DEVELOPMENTAL NEUROREHABILITATION
http://informahealthcare.com/pdr
ISSN: 1751-8423 (print), 1751-8431 (electronic)
Dev Neurorehabil, Early Online: 1–13

DOI: 10.3109/17518423.2013.806963
informa healthcare

ORIGINAL ARTICLE

Matrix for assessment of activities and participation: Measuring functioning beyond diagnosis in young children with disabilities

Susana Castro & Ana Pinto

Faculty of Psychology and Educational Sciences, Porto University, Porto, Portugal

Abstract

Objective: (i) To study the functioning patterns of young children with disabilities compared with typically developing children, using a new ICF-CY based tool – the Matrix for Assessment of Activities and Participation; (ii) study the factors that predict these functioning patterns.
Methods: The MAAP tool was administered to three groups of children: (i) with autism, (ii) with other types of disabilities and (iii) typically developing.
Results: Cluster analysis showed that children group according to the severity of their functioning profile and not according to the diagnostic category in which they were classified. Multiple regression analysis showed that a model comprising the environmental factors and the level of engagement in different routines of the child is a good predictor of these children's functioning patterns.
Conclusion: These results support a functional approach to disability instead of the traditional medical model approach, underlining the role of engagement and environment in determining functioning.

Keywords

Engagement, environment, functioning patterns, ICF-CY, measure

History

Received 8 March 2013
Revised 13 May 2013
Accepted 16 May 2013
Published online 18 July 2013

Introduction

A growing body of literature has been focusing on the usefulness of a functional approach to disability, particularly in what concerns educational interventions in preschool settings (e.g. [1, 2]), which may operationalized by the International Classification of Functioning Disability and Health for Children and Youth [3]. Based on this theoretical framework and classification system, the aim of this article is to describe the development of a new assessment measure, to be used by preschool teachers in order to support an authentic assessment [4] procedure of young children with disabilities, to describe the study of reliability properties of this new tool and to describe a first pilot study conducted with it.

The International Classification of Functioning Disability and Health for Children and Youth as a framework for describing disability in young children

The International Classification of Functioning, Disability and Health for Children and Youth [3] is part of the ''Family of Classifications'' of the World Health Organization (WHO), and it was preceded by an adult version, the ICF [5]. The ICF model uses a multidimensional approach to disability [6, 7]. Previously, the most widely used classifications, the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) [8] and the International Classification of Diseases and Related Health Problems (ICD) [9] were based on a medical approach to disability. While the ICD-10 provides etiological information on specific diseases, the ICF describes dimensions of functioning within a health condition, regardless of specific diagnosis.

The ICF-CY model is divided in two parts (see Figure 1): (1) components of functioning and disability and (2) components of contextual factors. Within part 1, the body component comprises two classifications: one for body functions and one for body structures. The activities and participation component comprises the range of domains denoting aspects of functioning from an individual to a societal perspective. In part 2, the components of contextual factors include the environmental factors, influencing and being influenced by all other components of the model, and also the personal factors, although these are not coded. All components may be described within a specific health condition, which, in turn, can be classified by a diagnostic manual, such as ICD-10 [10] (Figure 1).

The efforts that have been made in many countries to use the ICF framework and taxonomy as a way to improve service delivery in health and education is very illustrative of the shift in approaching disability from a medical to a multidimensional perspective [2]. However, the WHO [3, 4] recommends that the two types of classification (the ICF-CY and diagnostic manuals) should be used together, as the information they provide is complementary.

The complementary use of both types of classification enables us to describe children's heath status, functioning and

Correspondence: Susana Castro, PhD, Faculty of Psychology and Educational Sciences, Porto University, Rua Alfredo Allen 4200-135 Porto, Portugal. Tel: +351916254028. E-mail: susanacastro161@gmail.com

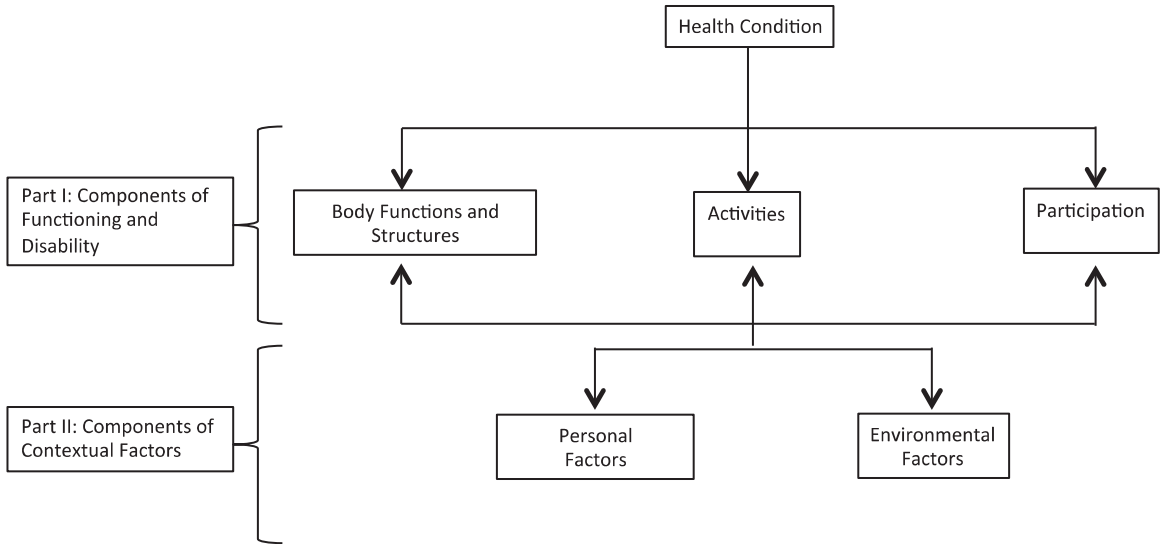

Figure 1. The ICF/ICF-CY model.

participation, in line with contextualistic approaches to human development. In fact, the transactional nature of development implies that children's particular forms of activities, ways of participating and environmental constraints to optimal functioning are addressed, especially when their development is not following a typical trajectory. The ICF-CY version was designed to record these multilevel aspects of children's lives, using a common language and taxonomy to address developmental changes and idiosyncrasies [3, 10].

In spite of the usefulness of such a broad classification system, specific classes of ICF-CY codes may be defined in order to characterize a specific functioning problem or health condition, thus clarifying diagnostic information and providing a basis to plan interventions (*core-sets*). Castro and Pinto [11] developed a core-set for young children with autism spectrum disorders, however, other types of sets of ICF-CY codes may be developed: for instance, Elligsen [12] developed a *code set* aimed to describe essential ICF-CY codes for specific age groups in childhood. While the *core-sets* describe functioning within a specific health condition, the *code-sets* describe functioning for specific circumstances or life-situations. Even when core-sets are developed for a specific health condition, the ICF-CY provides a functioning profile, rather than diagnostic information, with the purpose of describing the nature and the severity of the limitations of functioning and the environmental factors influencing them [3, 5, 7].

The need for a new measure of functioning in preschool contexts

According to Simeonsson et al. [3] (p. 603) 'a key function of a classification system is its ability to serve as a framework for the development of assessment measures reflecting the specified dimensions of that classification'. The authors also recognize the limited availability of measurements to assess functional limitations in children that are brief and effective, based on an international taxonomy, and that are of use in disability screening. Moreover, an essential requirement for implementing effective intervention programs for children with disabilities is the use of a common language to document components of functioning and development. Adopting the ICF-CY taxonomy in the development of new measures may enable the use of such common language by providing a match between the classification functioning dimensions for assessment, and specific variables that will constitute items in questionnaires and scales.

