Title: An exploration of the relationship between two measures of children's participation

Running Title: Relationship between CPQ and CAP-Hand

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An exploration of the relationship between two measures of children's participation

Abstract

Purpose: To investigate the relationship between the Children Participation Questionnaire (CPQ) and the Children's Assessment of Participation with Hands (CAP-Hand).

Materials and methods: Two researchers classified the CPQ and CAP-Hand item contents independently using the International Classification of Functioning, Disability and Health-Child and Youth version (ICF-CY) as a guide. Parents of 51 children with intellectual and developmental disabilities completed both measures within one month.

Results: The ICF-CY linking results indicated that the CPQ and CAP-Hand covered a broad range of life domains, which corresponded well to the conceptually matched ICF-CY Activities and Participation categories/chapters. A significant moderate link (Pearson's r coefficient = 0.63, $p < 0.01$) between the CPQ and CAP-Hand was found, and all of their matched domains (except for the educational domain) also revealed small to moderate associations ($r = 0.44–0.66$, $p < 0.01$). The paired items that asked identical or similar life situations between the CPQ and CAP-Hand demonstrated varying correlation levels ($r = 0.07–0.82$).

Conclusion: This study provides evidence for the content and construct validity of the CPQ and CAP-Hand. The findings also offer important insights about the similarities and differences between the two measures. This knowledge will assist clinicians in selecting outcome measures.

Keywords: Participation; Children; ICF-CY linking rules; Intellectual and developmental disability; Children Participation Questionnaire (CPQ); Children's Assessment of Participation with Hands (CAP-Hand).

Introduction

Participation is defined as an individual's involvement in life situations in the International Classification of Functioning, Disability and Health (ICF) [1] as well as its expanded version for children and youth (ICF-CY) [2]. Promoting participation has been recognised as an important outcome and ultimate goal for rehabilitation and healthcare services for children with disabilities [3-5]. Many children's participation measures therefore have been developed to help professionals assess children's individual participation patterns and to focus on which aspects are important for each child [6-8].

According to several published systematic reviews [9-14], there are collectively more than 30 children's participation measures available for use in clinical and research settings. The large number of participation measures are reflective of the various assessment needs of children across different age ranges (preschool and/or school-age) and diagnostic groups (specific or most disabilities). These measures utilise their unique formats (observation-, questionnaire- or interview-based) to assess children's participation directly from themselves or through the proxy (parents, caregivers, or teachers). Furthermore, the scope and number of life situations covered in those children's participation measures are also varied. For example, some measures assess children's participation in a comprehensive range of generic life situations within self-care, play, education, social interaction, and community settings. Some measures assess life situations in one specific domain (i.e., leisure [15]) or under specific conditions (i.e., activities involving communication [16] or hand use [17]). Although there are many options to choose from, few existing studies have explored the relationship between two or more individual measures of children's participation. Clinicians and researchers may not be conversant with the similarities or differences of these measures and whether the results obtained from those measures are comparable.

Among the many participation measures, it has been noted that most conceptualise and describe life situations in different ways, even when those life situations are similar. These

differences could range from describing life situations in simple phrases, by providing pictorial cards, or by including contextual details and illustrative examples. For example, the life situation “playing individual games indoors” is outlined using a simple phrase in the Assessment of Life Habits for Children [18]. This life situation is presented slightly differently in the Children’s Assessment of Participation and Enjoyment [19] by using a pictorial illustration in addition to the following short phrase “playing with things or toys”. However, the Participation and Environment Measure-Children and Youth (PEM-CY) [20] provides detailed contextual information and examples; that is, “indoor play and games (at home), i.e., playing with toys, puzzles, or board games, playing kitchen or dress-up”. This PEM-CY style is based on Coster et al.’s [4,21] proposition that a life situation for children is structured from sets of organised sequences of activities directed towards a personally/socially meaningful goal as well as occurring in a specific setting. Considering the range of wording approaches utilised to represent the same factor, it is important to determine whether the same life situations based on differently phrased and formatted items among those measures result in participation outcomes that are associated. In theory, if two different items from two different participation measures are assessing the same factor or construct, they should positively and highly correlate when completed by the same respondent.

The aim of this study was to investigate the relationship between two measures of children’s participation that assess similar factors; one measure is the Children Participation Questionnaire (CPQ) [22] and the other is the Children’s Assessment of Participation with Hands (CAP-Hand) [17]. Both measures are recently developed, parent-report questionnaires that can be used with a wide range of diagnostic groups and are comprehensive in their assessment of children’s life domains. However, the CAP-Hand includes life situations that involve hand use specifically, whereas the CPQ includes generic life situations that may or may not specifically require hand use. Furthermore, the CPQ items use simple phrases whereas the CAP-Hand items are modelled on the PEM-CY style of describing life situations.

These differences provide a unique basis to examine the relationship between the condition-specific (i.e., the CAP-Hand) and generic (i.e., the CPQ) participation measures as well as to explore whether specific items that capture similar life situations between the two measures are associated.

Methods

Participants

Children's participation data were retrieved from a larger research study that included two stages to investigate factors influencing children's hand-use life participation by using various assessments [17]. In that study, a survey was conducted to recruit children from southeast Queensland special schools if they (1) had intellectual and developmental disability, (2) were aged 2-12 years, and (3) had parents who were able to read English. Children who exhibited only physical, visual, or hearing impairments were excluded from this study. Ethical approval for the entire study was granted by the Department of Education, Training and Employment (file number: 550/27/1126) and the ethical review committee at the University of Queensland (project number: 2011000600).

