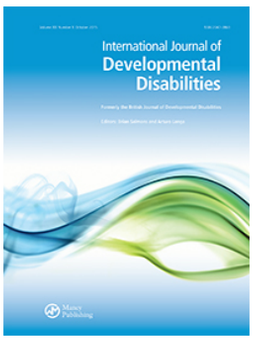

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Linking the early development instrument with the ICF-CY

Susana Castro[1], **Catarina Grande**[2]

[1]School of Education, University of Roehampton, London, UK, [2]Faculty of Psychology and Educational Sciences, Porto University, Porto, Portugal

Objective: The International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY) provides a universal taxonomy to describe functioning. One of the most relevant applications of the ICF has been the development of code-sets for particular contexts/situations, such specific age groups. An important step in research around child assessment and intervention is to identify extant measures that can assess the essential functioning features for each age range. This study aims to map the Early Development Instrument (EDI) with the ICF-CY and to identify the functioning dimensions regarded by experts as essential in the age range 3–5 that are covered by this instrument.
Method: A systematic deductive content analysis procedure was used in the mapping process.
Results: Most of EDI items were mapped to Activities and Participation and the majority of Activities and Participation regarded as essential from 3 to 5 years are assessed by the EDI; only some essential Environmental Factors and Body Functions are covered.
Conclusion: The mapping process between the EDI and the ICF has shown that the EDI should be complemented with other measures with a focus on Body Functions and Environmental Factors, in order to facilitate a holistic description of the child.

Keywords: ICF-CY, Functioning, Development, EDI, Code-set

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A functional approach to the development of young children

The International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY) is part of the 'family of classifications' of the World Health Organization (WHO) and it aims to provide a universal taxonomy to describe functioning (World Health Organization 2007). It provides detailed codes for three main components, within a specific health condition – *Body Functions and Structures*, *Activities and Participation* and *Environmental Factors*. The main theoretical underpinning of the ICF-CY model is that within a specific health condition (which may be a diagnosis or simply the health status of the child), there are discrete aspects of functioning that should be described in order to provide a detailed picture of the individual's life and behavior, holistically. Moreover, instead of describing disability and/or developmental delays in terms of problems in specific areas of development (which is closer to a medical model approach to disability adopted in previous classification systems, such as the International Classification of Diseases (ICD) or the Diagnostic and Statistical Manual of Mental Disorders, the ICF-CY provides a detailed description of aspects of functioning in children's daily lives that can be related to more than one developmental domain (World Health Organization 2007). This is highly informative for intervention purposes, as it provides a much more detailed level of specification than the traditional disability manuals. More specifically, while previous classifications would describe difficulties in social development, for instance, as a criterion for certain diagnosis, the ICF-CY proposes a detailed description of those difficulties particularly relevant for intervention within the social development domain (e.g. difficulties in initiating, maintaining or terminating interactions, with strangers, with adults, with peers, etc.); Often in multi-agency working with children with disabilities there is the need for considerably higher level of detail in order to accurately identify the abilities and difficulties of the child receiving the intervention. One of the main advantages of the ICF-CY in this context of multi-agency working is that it constitutes a common and universal language to describe functioning: professionals from different backgrounds and disciplines, and in different cultural settings, can use the same coding language to describe a child's profile or even the functioning profile of a specific population of children and young people (World Health Organization 2007). Another innovative feature of the ICF-CY is that it provides not only a method for describing the magnitude of a child's problem, but it also enables the identification of functioning areas in which a functioning problem is not being observed or the risk is minimal. The 5-point

Correspondence to: Dr Susana Castro, University of Roehampton, School of Education, London SW15 5 PJ Email: Susana.Castro@roehampton.ac.uk

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universal qualifier scale (ranging from 0 – no problem, to 4 – total problem) should be added to each code to express the level of difficulty observed in that particular functioning dimension (World Health Organization 2007). The identification of functioning aspects in which no problem of functioning is observed (which corresponds to the 0 qualifier) is important to determine what the child is more able to do, which in turn can be helpful to plan intervention strategies.

Core-sets and code-sets of functioning dimensions and their applicability

One of the most relevant recommendations made regarding potential applications of the ICF has been the development of sets of codes for specific health-conditions/health status. This area of research has been particularly prolific in relation to adult health-conditions, with systematic sets of ICF codes (for adults) being identified for clear diagnostic categories (e.g. Cieza *et al*. 2010; Coenen *et al*. 2011) – these have been designated *core-sets* of ICF codes. In the case of the ICF-CY, the identification of specific sets of codes for discrete diagnosis is debatable as it may indicate a non-desirable return to the medical model of disability in planning assessment and intervention; this is particularly relevant with young children – in fact, early diagnosis should be attributed with cautiousness as development occurs faster in early years, having been recognized as 'a moving target' (Illingworth 2013, p. 6). It is well established that early diagnosis is relevant but challenging, and careful consideration should be given to inadequate and potentially stigmatizing labeling (Matson *et al*. 2008).