The *Matrix for Assessment of Activities and Participation* (MAAP) was developed based on the activities and participation as well as on the environmental factors components of the ICF-CY [3]. The aim was to provide an *authentic assessment* procedure to professionals working with young children with ASD in light of a functional approach to the assessment-intervention process [4]. The measure is intended to be used by early childhood special education professionals to guide the assessment of children's performance (ages 2 to 6) and surrounding environmental factors, based on their functioning in daily natural settings, namely the preschool classrooms. As the MAAP was designed taking the ICF-CY taxonomy as a reference framework for content and structure of the measurement, it provides a profile of child functioning on the classification's dimensions. It is also meant to be a useful tool to support an *authentic assessment*. According to Bagnato [13] (p. 27) *authentic assessment* is 'the systematic recording of developmental observations over time by familiar and knowledgeable caregivers about the naturally occurring competencies of young children in daily routines'. Unlike the traditional testing, authentic assessment procedures rely solely on information obtained in children's natural environments. Items of authentic assessment instruments are not based on standardized content but on children's real behaviours, which are observed and considered as significant for functioning in their daily routines. Also, these instruments elicit teaching strategies because the items may be (and often are) included as part of the curriculum [4]. As guidelines for an authentic assessment procedure, Bagnato [13] suggests the following: (a) sharing the assessment responsibilities with a team; (b) conducting the assessment over time; (c) having a team leader that becomes the ''orchestrator'' of the assessment across professionals and contexts; (d) adopting a flexible style to adjust the assessment process to the particular

2. Explores properties of objects in the surrounding environment through actions with more than one object, such as, completing puzzles, taking blocks out of a box and putting them inside again (d1311).				
☐ 0	☐ 1	☐ 2	☐ 3	☐ 4
Always explores spontaneously several objects simultaneously, demonstrating interest and manipulating them whenever they are present in the surrounding environment, **without any difficulty**.	**Often explores several objects of the environment spontaneously, manipulating them independently. Sometimes you may need to direct his/her attention to the objects.**	Has **some difficulty** in simultaneously exploring various objects from the surrounding environment, spontaneously. **Often you have to direct his/her attention** to the objects and encourage exploration. However, with this support can make an exploration of objects with **some frequency**.	**Demonstrates having a hard time** to spontaneously explore various objects from the surrounding environment. **Almost always is necessary to direct his/her attention** to the objects and encourage their exploitation. **Needs a lot of adult support** to explore multiple objects simultaneously.	**Does not spontaneously explores several objects simultaneously. Even when calling his/her attention to the objects and encouraging exploration, he/she is not interested in handling, or explores only one object.**
MARK THE BEHAVIOR WITH HIGHER DEVELOPMENTAL LEVEL THAT THE CHILD IS ABLE TO DEMONSTRATE, USING ANNEX I NA ☐ ☐ A ☐ B ☐ C ☐ D				

Figure 2. Example of one item of the MAAP.

characteristics of each child; (e) relying on parents' judgments and observations; (f) selecting 'a common instrument to unify interdisciplinary and interagency teamwork'; (g) employing 'jargon-free materials'; (h) using instruments that are sensible to child progress; (i) using technology to facilitate assessment [3] (p. 35). According to this author, when an assessment is authentic it yields information on children's natural and typical environments, on the characteristics of their own ecology, documenting the functionality of such environments.

The MAAP comprises 45 items. An example of one item is presented in Figure 2. Each item corresponds to an ICF-CY functioning dimension that was regarded, by experts in the field of early childhood special education, childhood disability, child development and ASD, as Essential for the assessment-intervention process of children diagnosed or presenting signs of an ASD, from birth to 6 years of age (core-set for ASD). In spite of the fact that the MAAP is to be used for the assessment of children from 2 to 6 years of age, functioning dimensions considered essential from birth to 2 years of age were included, as some children aged 2 and above may present difficulties in functioning features regarded as essential in lower ages.

The following procedure was adopted for the development of the MAAP:

(i) Each ICF-CY functioning dimension included in the core-set for ASD [11] was reformulated into an easy understandable item, which was clear enough to guide the observation of children's performance, based on the ICF-CY descriptor for each functioning dimension, as well as on the content of items of assessment instruments that were previously linked to the ICF-CY (e.g., ADOS, ADI-R, Carolina Curriculum) [14, 15].

(ii) Each item was complemented with a rating scale ranging from 0 to 4. This scale corresponds to the ICF-CY Universal Qualifier scale, enabling the identification of the magnitude of the problem observed in that item. A descriptor for each value of the scale was added, based on two main criteria: frequency in time (according to the ICF-CY suggestions on the percentage of time that the problems in functioning affect the child's daily life) and the level of difficulty faced by the child.

(iii) Each item (see Figure 2) also includes a scale for rating the developmental level of the child's performance, according to the age norms of the assessment measures that were previously linked to the ICF-CY.

(iv) Besides the assessment of the Activities and Participation functioning dimensions, the MAAP includes a Questionnaire for the Assessment of Factors of the Environment – QAFE. Environmental Factors may be seen as scene-setters for the occurrence of activities and forms of Participation [16], influencing these dimensions of child functioning and being influenced by them, in line with transactional and systemic approaches to development [17, 18]. This questionnaire contains all the dimensions of the environmental factors component of the ICF-CY that were regarded as Essential by experts to the assessment-intervention process of young children with an ASD in the study conducted by Castro and Pinto [11]. The universal qualifier scale was adapted to include facilitators (0 to +4) and barriers (−4 to 0). Similarly to the previous MAAP items, each value of the scale is further detailed with a simple descriptor.

(v) Lastly, it was important to provide a way of assessing the broad level of children's engagement in their daily routine. To complement the information on functioning in light of the ICF-CY, an Engagement in routines scale was included in the MAAP, in which professionals interacting in a daily basis with the child being assessed, are asked to identify the routines/life situations of the child's typical day and to rate the level of engagement normally presented by the child in each of the identified routines, in a scale ranging from 1 (not engaged) to 5 (totally engaged). In order to ensure that all professionals have the same understanding of what 'being engaged' means, a summary of engagement characteristics defined in scientific literature is provided [19–21]. The engagement characteristics highlighted were the following: a child who is engaged in a specific routine is a child who: (a) spends most of the time in interaction with the environment, (b) focuses on the target tasks, (c) is interacting in an active, persistent/or and attentive way, (d) presents a behaviour that is adequate to the contextual demands and to his/her developmental level, (f) exhibits different levels of competence, (g) shows interest, motivation and/or fascination, (h) shows

openness to the sensorial or cognitive stimuli received, (i) shows satisfaction and release of physical and mental energy and (j) shows total dedication to the activity while performing it.

(vi) In order to improve the MAAP and the QAFE, and to ensure that they are 'user friendly', a field test was carried out with professionals working with children in preschool settings, in order to identify strengths and aspects for improvement in the tool. Professionals mentioned the similarity with ICF-CY structure and the assessment of aspects of the environment as main advantages of the measure. The main suggestions for improvement were minor and were related to language clarification.

Two main advantages for using these tools are identified: (1) to document children's functioning in a common language that crosses disciplinary boundaries – the ICF-CY terminology – following closely the ICF-CY taxonomy; (2) to conduct a detailed and *authentic assessment* [4] that informs the individualized intervention planning and (3) to adopt a functional approach to the assessment-intervention planning. Moreover, in line with the *authentic assessment* approach, the MAAP may be used by teams working with children, and enables the joint application by the professionals, based on their knowledgeable about the particular child being assessed. The principles that guided the development of the MAAP are also in line with what is recommended by Coster and Khetani [22]: involving teachers as respondents is essential when the purpose of the assessment is to support them in the promotion of children's development and well-being.

Purpose and research questions

This study aims to (i) study reliability properties of the data obtained with MAAP; (ii) analyse the extent to which the functional profiles of children with ASD differ from the functional profiles of children with other types of disabilities and from the functional profiles of typically developing children and (iii) analyse whether the level of engagement and the features of the environment, as measured by the MAAP, are good predictors of functioning levels.

To this purpose, the following research questions were formulated:

(1) Is data obtained with the MAAP reliable?
(2) To what extent do children with ASD diagnosis have a functioning pattern that characterizes them and that is different from children with other types of disabilities and from typically developing children?
(3) How do the functioning differences among children reflect differences in environmental features and in children's level of engagement in routines?
(4) Are environmental factors and engagement in routines good predictors of the functioning level of the children?