At first, 11 of 15 public special schools within Brisbane Queensland Metropolitan regions in Australia provided permission for distributing research invitations and questionnaires to eligible children. A total of 97 parents provided written consent and completed the first round of questionnaires (including the CAP-Hand), with 82 of them indicating their willingness to receive the second set of questionnaires (where the CPQ was included). Sixty-one of the 82 consenting parents returned the CPQ, but ten were further eliminated due to completing the CPQ beyond one month after the CAP-Hand was completed. One month was considered as a reasonable timeframe that has been widely used to avoid memory effects in test-retest reliability examinations of children's participation measures [20,23]. Hence, the remaining 51 parents who completed the CPQ and CAP-Hand within one month were included in the present study.

Table 1 summarises the demographics of the 51 children whose parents completed both the CPQ and CAP-Hand as well as whose did not. There were no significant differences in children's gender ($\chi^2 = 0.62$, $p = 0.43$), age ($t = 1.13$, $p = 0.26$), and the types of diagnoses/disabilities ($\chi^2 = 0.03–2.88$, $p = 0.09–0.87$), and the roles of the respondents ($\chi^2 = 2.88$, $p = 0.24$).

Insert table 1 about here

Measures

The Children Participation Questionnaire (CPQ) [22] is designed to capture everyday life participation of children aged 4−6 years. For the purpose of our study, we used the CPQ for children aged 2−12 years because its items were also appropriate for younger children [24] and children of elementary school age [25]. The CPQ consists of 44 items across six life domains: activities of daily living (ADL; 5 items), instrumental activities of daily living (IADL; 5 items), play (5 items), leisure (10 items), social participation (SP; 8 items), and education (11 items). Each CPQ item utilises simple phrases to describe a typical childhood occupation such as playing construction toys (all item descriptions can be found elsewhere [22] and in appendix S1, published online). In the CPQ, parents are asked to rate how frequently their child participates in each activity (using a 6-level rating scale from 0 = never, 1 = once in three months, 2 = once or twice a month, 3 = once a week, 4 = twice a week, and 5 = everyday). If the child participates in a particular activity, the parent further reports on the degree of assistance provided, child's enjoyment, and parents' satisfaction. Thus, the CPQ yields five participation dimension scores based on each life domain, but the present study only analysed children's participation frequency (using a mean score of 0−5). The CPQ has demonstrated acceptable construct validity [22,26] and excellent test-retest reliability (intraclass correlation coefficients=0.84−0.89) [22].

The Children's Assessment of Participation with Hands (CAP-Hand) [17] captures 2- to 12-year-old children's involvement in life situations that require hand use specifically as an indication of active participation. The CAP-Hand includes 34 items across four domains: self-care (9 items), recreation (9 items), education (8 items), and domestic life & community (DL&C; 8 items). Each CAP-Hand item begins with "*Does the child use his/her hands to* (engage in a specific life situation in which children would perform a set of similar activities that require hand use typically)". As mentioned earlier, each life situation included in the CAP-Hand is followed by the PEM-CY style to describe the life situation in detail (i.e., including a common goal for participation, specific settings, and potential surrounding people/children during participation). One example is "Play with construction toys with family/friends at home or at other venues (outside school). For example, your child may play with some kinds of blocks (i.e., wooden blocks, Lego blocks or unifix cubes) or building models." For readability, each item is abbreviated throughout this article (all item descriptions can be found in appendix S2, published online). In each item, the parent is asked to report yes or no to indicate whether his/her child participates in the life situation. If the child does participate, the parent then identifies how often the child has participated in the past three months (1 = less than once 1 month, 2 = 1–2 times a month, 3 = once a week, 4 = 2–3 times a week, and 5 = everyday); the assistance the child requires; and the parent's desire for change in the child's participation. For the present study, we analysed the participation frequency dimension (using a mean score of 0–5 by treating no participation as zero in the frequency). Evidence of the CAP-Hand's construct validity has been established, and its test-retest reliability (intraclass correlation coefficients=0.69−0.96) was also acceptable [17].

Examining content coverage of the CPQ and CAP-Hand by linking to ICF-CY

To examine the relationship between the CPQ and CAP-Hand, the ICF-CY was used as an external reference framework to identify and examine the content coverage of the two measures. Applying the ICF-CY categories to the concepts found in assessment tools has

been considered as a standardised and comprehensive way to explore the item contents and to examine similarities and differences [11,27,28]. In this study, both measures were linked to the ICF-CY by using the rules developed by Cieza and colleagues [29,30], and supplemented by Adolfsson et al. [11] and Chien et al. [28] when linking children's participation measures to the ICF-CY.

The linking process started with the identification of meaningful concepts in the individual item of both measures. If an item contained more than one concept, these were also considered during the linking process. Each of the identified meaningful concepts was subsequently linked by assigning an ICF-CY code at the most precise level. If the information of a meaningful concept was not sufficient in the determination of which ICF-CY code best represented it, the meaningful concept was coded as 'not definable'.

In this study, two raters (CWC and one trained rater) each completed the CPQ and CAP-Hand linkage process independently. Their overall agreement for the CPQ and CAP-Hand was 89.5% and 72.0% respectively in identifying meaningful concepts to be linked, as well as 76.0% and 92.9% for the second-level ICF-CY categories. In the instances where disagreement between the two raters' linking results existed, two other researchers (SR and JC who are pediatric occupational therapists with more than 25 years of experience) consulted with each other and consensus was reached based on group discussion.