Despite this, researchers have attempted to define specific core-sets for health conditions in children, arguing that this facilitates the work of multi-disciplinary teams when diagnosis is clear and the need is for the identification of functioning features within that clear health status; one example of this is the Delphi exercise carried out by Castro and Pinto (2013) for the identification of core-functioning features in Autism Spectrum Disorders, or the core-set of ICF-CY codes for children with Cerebral Palsy identified by Schiariti *et al*. (2014). Other studies have been focusing on identifying sets of ICF-CY codes for specific contextual situations, more than for diagnostic categories. This can resolve the extant dilemma between the need for identifying functioning features within specific health-conditions, and simultaneously avoiding the potential return to a medical model approach, particularly in early childhood intervention. These groups of ICF-CY codes gathered for specific contextual situations, instead of a clear diagnosis have been designated as *code-sets.* Some examples of this type of research are the studies conducted by Elingsen and Simeonsson (2011) on the identification of ICF-CY code-sets for specific age groups, the study by Rowland *et al*. (2012), which focused on the identification of sets of codes for children who rely on Augmentative and Alternative Communication and the recent study by Pan *et al*. (2015), describing the identification of an essential set of ICF-CY codes to be used in situations of Early Developmental Delay and Disabilities (EDD) – a *code-set* for EDD. In all the above-mentioned studies, sets of ICF-CY codes from all three components of the classification (Body Functions and Structures, Activities and Participation and Environmental Factors) were identified by experts in each field of study and systematically and consensually recognized as essential for assessment and intervention. According to Pan, Hwang, Simeonsson, Lu and Liao (2015, p. 1047) 'The EDD code-set within the ICF-CY framework could serve as a common language in the collaborative problem-solving process with parents (…) could be used in a questionnaire or checklist format for a clearer description of functioning, in order to generate individual functioning profiles'. In this study we have considered the premise that code-sets can also be used to check whether currently used measures for assessment and intervention with children and young people are actually covering or assessing all the functioning dimensions that the experts have considered essential in the situation or context at stake, or if those measures need to be complemented with other sources of assessment, so that all essential areas of functioning are covered. The purpose of this particular study is twofold: first, a mapping process was conducted to identify the match between a widely used measurement tool in the early childhood intervention field (The Early Development Instrument - EDI) and the ICF-CY; secondly, the ICF-CY dimensions of functioning that were linked to the EDI were compared with the code-set of essential functioning dimensions from 3 to 5 years of age developed by Elingsen and Simeonsson (2011), in order to determine if the EDI is a sufficient source of assessment in early intervention, or if other measures should be used complementarily for a thorough holistic assessment.

The early developmental instrument

The EDI was developed in Canada and it has been extensively validated and applied in many different countries (Brinkman *et al*. 2007; Hymel *et al*. 2011; Janus and Offord 2007; Woolfson *et al*. 2013). It is a measure for early development that considers 5 key areas (physical well-being, cognitive and language skills, social and emotional development, special concerns - related to specific impairments, and additional questions – related to contextual aspects). Most of the EDI items express a conventional approach focusing on traditional developmental areas (cognitive, language, social, and emotional development), however, interestingly, a few items also aim to gather information about environmental aspects of the child's life. Therefore, the EDI is framed within the bio-ecological model of development, as it aims to express the influence of the surrounding context on the development of the individual child (Bronfenbrenner and Morris 1998; Guhn and Goelman 2011). It has been explicitly stated that

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the tool should never be used for individual diagnosis, but rather for community-level monitoring allowing the participation of stakeholders and policy developers to contribute to improve the effectiveness of services and interventions provided at the local level (Woolfson *et al*. 2013). This is a very important direction in early childhood assessment, as diagnosis is very difficult to determine in early years, and simultaneously information on the characteristics of the environments where children are embedded is crucial for the success of early intervention (Shonkoff and Phillips 2000). We argue that this approach is very much aligned with the holistic principle underpinning the development of the ICF-CY; the inclusion of items in the EDI that inform community services, implies that environmental factors will be considered when describing functioning in very young children, and therefore, a holistic approach similar to the one portrayed by the ICF-CY framework is being adopted. For this reason, it is relevant to proceed to the mapping of EDI items with ICF-CY codes, so as to ascertain which functioning domains are being covered across components.

Structurally, the various sections of the EDI are organized as follows: the *Physical well-being section* of the EDI contains 13 items. Ten of these are answered in a 5-point scale scored from 10 (best) to 0 (worst) in 2.5 point intervals: 10, 7.5, 5, 2.5, and 0. Three questions are answered in a yes/no format. 'Yes' is scored as 10 and 'No' as 0. The *Language and Cognitive skills* section contains 40 items and all answers are scored on a 2-point scale: 'yes' (scored as 10) if a child demonstrates a skill and 'no' (scored as 0) if she/he does not. The *Social and Emotional development* section contains 58 items. All answers are scored on a 3-point scale: often or very true (scored as 10), sometimes or somewhat true (scored as 5), and never or not true (scored as 0). The *Special concerns* section has 5 items and all answers are coded as Yes/No. 'Yes' is scored as 10 and 'No' is scored as 0. The section on *additional questions* covers children's special skills, special problems, and aspects of the prekindergarten history, also coded as Yes/No. In final scoring, children are considered 'vulnerable' in one particular domain if they score in the bottom 10%, 'at risk' if they score between 10 and 25% and 'on track' if they score above 25% (Guhn and Goelman 2011; Janus and Offord 2007). It is important to highlight the scoring system aiming to identify vulnerable or 'at-risk' children instead of diagnostic categories – aligned with the ICF-CY approach to disability. Despite these criteria, the EDI is not a norm-referenced tool and is not meant to be used for comparison with a norm population, but it should be used for individual diagnosis. Similarly, the ICF-CY is to be used for individual descriptions of functioning profiles. The mapping process between the EDI and the ICF-CY serves the purpose of investigating which of the functioning dimensions endorsed by the WHO are susceptible of being assessed using the EDI, or whether the EDI needs to be complemented with other sources of assessment, in order for the practitioners to obtain a full and holistic picture of the child's functioning, and considering the ICF-CY code-set from 3 to 5 years of age.

Material and methods

To achieve the purpose of the study, and specifically the first aim, the EDI items were linked one by one with the ICF-CY classification system, following a deductive content analysis procedure. Two independent researchers, with wide knowledge and training on the use of the ICF-CY system, mapped each EDI item to the ICF-CY codes. Additionally, the two coders have experience of working in multi-disciplinary early intervention programs and are, therefore, very familiar with the bioecological framework for assessment and intervention with young children. The coding procedure followed similar steps to previous studies in which a similar mapping process was conducted between assessment measurements and the ICF-CY, such as with the Autism Diagnostic Observation Schedule, the Autism Diagnostic Interview Revised, the Child Autism Rating Scale, the Carolina Curriculum for Pre-schoolers with Special Needs and the Vineland Adaptive Behavior Scales (Castro *et al*. 2011; Castro, *et al*. 2013; Gleason and Coster 2012). Figure 1 illustrates the coding procedure, which includes deductive/manifest content analysis as well as an adaptation of the linking rules (Cieza *et al*. 2005), specifically developed for linking content with the ICF-CY classification system. The following steps summarize the coding procedure adopted in this study to link the EDI to the ICF-CY, also illustrated in fig 1:

STEP 1: According to Graneheim and Lundman (2004) the content to be coded constitutes our unit of analysis, which needs to be subdivided into units of meaning; Units of meaning may be defined as words, sentences or paragraphs that have a single specific meaning, and are, therefore, susceptible of receiving one single code. One unit of analysis may have several units of meaning. Therefore, the EDI items (unit of analysis) were subdivided into units of meaning by the two researchers, following a consensus procedure. In the case of the EDI, each item corresponded to one unit of meaning. This happens because units of meaning were defined as the minimum content susceptible of being coded; often the items of measurement tools are rather specific, thus reflecting a very well circumscribed meaning.