Method

Participants

Participants in this study were 66 children from 3 to 6 years of age, included in regular preschool classrooms, as well as their regular and special education teachers: 22 children were diagnosed with an autism spectrum disorder, 22 were diagnosed with several other types of disabilities and 22 were typically developing children. Children with other types of disabilities included 8 children with global developmental delays, 2 with multiple disabilities, 1 with *Spina bifida*, 2 deaf children, 2 with Down syndrome, 1 with cerebral palsy, 1 with a cognitive delay, 1 child with low vision capacity, 1 with cognitive and language delay, 1 with fetal alcohol syndrome, 1 with sequels of acute myocardial infarction and 1 with Prader Willi syndrome.

For each child, both special education teacher and regular preschool teacher jointly responded to the instruments used in this study to assess children's functioning, for all children, with the exception of the typically developing children, whose responses were provided solely by the regular preschool teacher. Each child had a different regular teacher, although some children shared the same special education teacher. Each child with autism was paired with one child with another type of disability included in a preschool classroom where no other child with disabilities was included. For each child with an ASD, both special education and regular teachers also rated the behaviour of a typically developing peer, with the same age, included in the same setting.

Instruments

Two measures were responded by the children's teachers (regular preschool teacher and special education teacher) to assess the functional profiles of children: the Matrix for the Assessment of Activities and Participation – MAAP (including its annexes – the QAFE and the Engagement in Routines Scale), and the Abilities' Index [23].

The Abilities' Index [23] is a measure designed to obtain functional information about the child, comprising the assessment of several functioning domains: audition, behaviour/social skills, intellectual functioning, limb, intentional communication, tonicity, integrity of health, eyes and structural status. For each of these dimensions, functioning is defined operationally with ratings in a 6-point ordinal scale reflecting successive levels of disability. The ratings are based on clinical judgment, on observation, and/or on previous knowledge about the child, and provide a relative rather than an absolute pattern of the child's abilities and disabilities. The scoring process in each of these functional dimensions is conducted using a 6-point scale, in which: 1 is 'normal'; 2 is 'suspected disability'; 3 is 'mild disability'; 4 is 'moderate disability'; 5 is 'severe disability'; and 6 is 'profound disability'. A final score may be obtained which describes the overall level of disability, based on specific cut-off points. Simeonsson et al. [24] state that the focus of this instrument is not only on portraying the differences between individuals, but also on documenting intra-individual variability of potential significance for matching individual child's needs to services. The authors also refer that the development of the Abilities' Index drew on previous approaches to the profiling of child traits and functional characteristics described in former studies.

Procedure

A meeting was scheduled with each child's special education and regular teachers. In this meeting, teachers responded, to the MAAP and its annexes in an interview format, as well as

to the Abilities' Index items based on their knowledge about the functioning of a particular child with autism or of a particular child with other types of disabilities included in their classroom. The regular teachers had had daily contact with the children for at least 2 months, so they were able to respond to the instruments regarding children's functioning characteristics with well-grounded knowledge of the children at stake. The special education teachers were supporting the child for, at least the same amount of time. The regular teachers who were responding in regard to a child with an ASD were asked to also rate the functional characteristics of a typically developing peer, the same age as the target child. The regular teachers who were responding in regard to a child with other types of disabilities did not need to provide any more information regarding other children.

Data analysis

Reliability analysis

Reliability analyses were conducted by computing Cronbach's alpha coefficient, to analyse the internal consistency of the data collected with the MAAP. Reliability analysis was not conducted with the QAFE items, as there was few items responded by teachers. Cronbach's Alpha was also computed for the composite variables computed from data collected with MAAP.

Descriptive statistics

Descriptive statistics were computed for the three groups of children – children with ASD, children with other types of disabilities, and typically developing children – regarding the MAAP variables, the QAFE variables, as well as the Engagement in routines' variables and the Abilities' Index variables.

Analysis of group differences

Because the assumptions for using the independent sample T-test were violated, namely the normality of the distribution, as well as the homogeneity of variance, the non-parametric equivalent to the independent *t*-test, the Mann–Whitney Test was used to study the differences between children with ASD and children with other disabilities regarding the MAAP variables. Results were interpreted based on the effect size computed as the *r* coefficient [25]. The Non-parametric equivalent to the One-Way ANOVA, the Kruskal–Wallis test was used to study differences between the three conditions (children with ASD, children with other types of disabilities and typically developing children).

Cluster analysis

A cluster analysis procedure was conducted, using the MAAP items compounded in composite variables or Indexes. These MAAP Indexes were obtained by computing the mean of the items comprised in each MAAP section, which corresponded to ICF-CY dimensions included in the same chapter of the Activities and Participation component. Therefore, six Indexes corresponding to these sections were obtained and included in the cluster analysis: Index d1 – learning and applying knowledge, Index d2 – general tasks and demands, Index d3 – communication, Index d5 – self-care and Index d7 – interpersonal interactions and Index d8 – Engagement in play. The cluster analysis enables the identification of sub-groups of subjects that share specific common characteristics within a predefined group [26]. A hierarchical cluster analysis is useful when there are no pre-defined expectations regarding the number of clusters to be found [27]. In this study we used a hierarchical cluster analysis procedure to test how children ''naturally'' group. First, we conducted a hierarchical cluster analysis using the Ward's method and the Squared Euclidian distance as a measure of the distance between pairs of cases. We looked for a cluster solution ranging from 2 to 4 clusters. To test the internal valid this solution we used the methods – *the Furthest neighbour* and the *Between Groups Linkage*. As Index variables do not all have the same range values, they were transformed into standardized variables (*z* scores), prior to conducting the cluster analysis [26]. External validity was tested by comparing mean differences between the three clusters using the Abilities' Index Variables. A one-way ANOVA was also performed, with post-hoc Scheffé test, to obtain information on differences between each pair of groups regarding (a) the Abilities' Index, (b) the environmental factors and (c) child engagement in routines. Effect sizes of one-way ANOVA were calculated based on Eta Square coefficient.

Determination of functioning predictors

Lastly, multiple regression analysis using the Forced Entry method was performed to test which variables among the Environmental factors and the Engagement in routines would best predict cluster membership. The method adopted for the analysis enables the introduction of predictors in the regression model, based on theoretical assumptions [25]. According to Field [25], some authors state that this is the only appropriate method for theory testing. Based on the theoretical assumptions of the ecological and transactional models of human development, which postulate a mutually influence between contextual variables and individual functioning, variables from the QAFE questionnaire (support of the mother and support of the peers) were introduced in the model to predict cluster membership (functioning pattern). Selection of the variables to be introduced in the model was based on the assumption of no perfect colinearity among predictors, that is, variables with correlations values of less than 0.80 among each other [25]. Effect sizes were calculated using Cohen's *f* coefficient [25].

Results

Typically developing children are clearly different in functioning from the other two groups, with No Problems (score 0) in functioning in almost every MAAP variable. However, children with ASD and children with other types of disabilities present a very similar functional profile. In fact, the dimensions of functioning in which children in the two groups show better performance and worse performance are very similar (see Table I). The functioning dimensions where these two groups showed poorer functioning (mean values higher than 3) in both groups were: Acquiring information, Acquiring language_syntax and Speculating.

Table I. Descriptive statistics of the MAAP variables in the three groups of children.