Data Analysis

The data analysis for this study consisted of three parts. In the first part, Pearson's *r* correlation coefficient and simple linear regression analyses were performed to estimate the relationship between the CPQ and CAP-Hand at the total scale level. The same statistical approaches were also used to investigate the associations of the matched domains that included similar life situations between the two measures.

The matched domains included the CPQ ADL domain and CAP-Hand self-care domain; combined CPQ play and leisure domains and CAP-Hand recreational domain; CPQ and

CAP-Hand educational domain; and combined CPQ IADL and SP domains and CAP-Hand DL&C domain. In the second part, descriptive analyses were completed to summarise the total number of meaningful concepts that were linked to the ICF-CY categories within the CPQ and CAP-Hand. The coverage of the domains of the CPQ and CAP-Hand was further investigated by examining the extent to which their concepts were linked to the most relevant ICF-CY Activities and Participation chapter(s); for example, the CPQ ADL domain should be covered within the d5 *Self-care*. This examination was based on the second-level coding of the ICF-CY categories (i.e., rounding up the third and fourth-level categories) as suggested elsewhere [31].

In the third part, we identified and paired the items that might capture similar life situations between the CPQ and CAP-Hand, and examined their relationship by comparing the ICF-CY linking results and by conducting Pearson's *r* correlation coefficients. All analyses were performed using the Statistical Package for Social Sciences Version 20.0.

Results

A significant moderate association between the CPQ and CAP-Hand at the total scale level was found ($r = 0.63$, $p < 0.01$). Linear regression analysis also showed that the CAP-Hand explained 40.0% of the total variance of the CPQ (see table 2). For the matched domains, small to moderate associations were found between the CPQ ADL domain and CAP-Hand self-care domain ($r = 0.56$, $p < 0.01$), between the combined CPQ play and leisure domains and CAP-Hand recreational domain ($r = 0.44$, $p < 0.01$), and between the combined CPQ IADL and SP domains and CAP-Hand DL&C domain ($r = 0.66$, $p < 0.01$). Table 2 shows that these CAP-Hand domains accounted for 19.0–43.7% of the total variance of their matched CPQ domains. However, an insignificant correlation between the CPQ and CAP-Hand educational domains ($r = 0.17$, $p = 0.23$) was noted.

Insert table 2 about here

In the comparison of content coverage by linking to the ICF-CY, 54 meaningful concepts in the CPQ and 109 in the CAP-Hand were identified. Almost all of these concepts in the CPQ (92.2%) and CAP-Hand (98.2%) were linked to the ICF-CY Activity and Participation chapters/categories (see appendices S1 and S2, published online). Both the CPQ and CAP-Hand were found to cover seven of the nine chapters (except for the d2 *General tasks and demands* and d7 *Interpersonal interaction and relationship*, see table 3 for overview).

By scrutinising the results into each CPQ domain, it was found that its ADL domain included five (100%) concepts from the d5 *Self-care*; the combined play and leisure domains included 12 (70.6%) from the d880 *Engagement in play* and d920 *Recreation and leisure*; the educational domain included eight (53.3%) from the d8 *Major life areas* in relation to school; and the combined IADL and SP domains included seven (46.7%) from the d3 *Communication* and d6 *Domestic life*. Similarly, the CAP-Hand linking to the ICF-CY determined that its self-care domain had 12 (70.6%) concepts from the d5 *Self-care*; the recreational domain with 18 (58.1%) from the d880 *Engagement in play* and d920 *Recreation and leisure*; the educational domain with 16 (47.1%) from the d1 *Learning and applying knowledge* and d8 *Major life areas* in relation to school; and the DL&C domain with 11 (44.0%) from the d3 *Communication* and d6 *Domestic life*.

Insert table 3 about here

Table 4 shows the ICF-CY linking comparisons and relationships of 16 paired items that were identified as capturing similar life situations between the CPQ and CAP-Hand. Eight CPQ items were 100% matched to their paired CAP-Hand items in terms of the ICF-CY

second-level coding, and all but two items further had significantly moderate to high correlations (r = 0.50–0.82, $p < 0.01$). The two pairs of the items with small and insignificant correlations (r = 0.16–0.18, p = 0.23–0.27) were *Eat with cutlery* in the CPQ (versus *Eat meal* in the CAP-Hand) and *Do arts and crafts* (versus *Do artwork*) at school. On the other hand, the remaining eight pairs of items had less than 100% ICF-CY second-level coding match between the CPQ and CAP-Hand. However, these items still exhibited significantly small to moderate correlations (r = 0.38–0.63, $p < 0.01$), except for one item: *Take sport/movement lessons-afternoon* in the CPQ (versus *Participate in sport/physical education lessons* in the CAP-Hand) at school.

Insert table 4 about here

Discussion

To the best of our knowledge, this study is the first to apply two participation measures (i.e., the CPQ and CAP-Hand) with the same group of children with disabilities and link their item contents with the ICF-CY to investigate the relationship. Overall, a significant moderate association between the two measures was found at the total scale level, and three of the matched domains also demonstrated small to moderate associations. Almost half (≥ 44.0%) of the concepts in each domain of these two measures were linked to the ICF-CY Activity and Participation category/chapter(s) that are conceptually the same or consistent. Furthermore, it was found that most of the paired CPQ and CAP-Hand items that captured similar life situations were significantly associated, even though the two measures used different wording approaches to illustrate similar life situations. These findings contribute to cumulative evidence to support the validity, particularly the content and convergent validity of the CPQ and CAP-Hand. This type of construct validity evidence by relating to similar participation measures has been rarely examined in the referred literature [9,10,12-14].

