asks the child to do something	80.1%
Seems to have difficulties to comprehend or is slow	68.3%
Caregivers	
Gender	
Woman	68.1%
Man	31.9%
Education level	
9-year elementary school	8.0%
Upper secondary school	26.4%
University	46.0%
Missing	19.6%
Need an interpreter	
Yes	16.6%
No	64.4%
Missing	19.0%
Survey language	
Swedish	90.2%
English	4.9%
Arabic	4.9%

#### 3.3 | Factor structure of the engagement component

The KMO test (0.92) and Bartlett's test (< 0.05) confirmed that the data fulfilled the assumptions for proceeding with EFA. The eigenvalues, scree plot and VSS indicated a one- to three-factor solution. The two-factor structure was judged most appropriate as it had no items loading on two factors. However, *organised activities outside the*

**TABLE 3** The fit of CFA on the factor structure in the frequency of attendance component.

Factor structure	Observations <sup>a</sup>	$\chi^2$	df	p-value	CFI	TLI	RMSEA	RMSEA confidence intervals
FUNDES-Child 7.0	154	309.200	146	0.000	0.991	0.989	0.085	0.072–0.099
FUNDES-Child-SE <sup>b</sup>	154	71.999	66	0.286	0.999	0.999	0.024	0.000–0.055

Abbreviations: CFI, comparative fit index; df, degrees of freedom; RMSEA, root mean square error of approximation; TLI, Tucker–Lewis index.

<sup>a</sup>Number of surveys with data on more than 50% of the items.

<sup>b</sup>Excluded items *moving about in and around the home, moving around at school, using pedagogical materials and equipment that are also available for other students or that are adapted for you/your child, shopping and managing money and using transportation in order to move around in society* and residual covariances between items 7 and 2, 15 and 12, 3 and 18, 15 and 11 and 12 and 11. All items are presented in Figure 1.

Factors in FUNDES-Child 7.0 <sup>a</sup>	Factor items in FUNDES-Child 7.0	Remaining factor items in FUNDES-Child-SE <sup>123</sup>	Standardized parameter estimates	Standard error	Confidence intervals
Daily living participation frequency <sup>1</sup>	3 16 17 <sup>1</sup> 18	3. Family chores, responsibilities and decisions at home	0.892	0.038	0.817–0.967
		16. Household activities	0.804	0.035	0.735–0.874
		18. Managing a daily schedule	0.842	0.042	0.760–0.924
Mobility participation frequency <sup>2</sup>	4 5 <sup>2</sup> 9 13 <sup>2</sup> 19 <sup>2</sup>	4. Taking care of yourself	0.726	0.035	0.608–0.844
		9. Moving around outside the home	0.701	0.053	0.596–0.806
Learning participation frequency <sup>3</sup>	15 1 6 11 12 14 <sup>3</sup>	15. Communicating with other students and adults at the school	0.808	0.032	0.746–0.870
		1. Social, play or leisure activities home with family	0.755	0.039	0.679–0.831
		6. Communicating with other children, youth and adults at home	0.890	0.022	0.847–0.932
		11. Instructional activities together with classmates	0.702	0.047	0.610–0.793
		12. Social, play or leisure activities with other students at school	0.758	0.041	0.678–0.839
Community participation frequency <sup>4</sup>	7 2 8 10	7. Social, play, or leisure activities with friends outside the home	0.732	0.042	0.650–0.814
		2. Social, play or leisure activities home with friends	0.694	0.049	0.598–0.791
		8. Organized activities outside the home	0.788	0.040	0.710–0.866
		10. Communicating with other children, youth and adults outside the home	0.890	0.026	0.838–0.942

**FIGURE 1** Participation frequency factors tested with a CFA. The figure presented the proposed factor structure in FUNDES-Child 7.0 and included items, the items remaining in factor structure in FUNDES-Child-SE, remaining items' standardised parameter estimates, standard error and confidence intervals. The figure also presents the covariance residuals added in CFA. <sup>a</sup>Item 20. Work and responsibilities not included in factors in the model by Hwang et al. (2020). <sup>1</sup>Item excluded 17. Shopping and managing money. Residual covariance between items 3 and 18. <sup>2</sup>Items excluded 5. Moving about in and around the home; 13. Moving around at school; and 19. Using transportation in order to move around in society. <sup>3</sup>Item excluded 14. Using pedagogical materials and equipment that are also available for other students or that are adapted for you/your child. Residual covariance between items 15 and 11, 15 and 12 and 11 and 12. <sup>4</sup>Residual covariance between items 7 and 2.