Typically developing $N = 22$			Other types of disabilities $N = 22$			Autism Spectrum Disorders $N = 22$				
M	*SD*	*Range*	*M*	*DP*	*Range*	*M*	*SD*	*Range*	MAAP variables	ICF-CY chapter
0	0	0	0.36	1.05	0–4	0.64	1.14	0–3	Learning through actions with a single object	d1 Learning and applying knowledge
0	0	0	1.18	1.33	0–4	1.23	1.48	0–4	Learning through actions with more than object	
0	0	0	0.77	1.41	0–4	1.14	1.48	0–4	Learning by relating objects according to characteristics	
0	0	0	1.91	1.77	0–4	3.09	1.47	0–4	Learning through pretend or symbolic play	
0	0	0	3.36	1.39	0–4	3.86	4.68	2–4	Acquiring information	
0.05	0.21	0–1	1.23	1.41	0–4	1.27	1.67	0–4	Acquiring language_ words	
0.05	0.21	0–1	2.68	1.52	0–4	3.05	1.43	0–4	Acquiring language_ phrases	
0.09	0.29	0–1	3.23	1.34	0–4	3.77	0.61	2–4	Acquiring language_ syntax	
0	0	0	2.23	1.48	0–4	2.55	1.63	0–4	Rehearsing	
0.05	0.21	0–1	2.32	1.49	0–4	2.05	1.76	0–4	Basic concepts	
0.05	0.21	0–1	2.36	1.56	0–4	2.23	1.74	0–4	Complex concepts	
0	0	0	1.45	1.34	0–4	2	1.27	0–4	Acquiring skills	
0	0	0	1.59	1.50	0–4	1.05	1.21	0–3	Focusing attention	
0	0	0	1.91	1.38	0–4	2.82	0.79	1–4	Directing attention	
0	0	0	1.45	1.57	0–4	2.77	1.57	0–4	Thinking	
0.18	0.85	0–4	2.14	1.67	0–4	3.32	1.32	0–4	Pretending	
0.14	0.35	0–1	3	1.60	0–4	3.55	1.22	0–4	Speculating	
0.05	0.21	0–1	2.41	1.76	0–4	3.50	1.06	0–4	Hypothesizing	
0.05	0.21	0–1	2.23	1.38	0–4	2.32	1.25	0–4	Undertaking a single task	d2 General tasks and demands
0	0	0	2.27	1.72	0–4	3.36	0.73	2–4	Undertaking multiple tasks	
0	0	0	0.36	0.95	0–4	1.73	1.52	0–4	Managing routines	
0.09	0.29	0–1	0.91	1.34	0–4	1.91	1.66	0–4	Handling stress and other psychological demands	
0.05	0.21	0–1	1.73	1.42	0–4	2.45	1.44	0–4	Managing one's own behavior	
0	0	0	0.23	0.69	0–3	0.36	0.66	0–2	Communicating: receiving oral messages	d3 Communication
0	0	0	0.50	1.30	0–4	0.68	1.13	0–4	Understanding simple instructions	
0.05	0.21	0–1	2.91	1.31	0–4	2.82	1.40	0–4	Understanding complex spoken messages	
0	0	0	1.04	1.33	0–4	0.82	1.22	0–4	Understanding non-verbal messages	
0	0	0	0.45	1.18	0–4	0.68	1.39	0–4	Pre-vocalizing	
0	0	0	2.45	1.34	0–4	3.27	0.94	0–4	Speaking	
0.05	0.21	0–1	1.36	1.56	0–4	2.05	1.56	0–4	Produce non-verbal messages	
0	0	0	2.64	1.79	0–4	3.14	1.36	0–4	Conversation	
0	0	0	1.82	1.68	0–4	1.32	1.52	0–4	Self-care with excretion processes	d5 Self-care
0	0	0	2	1.79	0–4	1.27	1.55	0–4	Defecate adequately	
0.09	0.29	0–1	2.27	1.55	0–4	2.32	1.32	0–4	Dressing/undressing	
0	0	0	1.36	1.53	0–4	1.50	1.37	0–4	Eating	
0	0	0	0.91	1.72	0–4	0.45	1.18	0–4	Drinking	
0.05	0.21	0	1.73	1.78	0–4	2	1.88	0–4	Caring for own safety	
0	0	0	0.86	1.32	0–4	1.27	1.32	0–3	Basic interpersonal interactions_ social cues	d7 Interpersonal Interactions
0	0	0	0.36	0.79	0–3	0.32	0.65	0–2	Physical contact	
0	0	0	0.27	0.88	0–4	0.36	1.00	0–4	Differentiating familiar people	
0.05	0.21	0–1	2.14	1.61	0–4	2.18	1.37	0–4	Complex interpersonal interactions	
0	0	0	1.14	1.52	0–4	2.18	1.47	0–4	Informal relationships with peers	
0	0	0	0.64	1.14	0–4	0.68	1.32	0–4	Solitary play	d8 Engagement in play
0	0	0	1.23	1.85	0–4	0.73	1.27	0–4	Parallel play	
0.05	0.21	0–1	2.23	1.38	0–4	2.95	1.33	0–4	Cooperative play	

Table II. Descriptive statistics of the QAFE variables in the three groups of children.

	Total $N = 41–64$ of 66			Autism Spectrum Disorders $N = 13–21$ of 22			Other types of disabilities $N = 14–22$ of 22			Typically developing $N = 13–21$ of 22		
QAFE variables	*M*	*SD*	*Range*	*M*	*SD*	*Range*	*M*	*SD*	*Range*	*M*	*SD*	*Range*
Support of the mother	3.03	1.23	−1–4	2.76	1.30	−1–4	2.45	1.26	0–4	3.89	0.46	2–4
Support of the father	2.89	1.46	−1–4	2.23	1.74	−1–4	2.25	1.41	0–4	3.90	0.44	2–4
Support of peers	3.50	0.97	0–4	2	0	2–2	–	–	–	–	–	–
Attitudes persons with authority (regular teacher)	4	0	4–4	4	0	4–4	4	0	4–4	4	0	4–4
Attitudes of persons with authority (special education teacher)	4	0	4–4	4	0	4–4	4	0	4–4	4	0	4–4
Attitudes of the father	3.14	1.19	−1–4	2.74	1.37	−1–4	2.75	1.16	0–4	4	0	4–4
Attitudes of the mother	2.84	1.48	−1–4	2.30	1.65	−1–4	2.18	1.47	0–4	4	0	4–4
Attitudes of persons with authority (regular teacher)	4	0	4–4	4	0	4–4	4	0	4–4	4	0	4–4
Attitudes of persons with authority (special education teacher)	4	0	4–4	4	0	4–4	4	0	4–4	4	0	4–4
Attitudes of the peers	3	0.97	0–4	3.67	0.62	2–4	3	1.85	0–4			
Education Services	3.95	0.21	3–4	4	0	4	3.86	0.35	3–4	4	0	4

Table III. Descriptive statistics of the Engagement in routines scale variables in the three groups of children.

Engagement in Routines Scale variables	Total $N = 39–64$ of 66			Autism Spectrum Disorders $N = 13–21$ of 22			Other types of disabilities $N = 15–21$ of 22			Typically developing $N = 15–22$ of 22		
	M	*SD*	*Range*	*M*	*SD*	*Range*	*M*	*SD*	*Range*	*M*	*SD*	*Range*
Welcoming	3.28	1.34	1–5	2.57	0.98	1–4	2.62	0.97	1–5	3.62	0.97	1–5
Structured activities	3.13	1.39	1–5	2.38	0.80	1–4	2.33	0.91	1–5	2.33	0.91	1–5
Free activities	3.61	1.74	1–5	2.62	1.04	1–4	3.31	0.85	2–5	3.31	0.85	2–5
Snack time	3.73	1.34	1–5	3	1.37	1–5	3.43	1.25	1–5	3.43	1.25	1–5
Outdoors activities	3.89	1.20	1–5	3.38	1.09	2–5	3.27	1.16	1–5	3.27	1.16	1–5
Self-care	3.94	1.18	1–5	3	1.29	1–5	–	–	–	4.17	0.75	3–5
Lunch time	3.58	1.41	1–5	2.5	1.15	1–5	–	–	–	–	–	–

Regarding the Questionnaire for Assessment of Factors of the Environment (QAFE), the variables that were identified by the majority of the teachers (more than 50%) were considered, namely: 'support of the mother', 'support of the father', 'support of peers', 'support of people in position of authority' (identified as the preschool teacher/special education teacher), 'Attitudes of the father', 'attitudes of the mother', 'attitudes of peers', 'attitudes of persons in a position of authority' (identified as preschool teachers/special education teacher) and 'education services'. Often, teachers who responded to the questionnaire had no information regarding the other Environmental Factors such as 'Social Security', 'Health professionals', or about the extent to which these factors influenced the child's daily participation. Typically developing children present higher mean values than the other two groups (see Table II).