The moderate correlation between the CPQ and CAP-Hand suggests that these two measures may capture more or less different aspects and/or degrees of participation in children with disabilities. This could be due to the fact that the CAP-Hand is a condition-specific measure that focuses on life situations that require hand use specifically, whereas the CPQ does not have this specific focus. Conceptually, using hands during participation may indicate a child's physical engagement (i.e., *doing* the activity) [32], which is different from physical attendance (i.e., *observing* others' engagement in the activity) [33,34]. The CAP-Hand outcome therefore could refer to the aspect of physical engagement, and the CPQ may reflect either one or both. The hand-use specificity of the CAP-Hand has also been verified in this study, as a large number of the concepts were linked to the ICF-CY d4 *Mobility* chapter that focused on hand/arm use (23 links, compared to three links in the CPQ, see table 3). Moreover, the CAP-Hand contained twice as many meaningful concepts as the CPQ does in the ICF-CY linking results, implying that more life situations or examples are covered in the CAP-Hand. Further, it is noted that the frequency rating scales used in the CPQ and CAP-Hand differ slightly (i.e., the rating level of four denotes twice a week in the CPQ but becomes 2–3 times a week in the CAP-Hand). These discrepancies between the CPQ and CAP-Hand may explain the moderate magnitude of their relationship.

Different wording approaches in describing life situations may present another reason for the modest association between the CPQ and CAP-Hand, especially for those paired items that represented similar life situations. Previous studies on question wording effects in self- or proxy-report survey have revealed that the presence of negative wording [35,36], question framing [37], and added prompts [38] may alter respondents' perceptions and lead to different levels of assessment outcome. Few studies have investigated whether providing more contextual details in the questions could consolidate or change the consistency of the outcome reported by participants. In the case of describing life situations, the CPQ uses simple phrasing (i.e., eating with cutlery), which are open and self-explanatory for parents

and caregivers to consider. By contrast, following the PEM-CY style [4,20,21], the CAP-Hand describes various life situations in detail (i.e., eating meals at home with family and this may involve eating with hands or utensils such as spoon, fork, knife, or chopsticks depending on the type of food). Parents are then asked to focus on one or more areas that they have concerns about. Hence, the impact of the wording of items and questions and the strategies to direct parents' concerns may have resulted in the wide range of the correlations of those paired items that captured similar life situations as well as the weak, insignificant correlations in two of the items with identical ICF-CY linked concepts between the CPQ and CAP-Hand. Of note, there is currently no consensus on the "best" way to define and describe life situations that can be used to derive authentic responses from the child or parents [4,11,39,40]. The present study also did not investigate the underlying judgment process on how the parents answered the questions with different descriptions on life situations. This deserves further exploration.

As for the educational domain, it is worth noting that no significant correlation between the CPQ and CAP-Hand was found in this study. This could be attributable to all of the aforementioned discrepancies between the two measures, but the CAP-Hand's focus on hand use in life situations outweigh other influences. A comparison of the meaningful concepts linked to the ICF-CY showed that the educational domain of the CAP-Hand had far more hand-use links to the d4 *Mobility* chapter than did in the CPQ. The CAP-Hand educational domain also had seven additional connections to copying or writing in the d1 *Learning and applying knowledge* chapter. Although there was only one item related to the d5 *Self-care* chapter in both the CPQ and CAP-Hand educational domain, more meaningful concepts (including toileting, dressing, eating, and drinking) were covered in the CAP-Hand, compared to just the one concept of eating in the CPQ. It appears that little connection exists between the CPQ and CAP-Hand in the domain of education.

Besides convergent validity, the present study provides added evidence for content validity of the CPQ and CAP-Hand by linking them to the ICF-CY and examining the content congruence. This study found that the two measures did cover most of the Activities and Participation chapters, except for the d2 *General tasks and demands* and the d7 *Interpersonal interaction and relationships*. This generally fits with the assessments' intention to cover a comprehensive range of childhood domains. Each domain of the CPQ and CAP-Hand also includes a substantial number of concepts that are related to the parallel ICF-CY category/chapter(s). In addition, as mentioned earlier, a number of the links in the d4 *Mobility* related to hand/arm use were found in the CAP-Hand rather than in the CPQ. This contrast corresponds with the fact that the CAP-Hand was designed for hand-use life situations and the CPQ for generic life situations.

There are several limitations inherent in this study. First, the CPQ and CAP-Hand were administered separately across a one-month interval, rather than simultaneously. This could generate a temporal difference in the children's participation outcomes. However, completing both participation measures at the same time may not be feasible due to a potential interaction effect between the two measures if completed concurrently. Second, this study applied the CPQ and CAP-Hand to a sample of children with intellectual and developmental disabilities. The study's findings may not be readily generalisable to children with other disabilities. Future studies that recruit different disability groups of children are thus warranted to confirm the findings of this study. Correlating the CPQ and CAP-Hand with other children's participation measures is also suggested to examine their equivalence and establish further evidence of their validity.

In conclusion, the content comparison with the ICF-CY indicated that the CPQ and CAP-Hand cover a broad range of life situations and their domains correspond well to the conceptually matched Activities and Participation categories/chapters. However, the correlations between the CPQ and CAP-Hand as well as between their similar domains were

ranged from small to moderate. Furthermore, not all of the items that asked about similar life situations between the CPQ and CAP-Hand were highly associated. The results of this study, while supporting the content and construct validity of the CPQ and CAP-Hand, suggest that these two measures captured distinctive aspects and/or degrees of children's participation. It is therefore recommended that clinicians and researchers should be aware of the similarities and differences of children's participation measures. More studies that explore the relationships between other measures of children's participation are also needed to inform the selection of appropriate outcome measure(s) for interventions that target the promotion of children's participation.

