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Scale of emotional development–short: Reliability and validity in two samples of children with an intellectual disability

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ABSTRACT

Background: Intellectual disability (ID) is often accompanied by more significant delays in emotional development than in cognitive development. Diagnostic assessment can provide insight into emotional functioning. However, few standardized assessment instruments are available.
Aims: Examine the reliability and validity of the Scale of Emotional Development–Short (SED-S) in children with ID.
Methods and procedures: This methodological instrument validation study was conducted in the Netherlands and Switzerland with children ($N = 118$) older than 3 and younger than 18 years with ID ranging from profound to mild. Measures included: demographic and medical data, SED-S, and the Vineland. Coherence and reliability of the SED-S were determined using Cronbach's alpha, and validity was examined using Goodman and Kruskal's γ, Kruskal-Wallis *H,* and Mann-Whitney *U* tests.
Outcomes and results: The reliability of the SED-S was high, the convergent validity was good, and divergent validity was indicated in relation to autism spectrum disorder (ASD), visual and/or auditory impairment, and adaptive functioning.
Further research: Research is needed to better understand the implications of ASD and visual and/or auditory impairment on emotional development and their association with (normal) intelligence. Children with ID may also benefit from (more) detailed guidelines for imbalanced profiles on the SED-S.

What this paper adds

This is the first methodological instrument validation study exploring the psychometric properties of the SED-S in the assessment of children with an intellectual disability. The reliability of the SED-S was confirmed, as the eight domains are highly although not perfectly intercorrelated. The convergent validity was found to be good. Divergent validity was indicated using the Vineland Adaptive

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Behaviour Scales. Lower scores on the three domains *Relating to Significant Others*, *Relating to Peers*, and *Differentiating Emotions* indicate a need for further assessment of emotional development in children with ID. Furthermore, the results show that children with ASD scored lower on the SED-S than children without ASD. This was also found for children with a visual and/or auditory impairment. The SED-S can be used to assess the level of emotional functioning and the basic emotional needs of children with an intellectual disability and to plan children's treatment through the selection of adequate interventions. The SED-S could therefore be used to prevent mental problems in this group of children.

1. Introduction

The mental health of children with an intellectual disability is of great concern (World Health Organization, 2010). Wriedt, Wiberg, Sakar, and Noterdaeme (2010) report mental health problems in more than 40 % of children with intellectual disabilities living in residential homes and in about 14 % of outpatients. A study conducted by Einfeld, Ellis, and Emerson (2011) indicated a four-fold higher risk for mental health disorders in children with an intellectual disability (ID) compared with children without disabilities. In a sample of children with a mild or borderline ID who were referred for a comprehensive psychiatric assessment, the proportion of children meeting DSM-V criteria for Reactive Attachment Disorder (RAD) and/or Disinhibited Social Engagement Disorder (DSED) was as high as 18 % (Giltaij, Sterkenburg, & Schuengel, 2017). The prevalence of challenging behaviours among children with IDs is also significantly higher than in typically developing children (Emerson, Hastings, McGill, Pinney, & Shurlock, 2014). These mental health and behavioural problems reflect the fact that parents and caregivers have more difficulty understanding and adequately interpreting the attempts of children with IDs to communicate their needs (Schuengel & Janssen, 2006).

In typically developing young children, emotional regulation and emotional knowledge are both related to social competence (Denham et al., 2003). Emotional recognition and understanding are also related to success in the early school years, as well as to social problem solving and prosocial behaviour (Denham, Bassett, Zinsser, & Wyatt, 2014; Izard et al., 2001). Conversely, a lack of emotional differentiation and self-regulation is linked to specific behavioural problems, such as aggressive behaviours, particularly in boys (Brajša-Žganec & Hanzec, 2015; Izard et al., 2001). Understanding the developmental aspects of why some children struggle to understand, differentiate, and regulate emotions enables a broader conceptualisation of the causes of psychological distress and behavioural problems.

The underlying concept of the developmental approach is that emotional competencies emerge and progress over a series of stages. At each stage, people have specific emotional needs, motivations, and coping resources, which correspond to the developing brain maturing (from the bottom up) via myelinisation of the brain stem, deep limbic, mesolimbic-, and upper limbic levels of neurological functioning (Happé & Frith, 2014). To understand a person's behaviour, it is necessary to identify the underlying emotional needs (e.g., for physiological regulation, emotional attunement, or autonomy) at different stages of development (Došen, 2005a; Sappok, Hassiotis, Bertelli, & Sterkenburg, submitted).