**TABLE 4** The fit of CFA on the factor structure in the Independence component.

Factor structure	Observations <sup>a</sup>	$\chi^2$	df	p-value	CFI	TLI	RMSEA	RMSEA confidence intervals
FUNDES-Child 7.0	139	321.855	151	0.000	0.995	0.995	0.091	0.077–0.104
FUNDES-Child-SE <sup>b</sup>	139	123.481	101	0.064	0.999	0.999	0.040	0.000–0.063

Abbreviations: CFI, comparative fit index; df, degrees of freedom; RMSEA, root mean square error of approximation; TLI, Tucker–Lewis index.

<sup>a</sup>Number of surveys with data on more than 50% of the items.

<sup>b</sup>Excluded items *moving about in and around the home, moving around at school and using pedagogical materials and equipment that are also available for other students or that are adapted for you/your child* and covariances between items 10 and 15, and 17 and 18. All items are presented in Figure 2.

home loaded 0.33 and 0.39 on the factors and was subsequently excluded, after which the factors included 17 items. The two-factor structure was interpretable, and factors were named *engagement in*

*informal activities* and *engagement in formal activities*. The factors correlated strongly (0.66) and together explained 53% of the variance (Figure 3).

Factors in FUNDES-Child 7.0*	Factor items in FUNDES-Child 7.0	Remaining factor items in FUNDES-Child-SE <sup>1</sup>	Standardized parameter estimates	Standard error	Confidence intervals
Daily living participation independence <sup>1</sup>	16	16. Household activities	0.901	0.021	0.859-0.942
	3	3. Family chores, responsibilities and decisions at home	0.841	0.030	0.782-0.900
	4	4. Taking care of yourself	0.850	0.029	0.793-0.907
	5 <sup>1</sup>	9. Moving around outside the home	0.813	0.036	0.743-0.883
	9	17. Shopping and managing money	0.767	0.043	0.682-0.851
	13 <sup>1</sup>	18. Managing a daily schedule	0.802	0.036	0.732-0.873
	14 <sup>1</sup>	19. Using transportation in order to move around in society	0.829	0.035	0.761-0.896
	17				
	18				
Social participation independence <sup>2</sup>	7	7. Social, play, or leisure activities with friends outside the home	0.862	0.024	0.816-0.908
	1	1. Social, play or leisure activities home with family	0.827	0.032	0.763-0.890
	2	2. Social, play or leisure activities home with friends	0.890	0.021	0.848-0.932
	6	6. Communicating with other children, youth and adults at home	0.862	0.026	0.811-0.913
	8	8. Organized activities outside the home	0.892	0.022	0.849-0.935
	10	10. Communicating with other children, youth and adults outside the home	0.856	0.029	0.800-0.913
	11	11. Instructional activities together with classmates	0.844	0.030	0.784-0.903
	12	12. Social, play or leisure activities with other students at school	0.892	0.022	0.850-0.935
	15	15. Communicating with other students and adults at the school	0.843	0.031	0.782-0.905

**FIGURE 2** Independence factors tested with a CFA. Figure presented the proposed factor structure in FUNDES-Child 7.0 and included items, the items remaining in factor structure in FUNDES-Child-SE, remaining items' standardised parameter estimates, standard error and confidence intervals. The figure also presents the covariance residuals added in CFA. \*Item 20. Work and responsibilities not included in factors in the model by Hwang et al. (2020). <sup>1</sup>Items excluded 5. Moving about in and around the home; 13. Moving around at school; and 14. Using pedagogical materials and equipment that are also available for other students or that are adapted for you/your child. Residual covariance between items 17 and 18. <sup>2</sup>Residual covariance between items 10 and 15.