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Declaration of Interest Statement

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Table 1. Characteristics of participants

Characteristics	Participants who were included in this study (n=51)	Participants who were excluded from this study (n=31)
Child's gender, n (%)		
Boys	34 (66.7)	18 (58.1)
Girls	17 (33.3)	13 (41.9)
Child's age (month), Mean±SD	100.1 ± 30.8	107.9 ± 29.5
Child's diagnosis/disability, n (%)†		
Down syndrome/Fragile X	9 (17.6)	3 (9.7)
Autism	22 (43.1)	11 (35.5)
Intellectual disability	26 (51.0)	11 (35.5)
Developmental delay	15 (29.4)	13 (41.9)
Pervasive developmental delay	2 (3.9)	1 (3.2)
Learning disability	7 (13.7)	9 (29.0)
Respondents, n (%)		
Mother	43 (84.4)	24 (77.4)
Father	4 (7.8)	6 (19.4)
Guardian	4 (7.8)	1 (3.2)

† Parents can report multiple diagnoses/disabilities that their children have.

Table 2. Simple linear regression results of the CPQ and CAP-Hand

		Parameter estimates				Model effects	
Dependent variable	Independent variable	β	B	95% CI B	*p*	R^2	*p*
CPQ total scale	CAP-Hand total scale	0.63	0.37	0.24−0.50	<0.01	0.400	<0.001
CPQ Activity of Daily Living domain	CAP-Hand Self-care domain	0.56	0.49	0.29−0.70	<0.01	0.317	<0.001
CPQ Play and Leisure domains	CAP-Hand Recreational domain	0.44	0.32	0.13−0.51	<0.01	0.190	0.002
CPQ Educational domain	CAP-Hand Educational domain	0.17	0.14	-0.09−0.37	0.23	0.030	0.231
CPQ Instrumental Activity of Daily Living and Social Participation domains	CAP-Hand Domestic Life and Community domain	0.66	0.39	0.26−0.52	<0.01	0.437	<0.001

Abbreviations: CPQ, Children Participation Questionnaire; CAP-Hand, Children's Assessment of Participation with Hands; β, standardised beta; B, unstandardised beta, CI, confidence interval.

Table 3. ICF-CY second-level categories from the Activity and Participation components in the CPQ and CAP-Hand

	CPQ domains				CAP-Hand domains			
ICF-CY categories	ADL	P&L	EDU	IADL&SP	SC	REC	EDU	DL&C
d1 Learning and applying knowledge								
d110 Watching		1				1		
d130 Copying							2	
d145 Learn to write							3	
d170 Writing							2	
d177 Making decision		2						
d2 General tasks and demands								
d3 Communication								
d350 Conversation				1				1
d360 Using communication devices and techniques				1				1
d4 Mobility								
d430 Lifting and carrying objects							1	1
d440 Fine hand use		1	1	1	3	3	2	5
d445 Hand and arm use					2	1	4	3
d455 Moving around						6	1	
d460 Moving around in different locations								2
d475 Driving		1				2		
d5 Self-care								
d510 Washing oneself	1				3			
d520 Caring for body parts	1				1			
d530 Toileting	1				1		1	
d540 Dressing	1				3		2	
d550 Eating	1		1		1		1	1
d560 Drinking					2		1	
d570 Looking after one's health					1			
d6 Domestic life								
d620 Acquisition of goods and services				1				1
d630 Preparing meals				1				1
d640 Doing housework				2				6
d650 Caring for household objects				1				1
d7 Interpersonal interaction and relationships								
d8 Major life areas								
d815 Preschool education			3				4	
d816 Preschool life and related activities			1					
d820 School education			3				5	
d835 School life and related activities			1					
d880 Engagement in play		3	2	1		5	1	1
d9 Community, social and civic life								
d920 Recreation and leisure		9	3	6		13	4	1
Total	5	17	15	15	17	31	34	25

Gray-shaded areas indicate perfect matching between the content of the domain and corresponding concepts represented in the ICF-CY Activity and Participation components.

Abbreviations: ICF-CY, International Classification of Functioning, Health and Disability for Child and Youth; CPQ, Children Participation Questionnaire; CAP-Hand, Children's Assessment of Participation with Hands; ADL, Activities of Daily Living; P&L, Play and Leisure; EDU, Education; IADL&SP, Instrumental Activities of Daily Living and Social Participation; SC, Self-care; REC, Recreational; EDU, educational; DL&C, Domestic life and community.