The assessment of emotional functioning in children with ID has the potential to extend to our current understanding of mental health and behavioural difficulties, and could lead to more developmentally appropriate and effective interventions. One example is emotional recognition and social understanding (Bons et al., 2013). Emotional dysregulation in children with autism spectrum disorder (ASD), in comparison with typical children, is more strongly correlated to social and behavioural functioning and related to higher internalizing and externalizing behavioural problems (Berkovits, Eisenhower, & Blacher, 2017; Mazefsky et al., 2013; Samson et al., 2014). Given the adverse effects of challenging behaviours exhibited by children with intellectual disabilities on their families, caregivers and other children, as well as on their own education and quality of life, early assessment of emotional competencies is crucial in diagnosis and treatment (De Bildt, Sytema, Kraijer, Sparrow, & Minderaa, 2005; Peña-Salazar et al., 2018).

Although cognitive and emotional development are interrelated, several studies indicate discrepancies between cognitive and emotional abilities in people with ID (Baurain, Nader-Grosbois, & Dionne, 2013; Böhm, Dziobek, & Sappok, 2019; Hentrich & Huber, 2018). The level of emotional development appears to be partially independent of the severity of ID (Hentrich & Huber, 2018; Sappok et al., 2013). Furthermore, in children with ASD, emotion dysregulation is independent of children's IQ (Samson et al., 2014). This is significant because lower levels of emotional development compared with cognitive development have been found to predict challenging behaviour in people with ID (Sappok et al., 2014). Therefore, as Došen (2007) stated, during the assessment of people with ID, it is essential to assess their level of emotional development in addition to their cognitive abilities and to examine the possible disharmonious results in their profiles.

Due to the etiology of the ID, children with ID are also more likely than typically developing children to have visual impairment (Evenhuis et al., 2007). Children with impaired vision have reduced available sensory information, which contributes to a higher risk of not reaching their potential in communicating and interacting with other people (Hoevenaars-van den Boom, Antonissen, Knoors, & Vervloed, 2009). The visual impairment can thus affect children's development and psychological well-being (Nyman, Gosney, & Victor, 2010). It can therefore be expected that the emotional development of children with a visual impairment is lower than that of their visually able peers. Thus, any visual impairment also needs to be taken into account in the assessment of intellectual impairments and ASD.

To detect the factors that mediate developmental delays and their effects on (mal)adaptive behaviours, the pattern underpinning emotional functioning should be assessed in different domains. For example, children with developmental delays show lower social skills (Burris, Chernenok, Bussey, & Rivera, 2019), and another example is that children with Down Syndrome have fewer regulatory strategies when confronted with frustrating tasks, compared with typically developed children (Jahromi, Gulsrud, & Kasari, 2008). Furthermore, children with Down Syndrome show less cognitive/verbal self-soothing, and they seek less assistance than typically developing children during a frustrating task (Jahromi et al., 2008). Emotional development is, however, complex, multi-layered, and

difficult to measure due to methodological challenges, especially in children with ID (Burris et al., 2019). Therefore, to better observe, rate, and understand emotional functioning and the related specific emotional needs, motivations and adaptive strategies of children with ID, it is (also) necessary to map observed behaviour.

Došen (2007) developed an important semi-structured interview tool that is used in clinical practice for the assessment of emotional development of children and adults with ID. The Scheme for Appraisal of Emotional Development (SAED; Došen, 2014) specifies a five-stage model of typical emotional development for children from 0 to 12 years of age. Later, this was developed into the Scale for Emotional Development-Revised (SED-R; Claes & Verduyn, 2012) and the SED-R^2 (Morisse & Došen, 2016). However these tools were lengthy to administer and lacked the robust psychometric properties needed for scientific research.

For children and adults with ID, regardless of the cause, a short, psychometrically sound scale was developed to assess emotional functioning, one which is suitable for diagnostic and scientific purposes: the Scale of Emotional Development–Short (SED-S; Sappok et al., 2016). The SED-S has shown high internal consistency and high interrater reliability in a sample of typically developing children (Sappok et al., 2019). Thus far, the SED-S is the only assessment tool that has established norms in a sample of typically developed children, reporting excellent internal consistency ($\alpha = .99$) and high agreement between scale classification and children's chronological age ($Kw = .95$; exact agreement = 80.6 %; Sappok et al., 2019). However, up to now, the assessment of the psychometric properties of the SED-S in children with ID has not been examined.

Therefore, in this study the primary aim was to test the applicability and the psychometric properties of the SED-S in a sample of children with ID. The main hypotheses were as follows: (1) We predicted that the SED-S would be a coherent scale with high internal consistency of the eight domains; (2) these domains would be highly intercorrelated in indicating inter-domain associations; and that (3) the scales are unidimensional, representing a single concept. Furthermore, (4) there would be a strong association between the SED-S and ID, indicating good convergent validity. Concerning the divergent validity (5), it was hypothesised that there would be a strong association between the SED-S and chronological age, as well as with the adaptive functioning of the children. Finally, (6) it was predicted that children with ASD and children with visual and/or auditory impairments would have lower scores on the SED-S than children without ASD or sensory impairments, respectively.