Factor structure found with EFA*	Factor items	Factor loadings	Standardized parameter estimates	Standard error	Confidence intervals
Engagement in informal activities <sup>2</sup>	1. Social, play or leisure activities home with family	0.74	0.733	0.042	0.651-0.816
	2. Social, play or leisure activities home with friends	0.71	0.686	0.049	0.590-0.782
	3. Family chores, responsibilities and decisions at home	0.79	0.610	0.038	0.497-0.727
	4. Taking care of yourself	0.42	0.663	0.057	0.552-0.775
	5. Moving about in and around the home <sup>2</sup>	0.51			
	6. Communicating with other children, youth and adults at home	0.48	0.835	0.033	0.771-0.899
	7. Social, play, or leisure activities with friends outside the home	0.73	0.770	0.042	0.688-0.852
	9. Moving around outside the home	0.50	0.787	0.038	0.713-0.861
	10. Communicating with other children, youth and adults outside the home	0.68	0.732	0.045	0.644-0.821
	16. Household activities	0.42	0.714	0.045	0.616-0.812
Engagement in formal activities <sup>3</sup>	11. Instructional activities together with classmates	0.84	0.859	0.028	0.805-0.914
	12. Social, play or leisure activities with other students at school	0.58	0.881	0.024	0.834-0.929
	13. Moving around at school	0.78	0.850	0.030	0.791-0.910
	14. Using pedagogical materials and equipment that are also available for other students or that are adapted for you/your child	0.94	0.816	0.031	0.756-0.876
	15. Communicating with other students and adults at the school	0.78	0.928	0.019	0.890-0.966
	17. Shopping and managing money	0.47	0.764	0.046	0.674-0.854
	18. Managing a daily schedule	0.49	0.846	0.039	0.770-0.922

**FIGURE 3** Engagement factors from EFA tested with a CFA. The figure presented the factor correlation, items included in factors and items' factor loadings. Also, the figure presents the items' standardised parameter estimates, standard error and confidence intervals from CFA. \*Items 8. Organized activities outside the home; 19. Using transportation in order to move around in society; and 20. Work and responsibilities, not included in factors. <sup>1</sup>Correlation coefficient for factors. <sup>2</sup>Item 5 was excluded in CFA. Residual covariances between items 10 and 6, 3 and 16, 1 and 3, 3 and 4, 2 and 7, 6 and 16 and 1 and 2. <sup>3</sup>Residual covariance between items 11 and 14, 13 and 14 and 12 and 18.

The following CFA on the two-factor structure showed an unacceptable fit with the data (Table 5). Item *moving about in and around the home* was subsequently excluded based on thresholds, and

10 covariances were added. In the final adjusted factor structure the fit was acceptable (Table 5), and all items had standardised parameter estimates >0.6 (Figure 3).



**TABLE 5** The fit of CFA on the factor structure in the engagement component.

Factor structure	Observations <sup>a</sup>	$\chi^2$	df	p-value	CFI	TLI	RMSEA	RMSEA confidence intervals
EFA identified two-factor factor structure	152	251.937	118	0.000	0.990	0.989	0.087	0.072–0.101
Adjusted factor structure <sup>b</sup>	152	131.822	93	0.005	0.997	0.996	0.053	0.030–0.072

Abbreviations: CFI, comparative fit index; df, degrees of freedom; RMSEA, root mean square error of approximation; TLI, Tucker–Lewis index.

<sup>a</sup>Number of surveys with data on more than 50% of the items.

<sup>b</sup>Item *moving about in and around the home* excluded and residual covariances between items 10 and 6, 3 and 16, 1 and 3, 3 and 4, 11 and 14, 13 and 14, 12 and 18, 2 and 7, 6 and 16, 1 and 2 added. All items are presented in Figure 3.

**TABLE 6** Cronbach's alpha correlation coefficient for the factors in FUNDES-Child-SE.

Component	Factor	Alpha <sup>a</sup> (95% confidence intervals)
Frequency of attendance	Daily living participation frequency	0.79 (0.73–0.85)
	Mobility participation frequency	0.63 (0.51–0.74)
	Learning participation frequency	0.87 (0.84–0.90)
	Community participation frequency	0.83 (0.78–0.87)
Independence	Daily living participation independence	0.90 (0.87–0.92)
	Social participation independence	0.94 (0.92–0.95)
Engagement	Engagement in informal activities	0.89 (0.87–0.92)
	Engagement in formal activities	0.91 (0.92–0.95)

<sup>a</sup>Alpha = Cronbach's alpha correlation coefficient.