Table 4. ICF-CY linking results and relationships of similar items between the CPQ and CAP-Hand

CPQ	CAP-Hand	No. of concepts linked to ICF-CY			Correlation	
Item descriptions	Item descriptions	CPQ	CAP-Hand	Matched[†]	*r*	*p*
Dress	Put on clothes	1	2	50.0%	0.40	<0.01
Shower/bath	Wash self	1	3	100.0%	0.50	<0.01
Brush teeth	Brush teeth	1	1	100.0%	0.70	<0.01
Toilet	Go to the toilet	1	1	100.0%	0.50	<0.01
Eat with cutlery	Eat meals (at home)	1	1	100.0%	0.16	0.27
Take part in organising room/house	Help to clean environment	1	4	50.0%	0.38	<0.01
Take part in meal preparation/setting the table	Assist in meal preparation	2	2	100.0%	0.82	<0.01
Shop in grocery store	Help with shopping	1	4	25.0%	0.45	<0.01
Take care of pet	Feed/care for/play with pets	1	2	50.0%	0.61	<0.01
Do arts and crafts at home	Do creative arts/craft (at home)	2	5	33.3%	0.63	<0.01
Play with construction toys (building blocks, puzzles)	Play with construction toys	1	1	100.0%	0.58	<0.01
Play games with rules (cards, board games)	Play card/board games	1	1	100.0%	0.65	<0.01
Talk on the phone	Operate a phone to talk	2	4	66.6%	0.59	<0.01
Play at schoolyard	Play games or on playground	1	4	25.0%	0.50	<0.01
Do arts and crafts (at school)	Do artwork (at school)	2	2	100.0%	0.18	0.23
Take sport/movement lessons-afternoon	Participate in sport/PE lessons	1	4	33.3%	0.07	0.64

* P <0.05

[†] The percentage of the matched concepts between the items was calculated based on the second-level ICF-CY categories.

Abbreviations: CPQ, Children Participation Questionnaire; CAP-Hand, Children's Assessment of Participation with Hands; PE, physical education.

Appendix S1. ICF-CY classification for the CPQ

CPQ items	Meaningful concept	ICF-CY code	Description
Dressing	Dressing	d540	Dressing
Showering/bathing	Showing/bathing	d5101	Washing whole body
Brushing teeth	Brushing teeth	d5201	Caring for teeth
Toileting	Toileting	d530	Toileting
Eating with cutlery	Eating with cutlery	d550	Eating
Taking part in organizing room/ house	Organizing room/house	d6402	Cleaning living area
Taking parting in meal preparation/ setting the table	Meal preparation	d630	Preparing meals
	Setting table	d6406	Helping to do housework
Operating electronic device (TV, DVD, phone)	Operating electronic device	d440	Fine hand use
Shopping in grocery store	Shopping	d6200	Shopping
Taking care of pet	Taking care of pet	d6506	Taking care of animals
Choosing a game	Choosing game	d177	Making decisions
Playing with construction toys (building blocks, puzzles)	Playing	d880	Engagement in play
Playing games with rules (cards, board games)	Playing games with rules	d9200	Play
Playing computer games	Playing computer games	d9200	Play
Taking part in pretend or make believe play	Pretend or make believe play	d880	Engagement in play
Choosing a leisure activity (occupy oneself)	Leisure activity	d920	Recreation and leisure
	Choosing	d177	Making decisions
Playing on playground equipment	Playing on playground equipment	d880	Engagement in play
Riding a bike	Riding bike	d4750	Driving human-powered transportation
Playing ball games	Play ball games	d9201	Sports
Listening to a story	Listening to story	d9202	Arts and culture
Watching TV	Watching	d110	Watching
Doing arts and craft materials at home	Doing crafts	d9203	Crafts
	Doing arts	d9202	Arts and culture
Using art and craft materials	Using art and craft materials	d440	Fine hand use
Going for a day trip, picnic, camping	Going for day trip, picnic, camping	d920	Recreation and leisure
Going to a live event (i.e., movie, theatre)	Going to live event	d9202	Arts and culture
Playing with a friend	Playing with friends	d8803	Shared cooperative play
Visiting at a friend's house	Visiting a friend’s house	d9205	Socializing
Inviting and hosting a friend	Inviting and hosting a friend	d9205	Socializing
Attending friends' birthday parties	Attending party	d9205	Socializing
Going to family events	Going to family events	d9205	Socializing
Sleeping over at family house	Sleeping over	d9205	Socializing
	Sleeping	b134	Sleeping functions
Sleeping over at a friend's house	Sleeping over	d9205	Socializing
	Sleeping	b134	Sleeping functions
Talking on the phone	Talking on phone	d3600	Using telecommunication devices
	Talking	d350	Conversation
Attending circle time	Attending circle time	d8201	Maintaining educational programme

		d8151	Maintaining preschool educational programme
Playing at schoolyard	Playing	d880	Engagement in play
Taking part in social play with toys	Social play	d8803	Shared cooperative play
Eating in meal time	Eating	d550	Eating
Attending sport and music class	Attending sport and music class	d8201	Maintaining educational programme
		d8151	Maintaining preschool educational programme
Doing arts and craft	Doing arts and crafts	d8201	Maintaining educational programme
		d8151	Maintaining preschool educational programme
Using arts and craft materials	Using arts and craft materials	d440	Fine hand use
Attending school ceremonies/parties	Attending school ceremonies/parties	d835	School life and related activities
		d816	Preschool life and related activities
Taking sport/movement lessons - afternoon	Sport/movement lessons	d9201	Sports
Taking music/art lessons - afternoon	Music/art lessons	d9202	Arts and culture
Taking self improvement class (science, languages)	Self-improvement class	d920	Recreation and leisure