Regarding the Engagement in Routines Scale, only the routines that were identified by more than 50% of the teachers in their classrooms were included in the analysis, namely: '*welcoming*', '*structured activities*', '*free activities*', '*snack time*', '*outdoors activities*' and '*lunch time*'. Other routines were specified by only a few teachers each: 'Individual Activities', 'Group Activities', 'Specific Games', 'Reading' and 'Field trips'. Descriptive statistics show that typically developing children present higher values than the other two groups (see Table III).

The Abilities Index [23] was responded jointly by regular and the special education teachers as a measure of severity of disability for both children with ASD and children with other types of disabilities. Also, for children in the typically developing group, teachers confirmed that their functioning was in the 'Normal' range for all the dimension of the Abilities' Index. Here, the severity profiles are very similar for children in the two groups across disability domains as well as in the final score. Higher mean rates on severity of disability were found for the two groups of children regarding 'social skills', 'Inappropriate behaviour', 'understanding others' and 'communicating with others' (see Table IV).

Is data obtained with the MAAP reliable?

The totality of MAAP items showed very good internal consistency ($\alpha = 0.98$). When excluding the 22 typically developing children from the sample (because often their ratings were all identical), Cronbach's alpha is 0.96. As previously mentioned in the method section, internal consistency of the data for the composite variables – MAAP Indexes – was also calculated with Cronbach's alpha, resulting in good reliability values for all indexes: Index d1 – learning and applying knowledge ($\alpha = 0.97$), Index d2 – general tasks and demands ($\alpha = 0.86$), Index d3 – communication ($\alpha = 0.86$), Index d5 – self-care ($\alpha = 0.89$) and Index d7 – interpersonal

Table IV. Descriptive statistics of the Abilities' Index variables.

	Autism spectrum disorders			Other types of disabilities		
Abilities Index	*M*	*SD*	*Range*	*M*	*SD*	*Range*
Left ear	1	0	1	1.86	1.61	1–6
Right ear	1	0	1	1.73	1.55	1–6
Social skills	3.86	0.83	2–5	2.86	1.61	1–6
Inappropriate behavior	3.45	1.14	1–5	2.18	1.29	1–4
Thinking and reasoning	3	1.27	1–5	3.32	1.43	1–5
Left hand	1.59	1.22	1–5	1.64	1.18	1–5
Left arm	1.45	0.96	1–4	1.59	1.09	1–5
Left leg	1.50	1.01	1–4	1.90	1.38	1–5
Right hand	1.59	1.22	1–5	1.73	1.20	1–5
Right arm	1.41	0.96	1–4	1.68	1.13	1–5
Right leg	1.50	1.01	1–4	2	1.38	1–5
Understanding others	3.36	1.18	1–5	3.86	1.13	1–5
Communicating with others	4.41	0.79	2–5	4.23	1.19	1–5
Degree of tightness	1.18	0.39	1–2	1.36	1.00	1–5
Degree of looseness	1.45	0.96	1–4	1.32	1.04	1–5
Overall health	2.59	1.56	1–5	2.41	1.59	1–6
Left eye	1.23	0.75	1–4	2.13	1.39	1–6
Right eye	1.23	0.75	1–4	2.09	1.41	1–6
Shape, body form and structure	1	0	1	1.59	1.33	1–5
Final Score	1.36	0.58	1–3	1.41	0.73	1–4

interactions ($\alpha = 0.76$) and Index d8 – Engagement in play ($\alpha = 0.76$).

To what extent do children with ASD diagnosis have a functioning pattern that characterizes them and that is different from children with other types of disabilities and from typically developing children?

Differences between the three groups of children are significant for all MAAP variables, except for pre-vocalization, drinking, physical contact and differentiating familiar people. However, these results are not very informative, since typically developing children scored 0 (no difficulty in functioning) in most items. After post-hoc procedures were conducted by computing a series of Mann–Whitney tests between pairs of groups (Field, 2009), the following differences were found:

- Children with ASD differ significantly ($p < 0.05$) from typically developing children in all MAAP variables, with the only exception for the variable *differentiating familiar people*. Effect sizes for these differences are *large* for the variables: 'Learning through pretend play', 'Acquiring information', 'Acquiring language – phrase', 'Acquiring language – syntax', 'Rehearsing', 'Acquiring basic and complex concepts', 'Acquiring skills', 'Directing attention', 'Thinking', 'Pretend play', 'Speculating', 'Hypothesizing', 'Undertaking a single and multiple tasks', 'Managing daily routines, stress and one owns behaviour', 'Understanding complex spoken messages', 'Understanding non-verbal messages', 'Speaking', 'Produce non-verbal messages', 'Conversation', all variables concerned with Self-care activities, 'Basic' and 'complex interpersonal interactions', 'Informal relationships' and 'Cooperative play'. For all other variables in which there are differences between the two groups of children, effect sizes are medium.
- Children with other types of disabilities differ significantly ($p < 0.05$) from typically developing children in almost all MAAP variables, with the exception of the variables Learning through actions with a single object, Communicating receiving oral messages, understanding simple instructions, pre-vocalization and differentiating familiar people. Effect sizes for these differences are large regarding the variables 'learning through actions with more than one object', 'learning through pretend play', all variables related to acquiring language, 'rehearsing', 'acquiring concepts and skills', 'focusing and directing attention', 'thinking', 'pretend play', 'speculating', 'hypothesizing', undertaking simple and multiple tasks, 'Managing one's own behaviour', understanding complex spoken messages and non-verbal messages, 'Speaking', 'producing non-verbal messages', 'conversation', all variables related with self-care activities, basic and complex interpersonal interactions, 'physical contact', 'informal relationships' and 'cooperative play'. For other differences effect sizes are medium.

Children with ASD and children with other types of disabilities differ significantly in only 9 of the 45 MAAP items. However, only for the variable 'carrying out daily routines' was the effect size of large magnitude.

Regarding the Abilities' Index variables, a series of Mann–Whitney tests were conducted with the three groups of children. Results are as follows:

- Children with ASD differ significantly from typically developing children in almost all Abilities' Index variables, except for: Audition (left and right), left and right eye and body shape. Effect sizes for these differences are small for the variable 'social competence' ($r = 0.27$, $p < 0.001$), medium for the variables 'total score' ($r = -0.44$, $p < 0.05$), 'left hand', 'left arm', 'left leg', 'right hand', 'right leg', 'hypotonia' ($r = -0.37$, $p < 0.05$), 'hypertonia' ($r = -0.33$, $p < 0.05$); and large for 'communicating with others' ($r = -0.98$, $p < 0.001$), 'inadequate behaviour', 'intellectual function', 'understanding others' ($r = -0.90$; $p < 0.001$), 'right arm' ($r = -0.69$, $p < 0.05$), and 'general health' ($r = -0.62$, $p < 0.001$).

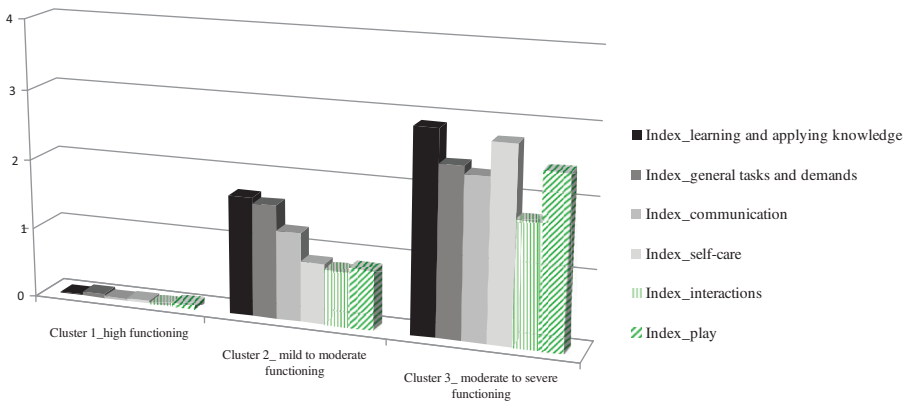

Figure 3. ?Three clusters of functioning patterns.