STEP 2: After agreeing on the number and format of units of meaning to be coded, the two trained researchers independently and deductively coded these units, having the ICF-CY classification system as a matrix of pre-defined categories for deductive coding. The researchers agreed on the coding criteria based on Castro *et al*. (2011), which matches some of the recommendations made by Fayed *et al*. (2012) for coding children's health-content: (a) If there were two ICF-CY codes considered equally relevant for coding a particular unit of meaning, than both codes were used (for example, the expected juxtaposition of

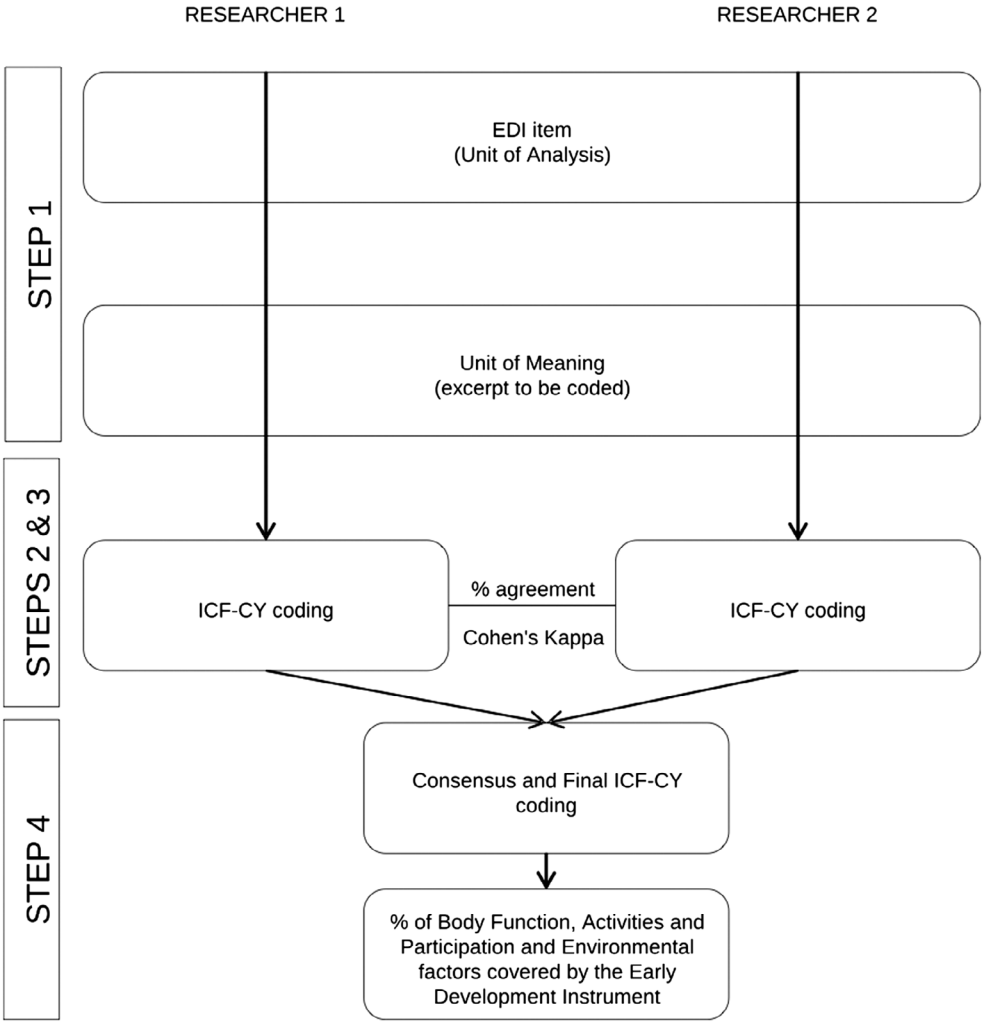

Figure 1 Procedure for coding EDI content.