2. Materials and methods

2.1. Design

This is a methodological instrument validation study examining the reliability and construct validity of the SED-S.

2.2. Participants

A convenience sample of participants was recruited from the Netherlands and Switzerland between September 2017 and September 2019. In the Netherlands, three care organisations that provide services to children with intellectual disabilities participated. They are located in the east, west, and south of the Netherlands. Permission was granted by the ethics teams of the care organisations to ask parents of children with ID for consent. In Switzerland, three care organisations participated. The Ethics Commission of the Canton of Zurich gave ethical approval. The consent letters were sent to the legal guardians of all persons with an ID, who received care within these organisations. The study was conducted according to the Ethical Principles for Medical Research Involving Human Subjects of the World Medical Association Declaration of Helsinki (World Medical Association, 2013).

The sample (N = 118; Table 1) were children with an ID older than 3 years and younger than 18 years (M = 10.09; SD = 3.89).

Table 1
Demographic data of all participants (N = 118).

	Country		
Demographics	Switzerland (n = 65)	The Netherlands (n = 53)	Total (N = 118)
Age in years (*M, SD*)	5–17 (11.89, 3.61)	3–14 (7.89, 2.98)	3–17 (10.09, 3.89)
Sex, m/f (%)	41/24 (63 % / 37 %)	37/16 (70 %/30 %)	78/40 (66 % / 34 %)
Severity of ID, n (%)			
Mild	19 (29 %)	10 (19 %)	29 (25 %)
Moderate	24 (37 %)	22 (42 %)	46 (39 %)
Severe	14 (22 %)	18 (34 %)	32 (27 %)
Profound	8 (12 %)	2 (4 %)	10 (8 %)
Unknown		1 (2 %)	1 (1 %)
Living arrangement, n (%)			
With parents	25 (38 %)	51 (96 %)	76 (64 %)
Group homes	27 (42 %)	–	27 (23 %)
Partially supported by care facilities	13 (20 %)	1 (2 %)	14 (11 %)
Unknown		1 (2 %)	1 (1 %)

Note. *M* = Mean; *SD* = Standard Deviation; %: Errors due to round-off error.

There were more boys (66 %) than girls (34 %). The ID level ranged from profound (8 %) to mild (25 %) with children with a moderate ID being the largest group (39 %). In one case the severity of ID was not reported and is therefore described as unknown. Intellectual functioning was extracted from the psychological and/or medical file based on the DSM-5 (American Psychiatric Association, 2013) in the Netherlands ($n = 53$), and based on the ICD-10 (Dilling & World Health Organization, 2011) in Switzerland ($n = 65$). The children received varying grades of support, ranging from living with their parents (64 %) to being partially supported by caregivers linked to the participating organisations (11 %) (Table 1).

The psychiatric disorders, which were reported in the medical files, indicated a prevalence of 33 % for ASD, and challenging behaviour was reported in 15 % of the cases. The most common somatic comorbidities were epilepsy (13 %) and motor, visual, and auditory impairments (22 %) (Table 2).

2.3. Measures

2.3.1. The SED-S

The SED-S is a semi-structured interview consisting of 200 items about observable behaviours exhibited by the child within 2–12 weeks prior to the interview (Sappok et al., 2019). Each item has binary response options, and is answered either "yes" or "no". For each child, the interviews were conducted with two informants in the the Netherlands and one informant in Switzerland. Each informant was a family member or a professional caregiver. For the Dutch sample, each item was scored only after the two informants reached consensus. The items are grouped into eight domains: Relating to His/Her Own Body (*Body*), Relating to Significant Others (*Others*), Dealing with–Object Permanence (*Object*), Differentiating Emotions (*Emotions*), Relating to Peers (*Peers*), Engaging with the Material World (*Material*), Communicating with Others (*Communication*), and Regulating Affect (*Affect*). Each of these eight domains is arranged into five levels in a stage-wise manner. These five levels of emotional development (developmental age) are: Adaption (0–6 months); Socialization (6–18 months); Individuation (18–36 months); Identification (3–7 years); and Reality Awareness (7–12 years). Each of the levels within each of the domains consists of five statements, thus each domain entails 25 statements (Sappok et al., 2016).