### 3.4 | Internal consistency of FUNDES-Child-SE

In the component of frequency of attendance, Cronbach's alpha was acceptable in all factors (0.79–0.87) except *mobility participation frequency* (0.63) (Table 6). Cronbach's alpha was acceptable for all factors of the components independence (0.90–0.94) and engagement (0.89–0.91) (Table 6).

## 4 | DISCUSSION

This study aimed to test the factor structure proposed in FUNDES-Child 7.0 on data from FUNDES-Child-SE and to evaluate the factor structure of the added engagement component. Adjustments were necessary for both the four-factor structure for frequency of attendance and the two-factor structure for independence. The Engagement component had two factors, named *engagement in informal activities* and *engagement in formal activities*. All factor structures needed adjustments to get a good fit.

To achieve a suitable factor structure for frequency of attendance, items related to mobility within home and school, and pedagogical equipment usage were excluded. Children in the study most likely had access to mobility aids provided by the habilitation centres and were entitled to use pedagogical equipment due to inclusive policies in Swedish schools (Maxwell & Granlund, 2011). Also, the items of shopping and using public transportation were excluded from the factor structure. The thresholds in these items could be affected

by transforming all *not relevant/not applicable* responses, 35.6% and 25.2%, respectively (Gothilander et al., 2023) to a rating of *never do it*. Shopping and using transportation may differ among children in Sweden and Taiwan.

The three items concerning moving around at home and in school and using pedagogical equipment were subsequently excluded also from the factor structure of independence. The reason for exclusion may in this component also be the thresholds due to sample characteristics and implementation of policy. Still, with minor adjustments, the two-factor structure for independence proposed by FUNDES-Child 7.0 was found in FUNDES-Child-SE. This may imply that independence can be considered less complex and a more universal construct compared to participation.

The added engagement component has the factors *engagement in formal activities* and *engagement in informal activities*. Engagement, unlike attendance, delves into the subjective experience of the internal state of focus or effort while attending a formal or informal activity (Imms et al., 2017). While some children's engagement could increase by having a structure (Volkmar & Wiesner, 2021), other children might engage more in free activities (Powrie et al., 2015). Formal settings can both ease and hinder engagement (Anaby et al., 2013). Firstly, these are commonly prioritised settings for which aids and assistance are given to children to promote their participation (Anaby et al., 2022; Karhula et al., 2021). Second, organised accommodations in formal settings, like adjusted lighting and background noise in classrooms, can increase acceptability, and thereby perhaps also engagement in activities within the setting, for example, for

children with autism (Dargue et al., 2021). To summarise, the factor structure may indicate that two seemingly similar activities in a formal or informal setting could have different levels of engagement, perhaps depending on the accommodations and the child's perceived acceptability within the setting.

The internal consistency was acceptable in all factors except *mobility participation frequency*. After excluding the moving around and transportation items, the factor only includes *taking care of yourself* and *moving around outside the home*. Thus, it is questionable if it is a mobility factor or if this is due to few participants having physical disabilities or already having been provided with aids. Consequently, this requires further investigation. Still, the other factors' internal consistency indicates that after some adjustments, the structure of FUNDES-Child-SE is similar to that of FUNDES-Child 7.0 in the components frequency of attendance and independence. The factor structures can be interpreted as consistent over several countries and participant characteristics and thus strengthen the understanding of the constructs in children with disabilities.

This study contributes to an enhanced understanding of the participation construct by illustrating the distinct factor structures of frequency of attendance and engagement. Although this study did not aim to test the fPRC framework, the results provide support for its suggestions regarding the participation complexity. Recognising the distinct nature of participation, each part with potentially different mechanisms and effects can enrich both research and practice. The need to adjust the factor structure for frequency of attendance proposed in FUNDES-Child 7.0 to data from FUNDES-Child-SE, despite having the same items and rating scale, implies that the structure of participation varies when divided into these components. These adjustments may stem from differences between countries, participant characteristics or treatment of missing data. Consequently, this encourages further tests of the factor structure on a larger and more diverse sample in contexts more similar to Sweden, such as other Nordic countries, as well as further research to investigate the effects of attendance and engagement as separate parts of the participation construct.