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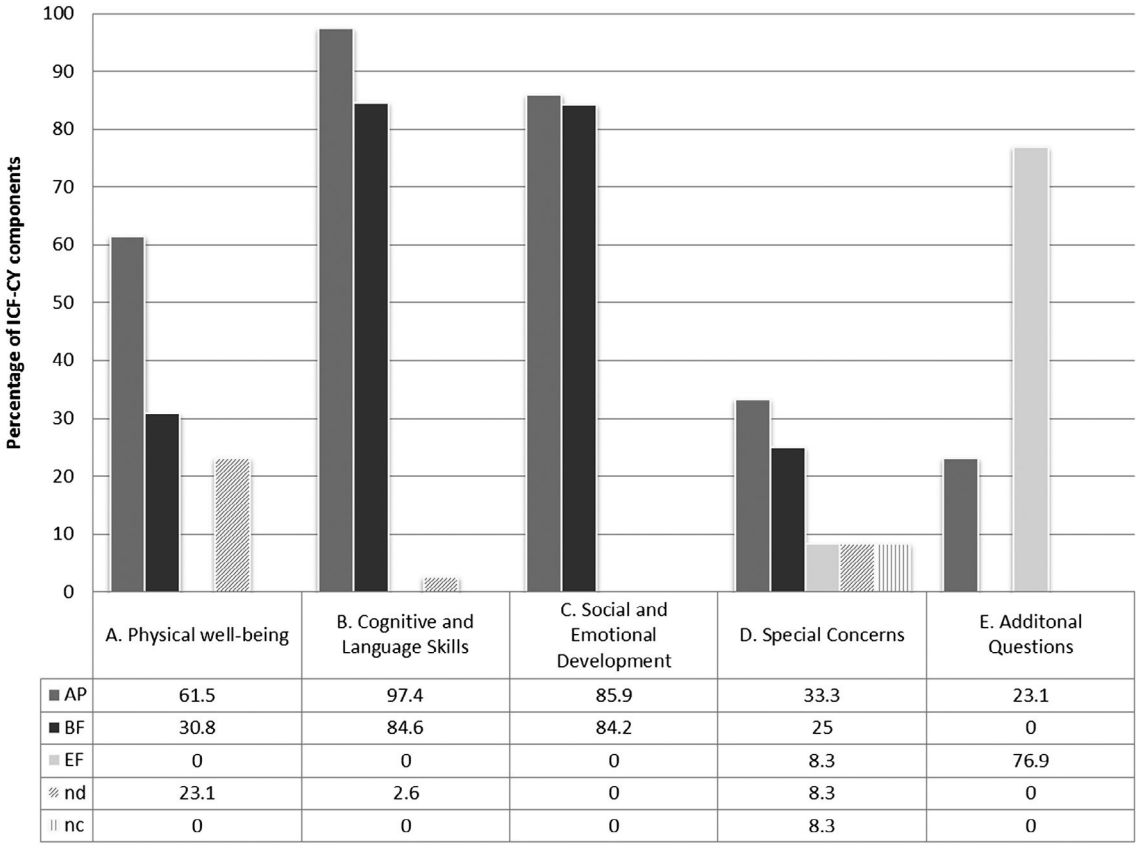
Activities and Participation and Body Functions); the true purpose of the item must be considered, which sometimes is not immediately deductible by the language used in the item; therefore, due to the complex developmental nature of the item, two components might have to be used simultaneously; however, the choice of components(s) should always be guided by the focus of the item (is it the child, or something else in other ecological systems?); (b) non-covered and non-definable Units were coded as *nc* and *nd* respectively, according to Cieza's *et al*. (2005) linking rules. Non-covered aspects include concepts and ideas that cannot ever be classified by the ICF-CY (e.g. diagnosis) and non-definable aspects are those that could be covered by the system but there is not sufficient specification within the classification to enable that (e.g. 'demonstrates skills or talents in other areas').

STEP 3: The level of agreement between the two researchers was calculated in terms of the proportion of units agreed, but also considering the level of agreement for using each ICF-CY code that was mapped to the EDI, using the Cohen's unweighted Kappa Coefficient, a measure of agreement which varies from 0 (absence of agreement) to 1 (total agreement); levels of agreement may be interpreted as follows: $.01 < k < .20$ – poor agreement, $.21 < k < .40$ – reasonable agreement, $.41 < k < .60$ – good agreement; $.61 < k < .80$ – very Good agreement, $.81 < k < 1.00$ – excellent agreement (Cohen 1960). More specifically, each ICF-CY code used by any or both of the coders was subjected to an unweighted kappa analysis where the probability of agreeing or not agreeing on using that code in that context was inputted.

STEP 4: Agreed codes were included in the final coding and a discussion to obtain consensus in relation to the disagreed codes was undertaken. Descriptive statistics were computed for final coding, including the global percentage of items covering Body Functions, Activities and Participation and Environmental Factors.

In order to address the second goal of the study, the EDI items that were linked to ICF-CY functioning dimensions included in the EDD code-set were identified and mapped to the code-set. Items of the EDD code-set that are not covered by the EDI were mapped to other assessment measurements, previously linked to the ICF-CY classification system.



	A. Physical well-being	B. Cognitive and Language Skills	C. Social and Emotional Development	D. Special Concerns	E. Additonal Questions
AP	61.5	97.4	85.9	33.3	23.1
BF	30.8	84.6	84.2	25	0
EF	0	0	0	8.3	76.9
nd	23.1	2.6	0	8.3	0
nc	0	0	0	8.3	0

Figure 2 **Percentage of each ICF component mapped to the EDI.**

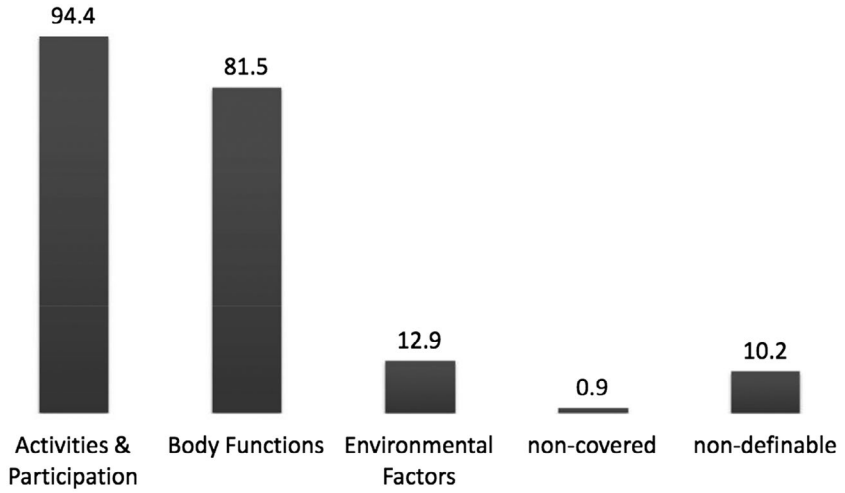


Figure 3 **Overall percentage of ICF components, non-covered and non-definable dimensions across the whole of the EDI.**

Result

Inter-coder agreement levels

Inter-coder levels of agreement are consistent with results of previous studies linking measurements' items with the ICF-CY classification system (e.g. Castro *et al*. 2013): the overall percentage of agreement is not very high (59,4%); however, Cohen's Kappa calculations for each ICF-CY code used, revealed that the range of agreement varies between 0 (no agreement) to 1 (total agreement), as illustrated in Table 1.