Appendix S2. ICF-CY classification for the CAP-Hand

CAP-Hand items	Meaningful concept	ICF-CY code	Description
Wash self at home when needed. For example, your child may wash hands, wash face, wash hair, or have a shower/bath to wash himself/herself.	Wash self	d510	Washing oneself
	Wash hands/faces/hairs	d5100	Washing body parts
	Have a shower/bath	d5101	Washing whole body
Go to the toilet at home when needed. This includes using the toilet, using toilet paper, and flushing the toilet.	Go to toilet (use the toilet, use toilet paper, flush the toilet)	d530	Toileting
Eat meals at home with family. This could include eating with hands or with utensils (i.e., spoon, fork, knife, or chopsticks, according to the type of food).	Eat (with hands or utensils)	d550	Eating
Get a drink at home when needed. For example, your child may get a cup, pour the drink into the cup and drink it, or turn on the tap for water, or use a drink bottle.	Get a drink/cup	d4452	Reaching
	Pour the drink into the cup and drink it	d560	Drinking
	Turn on the taps for water	d4453	Turning or twisting the hands or arms
	Use a drink bottle	d5602	Carrying out feeding from bottle
Take off clothes at home to have a shower/bath or change clothes. For example, your child may take off his/her pyjamas, T-shirt, shirt, dress, jumper, jacket, underwear, pants, trousers or skirt, including unfastening the buttons or zippers (if relevant).	Take off clothes	d5401	Taking off clothes
	Unfasten buttons or zippers	d440	Find hand use
Put on clothes at home after a shower/bath or when getting dressed. For example, your child may put on pyjamas, T-shirt, shirt, dress, jumper, jacket, underwear, pants, trousers or skirt, including fastening the buttons or zippers (if relevant).	Put on clothes	d5400	Putting on clothes
	Fasten buttons or zippers	d440	Find hand use
Put on shoes at home. This may include putting on socks, shoes with Velcro fasteners, shoes with shoelaces (tying shoelaces if relevant), or sandals with buckles.	Put on shoes	d5402	Putting on footwear
	Tie shoelace	d4402	Manipulating
Brush teeth at home before going to bed, after getting up, or after having a meal.	Brush teeth	d5201	Caring for teeth
Put on or remove assistance devices to maintain personal care and health. Assisting devices could be eyeglasses, splints, prostheses, hearing aid, etc.	Put on or remove assistance device	nd	
	Maintain personal care and health	d570	Looking after one's health
Play with construction toys with family/friends at home or at other venues (outside school). For example, your child may play with some kinds of blocks (i.e., wooden blocks, Lego blocks or unifix cubes) or build models.	Play with contraction toys or build models	d880	Engagement in play
Play card games or board games with family/friends at home or at other venues (outside school).	Play card games or board games	d9200	Play
Do creative art or craft with family/friends at	Do creative art	d9202	Arts and culture

home or at other venues (outside school). For example, this may include scribbling, colouring, drawing, cutting, pasting, making objects from recycled items (i.e., boxes or cardboard), knitting, making jewellery, playing with playdough, origami, etc.	Do creative craft (make objects, knit, make jewellery, origami)	d9203	Craft
	Scribble, colour, draw	d920	Recreation and leisure
	Cut, paste	d440	Manipulating
	Play with playdough	d880	Engagement in play
Get books and turn pages to look at pictures or read for relaxation/enjoyment at home or at the library. For example, your child may get a story book, magazine, or novel to look at or read.	Get books	d4452	Reaching
	Turn pages	d440	Fine hand use
	Look at pictures	d110	Watching
	Read for relaxation/ enjoyment	d9202	Arts and culture
Play musical instruments or play with musical toys at home or at other venues (outside school). For example, your child may play with some kinds of musical toys or informal/ formal musical instruments that can make sounds for the purpose of practice/fun/ entertainment with family/friends.	Play musical instruments	d9202	Arts and culture
	Play with musical toys	d880	Engagement in play
Engage in unstructured physical activities as play with family/friends at home (incl. backyard). For example, this may include playing in sand pit, playing on a swing, ball games, Frisbee, hopscotch, playing tag, bike riding, scooter riding, rough housing, tree climbing, skipping rope, swimming, etc.	Engage in unstructured physical activities (play hopscotch, play tag)	d9200	Play
	Play in sand pit, play on a swing, rough housing	d880	Engagement in play
	Ball game, play Frisbee	d9201	Sports
	Bike/scooter riding	d4750	Driving human-powered transportation
	Tree climbing	d4551	Climbing
	Skip rope	d4553	Jumping
	Swim	d4554	Swimming
Engage in unstructured physical activities as play with family/friends in community (incl. outdoor facilities). For example, this involves using community outdoor facilities and may include playing in sand pit, playing on a swing, ball games, Frisbee, hopscotch, playing tag, bike riding, scooter riding, rough housing, tree climbing, skipping rope, swimming, etc.	Engage in unstructured physical activities (play hopscotch, play tag)	d9200	Play
	Play in sand pit, play on a swing, rough housing	d880	Engagement in play
	Ball game, play Frisbee	d9201	Sports
	Bike/scooter riding	d4750	Driving human-powered transportation
	Tree climbing	d4551	Climbing
	Skip rope	d4553	Jumping
	Swim	d4554	Swimming
Engage in organised sport at a community venue or club. For example, this may include playing football, cricket, basketball, netball, handball, tennis, hockey, baseball, golf, bowling, badminton, gymnastics, dancing, swimming club/lesson, etc.	Engage in organized sport (football, cricket, basketball, netball, handball, tennis, hockey, baseball, golf, bowling, badminton, gymnastics, swimming club/lesson)	d9201	Sports
	Dance	d9202	Arts and culture
Take photos of something or somebody for fun at home or at a community venue. For example, your child may use a traditional camera, digital camera or mobile phone camera to take photos.	Take photos of something or somebody for fun	d9204	Hobbies
	Use camera	d4402	Manipulating