Quantitative scores, although crucial, have limited clinical utility unless responsiveness is evaluated (Lexell & Downham, 2005; Mokkink, Terwee, Knol, et al., 2010). It is important to also consider the interpretability, that is, the qualitative meaning of quantitative scores (Mokkink, Terwee, Patrick, et al., 2010c). Therefore, basing interventions on scores should be done with caution and always in dialogue with the child and their caregiver.

In a CFA with post hoc adjustments, there is a risk of overfitting the statistical model, so it fits data from a specific sample well but does not adequately represent the target population (Babyak, 2004). In this study, items with poor thresholds were excluded, and residual covariances between items within the factors were added. These adjustments are considered reasonable and provide information on which adaptations were needed in FUNDES-Child-SE to fit the factor structure of FUNDES-Child 7.0. Still, the risk of overfitting should be acknowledged.

It is generally accepted that an EFA requires 100–200 participants (Ferguson & Cox, 1993). However, Wolf et al. (2013) recommend basing sample size requirements on the number of factors, items, and strength of factor loadings. Considering that more than four items loaded >0.6 on each factor and the correlation and sampling assumptions for EFA were fulfilled, the sample size in this study was deemed acceptable (Ferguson & Cox, 1993). Following Hwang et al.'s method, both items *using transportation in order to move around in society* and *work and responsibility* were excluded before the EFA due to a high proportion of *not relevant/not applicable* responses. In most tested factor structures, several items loaded on multiple factors, indicating factors are not distinct and the CFA required 10 residual covariances to be added before the data fit the factor structure. Future studies should conduct a CFA on the factors in FUNDES-Child-SE on a larger and more diverse sample and invite children aged 8–10 years.

## 5 | CONCLUSIONS

This study highlights the need to distinguish between engagement and attendance in the analysis of participation, as they represent distinct constructs within the broader participation framework. The findings demonstrate that modifications are required to align the factor structures of the FUNDES-Child-SE with those concerning the frequency of attendance and independence proposed in the original FUNDES-Child 7.0 instrument.

The introduction of an engagement component in the Swedish version reveals a difference between engagement in formal and informal activities, suggesting that environmental accommodations may influence the subjective experience of participation. This insight could be useful for developing more effective, tailored interventions that meet the specific needs and circumstances of children with disabilities.

Further research should aim to expand the sample size and include a more diverse range of participants to confirm these factor structures across different contexts. Future studies should focus on the practical applications of these findings. The ultimate goal is to have a validated instrument that can be used to assess both participation components in interventions aimed at improving participation for children with disabilities.

## AUTHOR CONTRIBUTIONS

**Jennifer Gothilander:** Writing—original draft; formal analysis; project administration; funding acquisition; visualization; methodology; investigation; conceptualization; software; data curation. **Anna Karin Axelsson:** Conceptualization; funding acquisition; methodology; supervision; visualization; investigation. **Henrik Danielsson:** Funding acquisition; writing—original draft; methodology; formal analysis; software; data curation; supervision; validation; visualization. **Lena Almqvist:** Investigation; funding acquisition; supervision. **Anna Ullenhag:** Methodology; conceptualization; visualization; funding acquisition; supervision; investigation.



## ACKNOWLEDGEMENTS

We thank the participants and the Swedish Research Council (grant number 2018-05824\_VR), Stiftelsen Sunnerdahls handikappfond, and Futurum Academy for Health and Care, Region Jönköping County for funding.

## CONFLICT OF INTEREST STATEMENT

No conflict to declare.

## DATA AVAILABILITY STATEMENT

Data will be available upon reasonable request.

## ETHICS STATEMENT

The study was approved by the Swedish Review Authority (no. 2019-05028 and no. 2017/496-31) and the procedure complied with the Helsinki Declaration of Medical Research. All participants have signed written consents. FUNDES-Child-SE has been developed with permission from authors of FUNDES-Child, and developers of FUNDES-Child-SE are authors of this manuscript and have given their consent.

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**How to cite this article:** Gothilander, J., Axelsson, A. K., Danielsson, H., Almqvist, L., & Ullenhag, A. (2024). Factor structure of FUNDES-Child-SE measuring the participation and independence of children with disabilities. *Child: Care, Health and Development*, 50(4), e13306. <https://doi.org/10.1111/cch.13306>

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