The linkage between the EDI and the ICF-CY

Among the 126 EDI items, only seven were not susceptible of linkage to the ICF-CY: one item coded as non-covered (nc), as it was a response option described as 'other, if known print bellow', and 6 other items coded as non-definable (nd), particularly under the *special concerns* section (8.3% of the items in this section), where the items are more aligned with a diagnostic or medical model approach than with a functional and contextual approach; these items relate to specific impairments such as learning disabilities, emotional

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Table 1 Linkage between EDI items Units of Meaning and the ICF-CY codes with level of agreement

EDI section	EDI item	Unit of meaning	ICF-CY code	Cohen's Kappa
Physical well-being	1	Absence since the beginning of school in the fall	d8151	.74
		[frequency of being] over- or underdressed for school-related activities	nd	.42
		[frequency of being] too tired/sick to do school work	b4552	0
		Late [to school]	d2305	.26
		[frequency of being] hungry	nd	.42
		Independence in washroom habits	d510	1
		Shows an established hand preference	b1474	.53
		Is well coordinated (i.e. moves without running into or tripping over things)	b7602	0
			b1471	.53
			d4503	0
		Proficiency at holding a pen, crayons or a brush	d1450	.59
		Ability to manipulate objects	d4402	.49
		Ability to climb stairs	d4551	1
		Level of energy throughout the school day	b1300	.61
			d2504	.72
		Overall physical development	nd	.42
Cognitive and language skills	1	Ability to use language effectively in English	b1672	.42
			d133	0
	2	Ability to listen in English	b1670	.42
			d115	0
	3	Ability to tell a story	b1671	.42
			d330	.56
			d335	.49
	4	Ability to take part in imaginative play	d1630	0
Cognitive and language skills	5	Ability to communicate own needs in a way understandable to adults and peers	d330	.56
			d335	.49
			b1671	.42
	6	Ability to understand on first try what is being said to him/her	d310	.39
			b16700	.42
	7	Ability to articulate clearly, without sound substitutions	d330	.56
			b320	0
	8	Knows how to handle a book (e.g. turn a page)	d1551	.49
			d4402	.49
	9	Is generally interested in books (pictures and print)	b1301	.61
			d140	.59
	10	Is interested in reading (inquisitive/curious about the meaning of printed material)	b1301	.61
			d166	0
	11	Is able to identify at least 10 letters of the alphabet	d1400	.59
	12	Is able to attach sound to letters	d1401	.59
			b167	.42
	13	Is showing awareness of rhyming words	b167	.42
			d1330	0
	14	Is able to participate in group reading activities	d140	.59
			b16701	.42
			d2103	0
	15	Is able to read simple words	d1401	.59
			b16701	.42
	16	Is able to read complex words	d1660	0
			b16701	.42
	17	Is able to read simple sentences	b16701 d1661	.420
	18	Is experimenting with writing tools	d145	.59
			b16711	.42
			d4402	.49
Cognitive and Language skills	19	Is aware of writing directions in English (left to right, top to bottom)	d145	.59
			b16711	.42
	20	Is interested in writing voluntarily (and not only under the teacher's direction)	b1301	.61
			b1672	.42
			d1702	0
	21	Is able to write his/her own name in English	d1451	.59
			b16711	.42
	22	Is able to write simple words	d1452	.59
			b16711	.42
	23	Is able to write simple sentences	d1452	.59
			b16711	.42
	24	Is able to remember things easily	b144	1
	25	Is interested in mathematics	b1301	.61
			d172	0
	26	Is interested in games involving numbers	b1301	.61
			d880	.66
	27	Is able to sort and classify objects by a common characteristic (e.g. shape, color, size)	d1371	.74
			b163	0

(*Continued*)

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Table 1 (*Continued*)

EDI section	EDI item	Unit of meaning	ICF-CY code	Cohen's Kappa
	28	Is able to use one-to-one correspondence	d1500	.43
			b163	0
	29	Is able to count to 20	d1501	.43
			b163	0
	30	Is able to recognize numbers 1 - 10	d1500	.43
			b163	0
	31	Is able to say which number is bigger of the two	d1500	.43
			b163	0
	32	Is able to recognize geometric shapes (e.g. triangle, circle, square)	d1370	.74
			b163	0
Cognitive and language skills	33	Understands simple time concepts (e.g. today, summer, bedtime)	d1371	.74
			b1802	0
	34	Demonstrates special numeracy skills or talents	b1721	1
			d1721	0
	35	Demonstrates special literacy skills or talents	b1672	.42
			d1661	0
	36	Demonstrates special skills or talents in arts	d9203	.49
			d3352	.49
	37	Demonstrates special skills or talents in music	d9202	.49
	38	Demonstrates special skills or talents in athletics/dance	d9201	.49
	39	Demonstrates special skills or talents in problem solving in a creative way	b1646	1
			d1751	0
	40	Demonstrates skills or talents in other areas	nd	.42
Social and emotional development	1	Overall social/emotional development	b122	0
			b152	.41
	2	Ability to get along with peers	b122	0
			d7504	.39
	3	Plays and works cooperatively with other children at the level appropriate for his/her age	d2203	0
			d2502	.72
			d8803	.66
	4	Is able to play with various children	d8803	.66
			b122	0
			d7504	.39
	5	Follows rules and instructions	d1551	.49
			d7203	0
	6	Respects the property of others	b1261	.24
			d7202	0
EDI section	EDI item	Unit of meaning	ICF-CY code	Cohen's Kappa
Social and emotional development	7	Demonstrates self-control	b1304	.61
			d2303	.26
	8	Shows self-confidence	b1266	.24
	9	Demonstrates respect for adults	b1261	.24
			d7100	0
	10	Demonstrates respect for other children	b1261	.24
			d7504	.39
			d7100	0
	11	Accepts responsibility for actions	b1262	.24
			d2400	0
	12	Listens attentively	d161	.79
			d115	0
			b1400	.79
	13	Follows directions	d1551	.49
			d2300	.26
	14	Completes work on time	b1262	.24
			d2305	.26
	15	Works independently	d2204	0
	16	Takes care of school materials	d8151	.74
	17	Works neatly and carefully	b1262	.24
			d2303	.26
	18	Is curious about the world	d132	0
			b1264	.24
	19	Is eager to play with a new toy	d8800	.66
			b1301	.61
	20	Is eager to play a new game	d8800	.66
			b1301	.61
	21	Is eager to play with/read a new book	b1301	.61
			d8800	.66
			d2100	0
	22	Is able to solve day-to-day problems by him/herself	d1750	0