- Children with other types of disabilities also differ significantly from typically developing children in almost all variables, excepting: audition (right), left hand, left arm, Hypertonia, Hypotonia and body shape. Effect sizes of the differences are medium for the variables 'left eye' ($r = -0.51$, $p \leq 0.001$), 'inadequate behaviour' and 'right leg' ($r = -0.49$, $p < 0.05$), 'general health' ($r = -0.41$, $p \leq 0.001$), 'right eye' ($r = -0.41$, $p \leq 0.05$), 'left leg' ($r = -0.37$, $p < 0.05$), 'right hand', 'right arm' and 'audition-left' and 'total score' ($r = -0.32$, $p < 0.05$); and large for the variables 'social competence' ($r = -0.94$, $p < 0.001$), 'understanding others' and communicate with others ($r = -0.81$, $p < 0.001$), and 'intellectual function' ($r = -0.75$, $p < 0.001$).
- Children with ASD and children with other types of disabilities only differ in regard to seven variables of the Abilities' Index. However, effect sizes for these differences are all medium.

In what concerns the Engagement in routines scale, similar results have been observed:

- Children with ASD and typically developing children differ significantly from each other in terms of engagements level in preschool routines ($p < 0.001$). Children with ASD present lower levels of engagement when compared to typically developing children in all analysed routines: 'welcoming' ($r = 0.76$), structured activities ($r = 0.79$), 'free activities' ($r = 0.64$), 'snack time' ($r = 0.65$), 'outdoors/recess activities' ($r = 0.67$) and 'lunch time' ($r = 0.71$).
- Children with other types of disabilities also present significantly lower levels of engagement in preschool routines when compared to typically developing children ($p \leq 0.001$): 'welcoming' ($r = 0.73$), 'structured activities' ($r = 0.76$), 'free activities' ($r = 0.59$), 'snack time' ($r = 0.58$), 'outdoors activities' ($r = 0.69$) and 'lunch time' ($r = 0.52$).
- Children with ASD and children with other types of disabilities do not differ in the level of engagement they present in all of the analysed preschool routines.

In relation to the Environmental factors that were rated as facilitators or barriers by more than 50% of the inquired professionals, results are as follows:

- Children with ASD differ significantly from typically developing children regarding the variables: 'support of the mother' ($r = 0.57$, $p < 0.001$), 'support of people in position of authority' ($r = 0.38$, $p < 0.001$) and 'attitudes of the father' ($r = 0.49$, $p < 0.001$).
- Children with other types of disabilities differ significantly from typically developing children regarding the variables: 'support of the mother' ($r = 0.73$, $p < 0.001$), 'support of the father' ($r = 0.59$, $p < 0.001$), 'support of people in position of authority' ($r = 0.38$, $p < 0.05$), 'attitudes of the father' ($r = 0.60$, $p < 0.001$), 'attitudes of the mother' ($r = 0.43$, $p < 0.05$), and 'attitudes of persons in a position of authority' ($r = 0.33$, $p < 0.05$).
- Children with ASD and children with other types of disabilities do not differ in any of the analysed variables related with environmental factors.

The Cluster analysis conducted suggests three clusters of children, indicating that children group based on the level of severity in their functioning, as presented in Figure 3. Children with the same diagnostic condition (such as ASD) are split in the two clusters with more severe disability, regardless of their diagnostic condition. Figure 3 illustrates the three found clusters; there is a pattern of functioning with higher levels of difficulty in 'learning and applying knowledge', 'self-care' and 'play', and lower levels of difficulty in 'general tasks and demands', 'communication' and 'interactions'. Therefore, *Cluster 1 (normal functioning)* comprises 22 typically developing children and 2 children from the group with other types of disabilities (1 child with Global Developmental Delay and 1 child with Low vision); the pattern of the activities and participation dimensions show values between 0 and 0.4; *Cluster 2 (mild to moderate limitation in functioning)* comprises 14 children with ASD and 11 children with other disabilities (6 Global Developmental Delays, 2 deaf children, 1 child with Prader Willi Syndrome, 1 child with Down Syndrome and 1 child with Fetal Alcoholic Syndrome); the pattern of children's functioning in this cluster shows higher level of difficulty in 'learning and applying knowledge', 'general tasks and demands' and 'communication', and lower level of difficulty in 'self-care', 'interactions' and 'play'; *Cluster 3 (moderate to severe limitation in functioning)* comprises 8 children with ASD and 8 children with other disabilities (2 children with multiple disabilities, 1 child with a cognitive delay, 1 child with a language delay, 1 child with Down Syndrome, 1 child with Cerebral Palsy, 1 child with

Table V. Differences between clusters for the Abilities' Index scores using One-way ANOVA test.

		ANOVA					
Variables		Sum Squares	df	Mean square	F	Sig.	Eta squared
Social competence	Between	101.64	2	50.82	47.92	0.000	0.60
	Total	168.44					
Inadequate behavior	Between	57.89	2	28.94	24.22	0.000	0.43
	Total	133.17					
Intellectual function	Between	84.19	2	42.09	40.58	0.000	0.56
	Total	149.53					
Left hand	Between	10.42	2	5.21	5.75	0.005	0.21
	Total	67.53					
Left arm	Between	10.75	2	5.37	8.55	0.001	0.21
	Total	50.32					
Left leg	Between	20.01	2	10.01	12.07	0.000	0.28
	Total	72.26					
Right hand	Between	10.54	2	5.27	5.59	0.006	0.15
	Total	69.96					
Right arm	Between	9.23	2	4.62	6.69	0.002	0.18
	Total	52.67					
Right leg	Between	19.58	2	9.79	11.24	0.000	0.26
	Total	74.44					
Understanding others	Between	124.99	2	62.49	100.13	0.000	0.76
	Total	164.32					
Communicating with others	Between	189.07	2	94.54	228.25	0.000	0.88
	Total	215.17					
Hypertonia	Between	2.97	2	1.48	4.49	0.015	0.12
	Total	23.77					
Hypotonia	Between	5.11	2	22.56	3.93	0.015	0.12
	Total	41.01					
General health	Between	35.70	2	17.85	10.68	0.000	0.25
	Total	140.99					
Body shape	Between	5.58	2	2.79	4.59	0.014	0.13
	Total	43.82					
Total score	Between	6.25	2	3.12	12.83	0.000	0.29
	Total	21.59					

squeals of myocardial infarction and 1 child with Spina Bifida).

Results of the differences among Clusters regarding the Abilities' Index (see Table V) show that the clusters differ significantly in almost all variables of the Index, except for 'audition' (right and left) and 'eyes' (right and left). Results of multiple comparisons in Post Hoc procedures (Scheffé test) reveal that all clusters differ from each other in 'social competence', 'intellectual function', 'understanding others' and 'communicating with others' with very large effect sizes.

Do the functioning differences among children reflect differences in environmental features and in children's level of engagement in routines?

In what concerns the MAAP's engagement in routines scale, children in the three clusters differ from each other in functioning in 'structured activities', 'snack time' and 'recess', with large effect sizes on 'structured activities' and 'recess'. Clusters 2 and 3 do not differ from each other in the welcome routine, free activities and lunchtime.

Regarding the Environmental Factors, significant group differences were found among the three clusters of children in the variables 'support of the mother', 'support of the father', 'support of peers', 'attitudes of the mother' and 'attitudes of the father'. Effect sizes are medium. No differences were found between groups in the support and attitudes of 'persons in a position of authority' as well as in the 'educational services'. Effect sizes are small to medium.

Are environmental factors and engagement in routines good predictors of the functioning level of the children?

Variables to be introduced in a multiple regression model were selected from the dimensions 'Engagement in routines' and 'Environmental Factors' based on the analysis of the correlation among possible predictors and to avoid multicollinearity. Among the environmental factors dimension, only the 'support of the mother' and the 'support of peers' were found to meet this assumption and thus, were introduced in the model. From the dimension 'Engagement in routines', the variables 'structured activities', 'recess' and 'snack' met the assumption to be introduced in the model. Table VI shows the found results: the 'support of the mother' appears to be a good predictor of cluster membership ($\beta = -0.35$; $\Delta R2 = 0.15$; $p < 0.05$; $f = 0.58$); when adding the 'support of peers', no significant changes are observed in the model. However, when adding the Engagement in routines variables one by one, changes were found to be significant for each of the engagement variable added, indicating that these variables predict cluster membership. The final model comprised by the five predictors explains 69% of the variance in cluster membership ($\beta = -0.29$; $\Delta R2 = 0.09$; $p < 0.05$; $f = 2.23$). The model has good cross-validity, as the value of R square

Table VI. Multiple regression model for prediction of functioning patterns.