Learn and practise handwriting at home or do handwriting when completing homework at home. For example, your child may copy or write letters/words/sentences/paragraphs depending on your child's age and grade level.	Learn and practice handwriting	d145	Learn to write
	Do handwriting	d170	Writing
	Copy letters	d130	Copying
	Write letters	d1450	Acquiring skills to use writing implements
	Write words/sentences/ paragraphs	d1452	Acquiring skills to write words and phrases
Get school items and pack school bag at home to take to day care, kindergarten, preschool or school. For example, school items may include pencils, pencil case, books, lunch box, jumper, etc.	Get school items	d4452	Reaching
	Pack school bag	d445	Hand and arm use
	Take to	d430	Lifting and carrying objects
Engage in classroom learning activities or lessons at kindergarten, preschool or school. For example, your child may get school items (i.e., pencils or books), copy from the board, write notes, or write examination answers.	Engage in classroom learning activities or lessons at kindergarten or preschool	d8151	Maintaining preschool educational programme
	Engage in classroom learning activities or lessons at school	d8201	Maintaining educational programme
	Get school items	d4452	Reaching
	Copy from the board	d130	Copying
	Write notes	d170	Writing
	Write examination answers	d8202	Progressing in educational programme
Operate computer in classroom learning activities at kindergarten, preschool or school. For example, your child may touch the screen, type on the keyboard, or use the mouse to search for information, surf the internet, or do computer projects.	Operate computer in classroom learning activities at kindergarten or preschool (search for information, surf the internet, do computer projects)	d8151	Maintaining preschool educational programme
	Operate computer in classroom learning activities at school (search for information, surf the internet, do computer projects)	d8201	Maintaining educational programme
	Touch the screen	b265	Touch function
	Type on the keyboard	d440	Fine hand use
	Use the mouse	d445	Hand and arm use
Do artwork at day care, kindergarten, preschool or school	Do artwork at day care, kindergarten, or preschool	d8151	Maintaining preschool educational programme
	Do artwork at school	d8201	Maintaining educational programme
Participate in sports/PE/physical activity lessons and then physically play those sports/games with peers at kindergarten, preschool or school	Participate in sports/PE/ physical activities	d9201	Sports
	Participate in lessons at kindergarten or preschool	d8151	Maintaining preschool educational programme
	Participate in lessons at kindergarten or preschool	d8201	Maintaining educational programme

	Play games	d9200	Play
Play games or on playground equipment with peers during day care, kindergarten, preschool, or school recess. For example, this may include quiet games (i.e., chess or cards), ball games (i.e., cricket or football), or climbing/playing on playground equipment.	Play on playground equipment	d880	Engagement in play
	Play games or quiet games (chess, cards)	d9200	Play
	Play ball games (cricket, football)	d9201	Sports
	Climb on playground equipment	d4551	Climbing
Manage self-care at day care, kindergarten, preschool or school. For example, this may include managing lunch box and eating lunch, drinking, toileting, or undressing and dressing for sports.	Manage self-care at day care, kindergarten, preschool, or school	d5	Self-care
	Managing lunch box	d440	Fine hand use
	Eat lunch	d550	Eating
	Drink	d560	Drinking
	Toilet	d530	Toileting
	Undress	d5401	Taking off clothes
	Dressing	d5400	Putting on clothes
Help clean up after having a meal at home. For example, your child may help to clean the table, load/unload the dishwasher, wash the dishes by hand, or put away dishes in the cupboard.	Help clean up after a meal (clean the table, load/unload the dishwasher, wash dishes by hands)	d6401	Cleaning cooking area and utensils
	Put away dishes in the cupboard	d6404	Storing daily necessities
Feed, care for, or play with pets at home. This may be in a play context (for younger children) or as a carer (for older children) or both.	Feed or care for pets	d6506	Taking care of animals
	Play with pets	d880	Engagement in play
Assist in meal preparation at home. For example, your child may help set the table or help to prepare for a meal for himself/herself or family.	Assist in meal preparation	d6302	Helping prepare meals
	Help set the table	d6406	Helping to do housework
Help to clean environment at home. For example, your child may pick up toys after play, tidy bedroom, help with sweeping or vacuuming, or take out the rubbish.	Help to clean environment	d6406	Helping to do housework
	Pick up toys	d4400	Picking up
	Tidy bedroom, sweep, vacuum	d6402	Cleaning living area
	Take out the rubbish	d6405	Disposing of garbage
Eat outside the home at social events with family/friends. For example, this may include eating at a restaurant, fast food outlet, park, picnic, etc.	Eat	d550	Eating
	Social events with family/ friends	d9205	Socializing
Help parents with shopping at grocery stores or shopping centres. For example, your child may help to pick up goods, push a trolley, or carry shopping bags.	Help with shopping	d6200	Shopping
	Pick up goods	d4400	Picking up
	Push a trolley	d4451	Pushing
	Carry shopping bags	d4301	Carrying in the hands
Get around within home or community. For example, this may include opening the door to enter a room, home or building, turning on the light when entering rooms, or pushing button on traffic light before crossing the road.	Get around within home	d4600	Moving around within the home
	Get around within community	d4601	Moving around within buildings other than home
	Open the door	d445	Hand and arm use
	Turn on the light	d440	Fine hand use
	Push button on traffic light	d4451	Pushing
Hold and/or operate a phone or mobile phone at	Hold a phone	d4401	Grasping

home to talk with friends or relatives. This may also include taking phone messages or texting messages.	Operate a phone	d440	Fine hand use
	Talk with friends or relatives	d350	Conversation
	Take phone message or text message	d3600	Using telecommunication devices