(*Continued*)

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Table 1 (*Continued*)

EDI section	EDI item	Unit of meaning	ICF-CY code	Cohen's Kappa
EDI section	EDI item	Unit of meaning	ICF-CY code	Cohen's Kappa
Social and emotional development	23	Is able to follow one-step instructions	d2300	.26
	24	Is able to follow class routines without reminders	d2300	.26
			d2204	0
	25	Is able to adjust to changes in routines	d2304	.26
			b1250	.22
	26	Answers questions showing knowledge about the world(e.g. leaves fall in the autumn, apple is a fruit, dogs bark)	d1750	0
			d3102	.39
	27	Shows tolerance to someone who made a mistake (e.g. when a child gives a wrong answer to a question posed by the teacher)	b1251	.22
			d7102	0
	28	Will try to help someone who has been hurt	b1255	.22
			d2402	0
	29	Volunteers to help clear up a mess someone else has made	b1255	.22
			d2400	0
	30	If there is a quarrel or dispute will try to stop it	b1261	.24
			d2504	.72
	31	Offers to help other children who have difficulty with a task	b1251	.22
			d7504	.39
	32	Comforts a child who is crying or upset	b1255,	.22
			d7504	.39
			d7100	0
	33	Spontaneously helps to pick up objects which another child hasdropped (e.g. pencils, books)	b1255	.22
			d7504	.39
Social and emotional development	35	Helps other children who are feeling sick	d6600	.56
			b1255	.22
			d7504	.39
	36	Is upset when left by parent/guardian	b1263	.24
			d2500	.72
	37	Gets into physical fights	d2502	.72
			b1521	.41
	38	Bullies or is mean to others	d2503	.72
			b1521	.41
	39	Kicks, bites, hits other children or adults	d2502b1251	.72.41
	40	Takes things that do not belong to him/her	d2503b1253	.72.41
	41	Laughs at other children's discomfort	d2503	.72
			b1253	
	42	Can't sit still, is restless	d2504	.41
			b1470	.53
	43	Is distractible, has trouble sticking to any activity	d161	.79
			d2100	0
			b1400	.79
	44	Fidgets	b1470	.53
			b1263	.24
	45	Is disobedient	d2501	.72
			b1261	.24
	46	Has temper tantrums	d2503	.72
			b1253	.22
	47	Is impulsive, acts without thinking	d2303	.26
			b1304	.61
	48	Has difficulty awaiting turn in games or groups	d2303	.26
			b1304	.61
	49	Cannot settle to anything for more than a few moments	d2303	.26
			b1304	.61
Social and emotional development	50	Is inattentive	d160	0
			d161	.79
			b1400	.79
	51	Seems to be unhappy, sad, or depressed	b1520	.41
	52	Appears fearful or anxious	b1522	.41
	53	Appears worried	b1263	.24
	54	Cries a lot	b1521	.41
	55	Is nervous, high-strung, or tense	b1520	.41
	56	Is incapable of making decisions	d177	1
	57	Is shy	b1260	.24
	58	Sucks a thumb/finger	d1200	0
			b1521	.41
Special concerns	1	[Having a problem that influences] ability to do school work in a regular classroom	d8151	.74
	2a	Physical disability	nd	.42
	2b	Visual impairment	b210	0
			d110	0
	2c	Hearing impairment	b230	0
			d115	0

(*Continued*)

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Table 1 (*Continued*)

EDI section	EDI item	Unit of meaning	ICF-CY code	Cohen's Kappa
			d115	0
	2d	Speech impairment	b320	0
			b330	0
			d330	.56
	2e	Learning disability	nd	.42
	2f	Emotional problem	nd	.42
	2g	Behavioral problem	nd	.42
	2h	Home environment problems at home	e310	.49
			e410	1
	2i	Chronic medical/health problems	nd	.42
	2j	Unaddressed dental needs	nd	.42
	2k	Other (if known, print below)	nc	.94
Special Concerns	3	Diagnosis	nd	.42
Additional Questions	1	Attended an early intervention program	e5853	.74
			e580	0
	2	Has been in non-parental care on a regular basis prior to kindergarten entry	d8150	.74
			e585	.74
	2a	Center-based, licensed, non-profit	e57502	.79
	2b	Center-based, licensed, for profit	e57502	.79
	2c	Other home-based, licensed	e57501	.79
	2d	Other home-based, unlicensed, non-relative	e57501	.79
	2e	Other home-based, unlicensed, relative	e57501	.79
	2f	Child's home, non-relative	e575	.79
	2g	Child's home, relative	e575	.79
	2i	[Schedule in pre-kinder garden arrangement]	e5852	.74
	3	Other language or religion classes	e5852	.74
			d9300	0
	4	[Attended] organized pre-school/nursery school	e585	.74
	5	[Attended] Junior Kindergarten	e585	.74
	6	[Readiness for school]	d8153	.74

problems or behavioral problems, and not to aspects of functioning; for this reason, these dimensions appeared too vague to be coded with the ICF-CY.