Model	R	R square	β	Adjusted R square	R square change	F change	Sig. F. change
Support of the mother	0.372	0.148	−0.35	0.110	0.148	4.969	0.033
Support of the peers	0.387	0.142	−0.05	0.095	0.004	0.127	0.724
Engagement in structured activity	0.687	0.469	−0.39	0.403	0.317	16.996	0.000
Engagement in recess	0.778	0.590	−0.36	0.532	0.131	8.979	0.006
Engagement in snack	0.822	0.685	−0.29	0.625	0.085	7.082	0.013

adjusted is 0.63, meaning that the loss of predictive power (or shrinkage) if this analysis was conducted at the population level is only of 0.06 (6%).

Discussion

Descriptive statistics on the functioning characteristics of the three diagnostic groups of children presented a first insight on group differences: while typically developing children seemed to clearly differ in functioning from the other two groups, the two groups of children (with ASD and with other types of disabilities) did not differ substantially, presenting similarities in their functioning profiles regarding the characteristics that show higher magnitude of a functioning problem. Accordingly, in the Abilities' Index, the two groups show similar profiles regarding the assessed functioning features.

Regarding the results of the Engagement in routines scale, the low level of consensus in the preschool classroom routines identified by the participant teachers seems to indicate a low level of awareness of these professionals towards environmental factors. In fact, the lack of consensus regarding children's typical routines in the preschool setting may be indicative of a lack of understanding of the multidimensional nature of child development and of daily functioning. Similarly, the lack of information teachers' display regarding Factors of the children's Environment, seems to confirm this tendency to disregard contextual circumstances in the child's proximal settings and thus to account for them when planning and designing educational interactions. As expected, typically developing children show higher levels of engagement when compared with children in the other two other groups, which were rated with similar levels of engagement in both routines. This result is in accordance with previous results from our group showing that child engagement is a current indicator of developmental level [28, 29].

The results obtained by comparing groups with different developmental status based on the MAAP variables show that children with autism and children with other types of disabilities do not differ in most of the variables. These results provide evidence on the fact that children's functioning does not differ depending on the diagnostic categories that are assigned to them. However, the few variables in which children with autism differ from children with other types of disabilities may be seen as particularly relevant variables to focus on in the assessment-intervention process with children with ASD. Particularly ''carrying out daily routines'' presents higher levels of difficulty in functioning for children in the ASD group, indicating that this should be an area of concern when designing interventions for these children. Although managing routines is not explicitly part of the diagnostic criteria for autism, it is well recognized as a relevant functioning problem for these children, often addressed in intervention research, such as in interventions using the TEACCH model (e.g. [30]). These findings are in line with recent advances in neuropsychiatry and medical research concerning neurodevelopmental disabilities, which have been emphasizing the need to overcome the traditional assessment based on diagnostic categories Gillberg [31] has been proposing the acronym ESSENCE to address a more functional approach to neurodevelopmental disabilities. ESSENCE accounts for *Early Symptomatic Syndromes Eliciting Neurodevelopmental Clinical Examinations* and refers to young children, before 5 years and often even before 3 years, presenting symptoms in one or more of the following dimensions: (a) general development, (b) communication and language, (c) social inter-relatedness, (d) motor coordination, (e) attention, (f) activity, (g) behaviour (h) mood and/or (i) sleep. Gillberg [31] posits that recent research on neurodevelopmental disabilities has lead the scientific community to overestimate diagnostic categories, searching for the right 'box' or label to classify children, thus, underestimating the inherent diffuseness of diagnosis. Therefore, the author states that no neurodevelopmental disorder expresses itself alone without simultaneously presenting signs that are typical from other diagnostic categories. ESSENCE may then be regarded as a more holistic approach to children with disability looking for any kind of symptoms within the referred dimensions, without focusing on the diagnosis. Gillberg [31] exemplifies the ESSENCE approach considering Autism Spectrum Disorders (ASD): although 75% of the children diagnosed with ASD before the age of 3 will still meet the diagnostic criteria for this disorder at follow-up, years later, the 25% that do not meet criteria for ASD, will present symptoms of other diagnostic categories. Therefore, ASD is a group of multifactorial determined conditions and there are almost as many different causes as cases [31]. The author also states that co-existing problems or symptoms in ASD are not an exception, but rather the rule and that 'the approach to diagnosis is likely to be unhelpful if it is exclusively directed to the diagnosis of one of these disorders'. Our study supports these findings providing evidence on the usefulness of a functional approach to ASD rather than a diagnostic one [31] (p. 1549).

When children are clustered, we verify that they group dependent on their functioning profiles rather than on their diagnostic label. These functioning profiles are characterized by differences in severity of limitation in each of the five dimensions of functioning, as well as on differences between clusters on how these functioning dimensions form different patterns. In fact, looking at the found patterns of functioning, results show that, for instance, children that have more difficulty in 'play' are included in the most severe cluster,

thus indicating the importance of engagement in play in defining functioning profiles.

In what concerns group differences in environmental characteristics, and although we do not have much information regarding these features, results show that typically developing children present higher levels of support than children with disabilities. This result seems to be indicative of the Transactional influences in development advocated by Sameroff, by which the child is influenced by the environmental features, but also has an influence on the environment [17, 32].

These findings are in line with recent advances in neuropsychiatry and medical research concerning neurodevelopmental disabilities, which have been emphasizing the need to overcome the traditional assessment based on diagnostic categories. Christopher Gillberg [31] has been proposing the acronym ESSENCE to address a more functional approach to neurodevelopmental disabilities. ESSENCE accounts for 'Early Symptomatic Syndromes Eliciting Neurodevelopmental Clinical Examinations' and refers to young children, before 5 years and often even before 3 years, presenting symptoms in one or more of the following dimensions: (a) general development, (b) communication and language, (c) social inter-relatedness, (d) motor coordination, (e) attention, (f) activity, (g) behaviour (h) mood and/or (i) sleep. Gillberg [31] posits that recent research on neurodevelopmental disabilities has lead the scientific community to overestimate diagnostic categories, searching for the right ''box'' or label to classify children, thus, underestimating the inherent diffuseness of diagnosis. Therefore, the author states that no neurodevelopmental disorder expresses itself alone without simultaneously presenting signs that are typical from other diagnostic categories. ESSENCE may then be regarded as a more holistic approach to children with disability looking for any kind of symptoms within the referred dimensions, without focusing on the diagnosis. Gillberg [31] exemplifies the ESSENCE approach considering Autism Spectrum Disorders (ASD): although 75% of the children diagnosed with ASD before the age of 3 will still meet the diagnostic criteria for this disorder at follow-up, years later, the 25% that do not meet criteria for ASD, will present symptoms of other diagnostic categories. Therefore, ASD is a group of multifactorial determined conditions and there are almost as many different causes as cases [31]. The author also states that co-existing problems or symptoms in ASD are not an exception, but rather the rule and that 'the approach to diagnosis is likely to be unhelpful if it is exclusively directed to the diagnosis of one of these disorders' [31] (p. 1549). Our study supports these findings providing evidence on the usefulness of a functional approach to ASD rather than a diagnostic one.

Results from the multiple regression analysis indicate that children's levels of engagement in daily routines as well as the support they receive in the immediate environment predict children's functioning patterns. In accordance with previous results, the quality and quantity of engagement that the child shows in daily routines of the preschool, as well as the influence of aspects of the environment are relevant factors to be taken into account when promoting positive functioning in young children with disabilities [28].

Results are in line with the bioecological and the transactional models of development and disability, which state the importance of taking into account the dimensions of the different levels of contextual variables in children's contexts, from the closer to the most distal, as well as the transactions that constantly and mutually occur between the child and the environment.