Considering the first step of data analysis presented in Fig. 1, 138units of meaning were identified in agreement between the two researchers. Table 1 presents these units of meaning with the corresponding EDI items, the final ICF-CY coding for each item and respective level of agreement in each code (Cohen's Kappa). In the coding process, 147 different ICF-CY codes were used, across the three components – *body Functions, activities and participation* and *environmental factors*. Figure 2 illustrates percentages of each component mapped to each section of the EDI. As illustrated, the majority of the EDI items were linked to the a*ctivities and participation* component, especially in the Cognitive and Language skills section and in the Social and Emotional Development section of the instrument. *Body Functions* was the second component to which most items were linked (sections Physical Wellbeing, Cognitive and Language Skills, Social and Emotional Development and Special Concerns). The EDI items were also linked to the *environmental factors* component – 76.9% of the units of meaning in the last section comprising additional questions and 8.3% of the Special Concerns section. Figure 3 illustrates the overall percentage of *activities and participation, body functions, environmental factors, non-covered* and *non-definable* dimensions across the whole of the EDI. The majority of the EDI items were linked to *activities and participation* issues (94.4%) followed by body functions (81.5%); these percentages also illustrate that the majority of the items assess both *activities and participation* as well as *body functions*, simultaneously, as observed in previous similar studies (Castro *et al*. 2013). 12.9% of the items were linked to the *environmental factors* component.

A more detailed analysis of final coding provided in Table 1 highlights the following: the majority of *body functions* to which the EDI items were linked are mental functions (b1), but exercise and tolerance functions (b4) and neuromusculoskeletal and movement-related functions (b7) were also found to be linked; the EDI items were linked to functioning dimensions across all categories of the activities and participation component – learning and applying knowledge (d1), general tasks and demands (d2), communication (d3), mobility (d4), self-care (d5), domestic-life (d6), interpersonal interactions and relationships (d7), major life areas, namely play (d8) and recreation and leisure (d9); Environmental factors to which the EDI items were linked were: social support systems, services and policies (e575), education services systems and policies (e585), health services, systems and policies (e580) and social security services systems and policies (e570); one item also assesses support in relationships (e310) and attitudes of the immediate family (e410).

Does the EDI cover essential functioning dimensions in the age range 3 – 5 years?

Ellingsen and Simeonsson (2011) concluded that experts in the field of child development regard 52 ICF-CY functioning dimensions as absolutely essential for the assessment and intervention with young children from 3 to 5 years of

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Table 2 Mapping of the EDI items assessing ICF-CY essential functioning dimensions from 3 to 5 Years Old

	Code-set (Ellingsen and Simeonsson 2011)	EDI Item	EDI meaningful unit
Body functions and structures	b134 – Sleep functions		Not assessed
	b140 – Attention functions	C (12)	Listens attentively
		C (43)	Is distractible, has trouble sticking to any activity
		C (50)	Is inattentive
		C (12)	Listens attentively
	b144 – Memory functions	B (24)	Is Able to remember things easily
	b156 – Perceptual functions		Not assessed
	b280 – Sensation of pain		Not assessed
	b310 – Voice and producing sounds and speech		Not assessed
	b410 – Heart Functions		Not assessed
	b435 – Immune response		Not assessed
	b440 – Respiration functions		Not assessed
	b510 – Eating and drinking functions		Not assessed
	b525 - Defecation		Not assessed
	b560 – Growth maintenance functions		Not assessed
	b620 - Urination		Not assessed
	b735 – Muscle Tone		Not assessed
	b755 – Postural, balance and threatening reactions		Not assessed
	b760 – Voluntary movement	A (1)	Is well coordinated (i.e. moves without running into or tripping over things)
Activities and participation	d131 – Learning through play and playing with objects		Not assessed
	d133 – Developing competencies to use words, phrases or sentences to represent persons, objects or events	B (1)	Ability to use language effectively in English
		B (13)	Is showing awareness of rhyming words
	d137 – Acquiring basic concepts	B (32)	Is able to recognize geometric shapes (e.g. triangle, circle, square)
	d210 – Undertaking a single task	B(14)	Is able to participate in group reading activities
	d310 – Comprehending spoken language	C (46)	Ability to understand on first try what is being said to him/her
		B (6)	Answers questions showing knowledge about the world(e.g. leaves fall in the autumn, apple is a fruit, dogs bark)
	d315 – Comprehending non-spoken language		Not assessed
	d330 - Speaking	B (3)	Ability to tell a story
		B (4)	Ability to communicate own needs in a way understandable to adults and peers
		B (7)	Ability to articulate clearly, without sound substitutions
		D (2d)	Speech impairment
	d335 – Producing non-verbal messages	B (3)	Ability to tell a story
		B (5)	Ability to communicate own needs in a way understandable to adults and peers
		B (36)	Demonstrates special skills or talents in arts
	d350 – Having a conversation		Not assessed
	d440 – Using hands and arms	A (10)	Ability to manipulate objects
		B (8)	Knows how to handle a book (e.g. turn a page)
		B (18)	Is experimenting with writing tools
	d450 - Walking	A (8)	Is well coordinated (i.e. moves without running into or tripping over things)
		B (19)	Is aware of writing directions in English (left to right, top to bottom)
	d455 – Moving around	A (1)	Ability to climb stairs
	d465 – Moving around using equipment		Not assessed
	d530 - Toileting		Not assessed
	d550 – Eating		Not assessed

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	d710 – Interacting with people	A (9)	Demonstrates respect for adults
		A (10)	Demonstrates respect for other children
		C (27)	Shows tolerance to someone who made a mistake (e.g. when a child gives a wrong answer to a question posed by the teacher)
		C (32)	Comforts a child who is crying or upset
	D815 – Engaging in preschool education	A (1)	Absence since the beginning of school in the fall
		C (16)	Takes care of school materials
		D (1)	Having a problem that influences ability to do school work in a regular classroom
		E (6)	Readiness for school
	d880 – Playing	B (26)	Is interested in games involving numbers
		C (3)	Plays and works cooperatively with other children at the level appropriate for his/her age
		C (4)	Is able to play with various children
		C (19)	Is eager to play with a new toy
		C (20)	Is eager to play a new game
		C (21)	Is eager to play with/read a new book
Environmental factors	e111 – Food and drink		Not assessed
	e110 – Drugs/medicine		Not assessed
	e115 – Products and technology for personal use in daily living		Not assessed
	e1152 – Products and technology used for play		Not assessed
	e120 – Products and technology for personal outdoor and indoor mobility and transportation		Not assessed
	e125 – Products and technology for communication		Not assessed
	e130 – Products and technology for education		Not assessed
	e140 – Products and technology for culture recreation, and sport		Not assessed
	e310 – Support of immediate family	D (2h)	Home environment/problems at home
	e315 – Support of extended family		Not assessed
	e340 – Support of personal care providers and personal assistants		Not assessed
	e355 – Support of Health professionals		Not assessed
	e410 – Attitudes of immediate family	D (2h)	Home environment/problems at home
	e415 – Attitudes of extended family		Not assessed
	e425 – Attitudes of friends		Not assessed
	e450 – Individual attitudes of health professionals		Not assessed
	e575 – Social support services systems and policies	E (2a)	Center-based, licensed, non-profit
		E (2b)	Center-based, licensed, for profit
		E (2c)	Other home-based, licensed
		E (2d)	Other home-based, unlicensed, non-relative
		E (2e)	Other home-based, unlicensed, relative
		E (2f)	Child's home, non-relative
		E (2g)	Child's home, relative

age. Table 2 illustrates this correspondence between the 3 to 5 code-set and the EDI items, as they were linked to the ICF-CY classification system. Among these 52 functioning dimensions established by consensus, 18 are Activities and Participation features, 16 are Body Functions and 18 are Environmental Factors. As a result of our mapping process between the EDI and the ICF-CY, it is possible to conclude that overall, the EDI items can support the assessment of 35% (18) of the 52 functioning dimensions regarded as essential for this age range, particularly at the Activities and Participation level. Even though the majority of the essential functioning features are not covered by the EDI, 12 of the 18 Activities and Participation dimensions regarded as essential by experts are assessed by the EDI; only *comprehending non-spoken language* (d315) and *having a conversation* (d350) do not seem to be assessed in specific detail using the EDI, however *speaking* (d330), *comprehending spoken language* (d310) and *producing non-verbal messages* (d335) are forms of communication addressed by the EDI. In relation to Body Functions, 3 of the 16 essential features are assessed – *attention* (b140) and *memory functions* (b144) and *voluntary movement* (b760); 3 of the 18 essential Environmental Factors are also assessed: support of the *immediate family* (e310), *attitudes of the immediate family* (e410) and *social support services systems and policies* (e575).

Discussion

The results of this study have shown evidence regarding two main points: firstly, that the EDI effectively covers a wide range of functioning dimensions across all areas of life, thus support its holistic focus; the EDI is particularly helpful in assessing Activities and Participation. Secondly, even through the EDI items do not assess the overall majority of the functioning features regarded as essential by experts for the age range 3 to 5, they do assess the majority of Activities and Participation items, thus reinforcing the bioecological nature of the instrument, where relationships and forms of participation in real life contexts are being considered. Therefore, the EDI remains a very useful instrument that can be complemented with other measurements covering the remaining 3–5 codes that the EDI is not covering. For example, in a previous study by Castro *et al*. (2014) it has been shown that instruments like The Schedule of Growing Skills or Griffiths developmental scales can provide a thorough assessment of many body functions; in fact, the authors have suggested that these two traditional developmental measures should be complemented with more contextual-based measures. The use of the EDI in a complementary way with other sources of assessment may provide the complete and holistic picture of the child that the experts suggest as essential, according to the study by Ellingsen and Simeonsson (2011). Future research should focus on the mapping process between the established code-sets and core-sets of ICF-CY codes and respective measurement tools, linked to those essential sets of codes. Such mapping would provide the practitioners with immediate identification of useful tools to assess all essential functioning dimensions in a given context. One final observation resulting from the present study that is also worth additional reflection is that rather limited link between EDI items and the environmental aspects that the experts consider essential from 3 to 5 years of age. In spite of the bioecological nature of the EDI, there is still a need for more contextual measures and assessment methods, as concluded in previous studies (e.g. Castro *et al*. 2013; Castro *et al*. 2011).

One limitation of this study that should be highlighted is the level of agreement between coders, even though the disparity of agreement levels noted has been observed in previous studies (e.g. Castro *et al*. 2013). These studies consistently found that aspects of functioning that are more accurately described in the item analyzed, or that by nature have a simpler definition, reached very high levels of agreement or total agreement (e.g. the ICF-CY code d455 – 'moving around': *Kappa* = 1, the d510 – 'washing oneself': *Kappa* = 1, and the d880 – 'engagement in play': *Kappa* = .66); aspects of functioning that are more vaguely described in the item or which are more subjective by nature, have reached lower levels of agreement (e.g. the ICF-CY code d110 – 'watching': *Kappa* = 0, the d240 – 'handling stress and other psychological demands': *Kappa* = 0 and the b125 – 'dispositions and intrapersonal functions': *Kappa* = .22). Thus, the level of agreement is more dependent on the nature of the functioning aspect being coded, than on other variables such as the coders' training on the ICF-CY system, since both researchers had the same training experience. In future research perhaps more explicit guidelines for coding should be developed prior to independent coding. Specific linking rules previously used in other studies were adopted here as well, however, perhaps it would be advantageous in the future to combine these rules with the recommendations made by Fayed *et al*. (2012) on linking child health assessment content with the ICF-CY. These recommendations were not adopted in full as a premise of this study because the measurement in analysis is not a health-based measurement. However, we argue that a combination of extant guidelines would provide the best coding system. Some of the recommendations adopted by Fayed *et al*. (2012) are indeed matching the criteria for coding used in this study, for example, the importance of clarifying the vantage point from which one is linking (e.g. child, parent, or family) which is itself the basis for deciding the ICF-CY component at stake, and the fact that the true purpose of the items should be considered before linking them to the ICF-CY, regardless of the language used in the item. However, a clear rationale for coding incorporating all evidence-based criteria could potentially increase agreement levels.

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ORCID

Susana Castro http://orcid.org/0000-0002-9838-7316

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