Conclusion

The main conclusion that we may draw from this study is that a functional approach to intervention in young children with disabilities may be more beneficial than a diagnostic approach, since children differ from each other in terms of patterns of functioning, rather than in terms of their health conditions or in function of the diagnostic label they were assigned. Such conclusion provides evidence indicating that interventions should be more oriented toward the promotion of positive functioning and participation based on the individual characteristics of the child, than on promoting capacities that are typically disadvantaged in a specific diagnostic group.

In summary, this study provides evidence and assessment resources (the new developed ICF-CY based tool – the MAAP), to support the adoption of a functional approach when conducting an assessment-intervention process with young children with disabilities. Teachers may now start assessing their children from the time they enter the preschool programme, following the detailed functional approach presented by the MAAP, as they observe their behaviour on an everyday basis and in a natural context. Moreover, repeated assessment over time enables monitoring of functioning progress, independently of diagnostic categories.

Limitations of the study

In future research, using the MAAP in a larger sample of young children with disabilities would be desirable in order to analyse the psychometric properties of data collected with the MAAP. It is important to underline that, since this study provided us with information on the fact that children do not differ in regards to their diagnostic category, but rather in regards to the severity of the limitation in functioning observed, it would be interesting that the larger sample could include children with various types of disabilities. Factor analysis are needed to verify whether the MAAP structure actually overlaps with the structure of the ICF-CY, as this was the authors' goal.

Another limitation of this study was that the instrument was responded by professionals following an interview format. This format may be useful, as it ensures that all teachers have the same understanding of the items, however, teachers should all have known the children for the same amount of time, which was not possible to control. Ideally, teachers should have a similar first contact with the tool (such as a small training workshop) and then respond to the items, as they observe their children, over a certain period of time.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper. The

authors wish to thank Fundação para a a Ciência e Tecnologia (FCT) for funding this study.

References

1. Simeonsson RJ, Bailey DB, Smith T, Buysse V. Young children with disabilities: Functional assessment by teachers. Journal Developmental and Physical Disabilities 1995;7:267–284. doi: 10.1007/BF02578431(1995).
2. Simeonsson RJ. Defining and classifying childhood disability. Institute of Medicine. Disability in America. Washington, DC: National Academy Press; 2005.
3. World Health Organization. International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY). Geneva: World Health Organization; 2007.
4. Bagnato SJ, Neisworth JT, Pretti-Frontczak K. Linking authentic assessment & early childhood intervention. Best measures for best practices. 2nd ed. Baltimore, MD: Paul Brookes; 2010.
5. World Health Organization. International Classification of Functioning, Disability and Health. Geneva: World Health Organization; 2001.
6. Florian L, Hollenweger J, Simeonsson RJ, Wedell K, Riddell S, Terzi L, Holland, A. Cross-Cultural Perspectives on the Classification of Children With Disabilities: Part I. Issues in the Classification of Children With Disabilities. The Journal of Special Education 2006;40(1):36–45. doi:10.1177/00224669060400010401.
7. Simeonsson RJ, Leonardi M, Lollar D, Bjorck-Akesson E, Hollenweger J, Martinuzzi A. Applying the International Classification of Functioning, Disability and Health (ICF) to measure childhood disability. Disability and rehabilitation 2003; 25(11–12):602–610. doi:10.1080/0963828031000137117(2003).
8. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 4th ed.; 2000.
9. World Health Organization. International Classification of Diseases and health related problems, 10th revision. Geneva: World Health Organization; 2010.
10. Lollar DJ, Simeonsson RJ. Diagnosis to function: Classification for children and youths. Journal of Developmental and Behavioral pediatrics: JDBP 2005;26(4):323–330.
11. Castro S, Pinto A. Identification of core functioning features for assessment and intervention in Autism Spectrum Disorders. Disability and Rehabilitation 2013;35:125–133.
12. Ellingsen KM. Deriving developmental code sets from the International Classification of Functioning, Disability and Health – for Children and Youth (ICF-CY) [unpublished dissertation]. University of North Carolina at Chapel Hill; 2011.
13. Bagnato, SJ. Authentic assessment for early childhood intervention: Best practices. New York: Guilford Press; 2008.
14. Castro S, Ferreira T, Dababnah S, Pinto AI. Linking Autism Measures with the ICF-CY: Functionality beyond the borders of Diagnosis and Interrater agreement Issues. Developmental Neurorehabilitation. DOI:10.3109/17518423.2012.733438.
15. Castro S, Pinto AI, Maia M. Linking the Carolina curriculum for preschoolers with special needs to the ICF-CY. British Journal of Developmental Disabilities 2011;52 Part 2(113):131–144. DOI:10.1179/096979511798967043.
16. Badley EM. Enhancing the conceptual clarity of the activity and participation components of the International Classification of Functioning, Disability, and Health. Social science & medicine 1982;66(11):2335–2345. doi:10.1016/j.socscimed.2008.01.026.
17. Sameroff AJ, Fiese BH. Transactional regulations: The developmental ecology of early intervention. In: Shonkoff JP, Meisels SJ, editors. Handbook of early childhood intervention. 2nd ed. Cambridge: Press Syndicate of the University of Cambridge; 2000. pp 135–159.
18. Skyttner L. General systems theory, 2nd ed. Singapore: World Scientific Publishing Co. Pte. Lda; 2005.
19. Almqvist L, Uys CJE, Sandberg, A. The concepts of participation, engagement and flow: A matter of creating optimal play experiences. South African Journal of Occupational Therapy 2007; 37(3):8–13.
20. Laevers F. Assessing the quality of childcare provision: ''Involvement'' as criterion. Researching Early Childhood 1997; 3:151–165.
21. McWilliam RA, Bailey DB. Promoting engagement and mastery. In: Bailey DB, Wolery M, editors. Teaching infants and preschoolers with disabilities, 2nd ed. New York: MacMillan Publishing Company; 1992. pp 230–255.
22. Coster W, Khetani MA. Measuring participation of children with disabilities: Issues and challenges. Disability and Rehabilitation 2008;30(8):639–648. doi:10.1080/09638280701400375.
23. Simeonsson RJ, Bailey DB. ABILITIES Index. Chapel Hill, NC: Frank Porter Graham Development Center, University of North Carolina; 1991.
24. Simeonsson RJ, Chen J, Hu Y. Functional assessment of Chinese children with the ABILITIES index. Disability and Rehabilitation 1995;17(7):400–410. doi: 10.3109/09638289509166728.
25. Field A. Discovering statistics using the SPSS. London: SAGE Publications Inc; 2009.
26. Maroco J. Análise Estatítica com o SPSS Statistics. Lisboa: Edições Sílabo; 2003.
27. Bergman LR, Magnusson D, El Khouri BM. Studying individual development in an interindividual context: A person-oriented approach (paths through life). London: Lawrence Earlbaum Associates, Publishers; 2003.
28. Grande C. Estudo do Impacto das Interacções Educadora-criança no desenvolvimento das crianças com necessidades educativas especiais em context de crèche e jardim de infância. [Unpublished dissertation]. Faculty of Psychology and Educational Sciences, Porto University; 2010.
29. Pinto AI, Barros S, Aguiar C, Pessanha M, Bairrão J. Relações entre idade desenvolvimental, dimensões do comportamento adaptativo e envolvimento observado [Relationships between developmental age, dimensions of adaptive behavior and observed engagement]. Análise Psicológica 2006;série XXIV(4):447–466.
30. McConachie H, Randle V, Hammal D, Le Couteur A. A controlled trial of a training course for parents of children with suspected autism spectrum disorder. The Journal of Pediatrics 2005; 147(3):335–340. doi:10.1016/j.jpeds.2005.03.056.
31. Gillberg C. The ESSENCE in child psychiatry: Early Symptomatic Syndromes eliciting neurodevelopmental clinical examinations. Research on Developmental Disabilities 2010;31(6):1543–1551. doi:10.1016/j.ridd.2010.06.002.
32. Sameroff AJ, Chandler MJ. Reproductive risk and the continuum of caretaking casualty. In: Horowitz FD, Hetherington M, Scarr-Salapatek S, Siegel G, editors. Review of child development research. Chicago: University of Chicago Press; 1975. pp 187–244.