To determine the level of emotional functioning, the following procedure was used: within each domain, the level with the highest number of items rated as the normative trajectory of typical development in children was assumed to provide the best estimation of the child's level of functioning. If there was a tie between two domain levels, the lower of the two levels was chosen. Next, the domain levels were ranked from lowest to highest. The fourth lowest domain level determined the overall level of emotional development (Sappok et al., 2016). In previous testing with typically developing children the inter-rater reliability was $\kappa_w = .98–1.00$, the internal consistency was $\alpha = .99$, and the validity in regard to chronological age was $\kappa_w = .95$ (Sappok et al., 2019).

2.3.2. Adaptive functioning

The Vineland Screener 0–6 is a 72-item scale used to measure adaptive functioning based on Sparrow, Carter, and Cicchetti (1993) and adapted into Dutch by Scholte et al. (2008). It can be used to assess young children aged 0–6 years and individuals with ID who are of equivalent developmental age. The Vineland Screener consists of four domains: communication development, social skills, daily living skills, and motor abilities. The inter-rater reliability for typically developing children was $\kappa_w = .97$, and the test-retest reliability was $r = .99$. The internal consistency for participants with ID was $\alpha = .99$ (Scholte, van Duijn, Dijkxhoorn, Noens, & van Berckelaer-Onnes, 2008).

The *Vineland-Z–Vineland Adaptive Behaviour Scales* is a 225-item scale that measures a person's level of adaptive functioning. It can be used to assess typically developing children aged 5–18 years (Sparrow, Balla, & Cicchetti, 1984) and people with ID who are of equivalent developmental age (De Bildt & Kraijer, 2003). The Vineland-Z consists of three domains: communicational development, social skills, and daily living skills. The test has an excellent internal consistency (split-half test) of .93 and its validity in regard to ID is strong, with $r = .70$ (De Bildt & Kraijer, 2003).

2.4. Procedure

The study designs in the Netherlands and in Switzerland were consistent in all essential respects. The minor differences were the following: (1) in the Netherlands, the Vineland Adaptive Behavior Scales was also assessed; and (2) in the Netherlands, for each child, two informants who knew the child well (caregiver[s] and/or family member[s]) responded to this research, and in Switzerland, one informant was used. Each interview waswas held at the participant's home, school, or day-care centre. Developmental psychologists

Table 2
Overview of prevalence of psychiatric disorders and somatic comorbidities (N = 117*).

Psychiatric disorders	n (%)	Somatic comorbidities	n (%)
Anxiety/OCD/Trauma	4 (3 %)	Auditory and auditory-and-visual (deaf and blind) disorder	5 (4 %)
ASD	39 (33 %)	Epilepsy	15 (13 %)
Challenging behaviour	17 (15 %)	Movement disorder	13 (11 %)
Other (Mood disorder,	2 (2 %)	Sensory integration problems	4 (3 %)
Psychotic disorder)		Visual disorder	8 (7 %)
		Other (genetic disorders)	4 (3 %)

Note: OCD = Obsessive-compulsive disorder; %: Errors due to round-off error.
* In one case the prevalence of psychiatric disorders was not reported (unknown).

with a master's degree conducted the interviews. They received standardized instructions and on-the-job training in the use of the SED-S.

2.5. Data analysis

For the statistical analysis, IBM Statistical Package for Social Sciences (SPSS) version 25 was used. The data were inspected, assumptions were tested, and appropriate tests were selected.

2.5.1. Construction of the SED-S

The association of SED-S domains to one another was assessed with a Goodman and Kruskal's γ test for rank correlation. An agglomerative hierarchical cluster analysis was conducted to determine the between-domain linkage of the eight domains. The distance of each domain from the others was calculated using the Squared Euclidian distance, and then the mean distance of each domain to the core concept was calculated.

2.5.2. Validity of the SED-S

The association of the SED-S overall and its domains with severity of ID was assessed using Goodman and Kruskal's γ tests, and the association between the SED-S overall and chronological age was calculated using a Kruskal-Wallis *H* test.

To test whether there was a difference in SED-S between domain levels between children with and without ASD, as well as between children with and without visual and/or auditory impairments, first an independent *t*-test was used to control for differences in *age*, and a Mann-Whitney *U* test was used to control for differences in the *severity of ID*. Then, Mann-Whitney *U* tests were used to determine whether a statistical difference between the children with and without ASD and between the children with and without visual and/or auditory impairments could be detected.

The association of the SED-S with the Vineland Adaptive Behavior Scales was tested with Goodman and Kruskal's γ tests. Depending on the severity of ID and age, two different Vineland scales were applied, in accordance with the target groups recommended for these measurements. The Vineland Screener was used in children ($n = 44$) aged 3–17 years ($M_{age} = 7.82$, $SD = 1.45$) with predominantly moderate or severe ID, whereas the Vineland Z was used in three children aged 9–11 years ($M_{age} = 9.5$) with mild, and in one case unknown, severity of ID to determine their level of adaptive behaviour.

To make the outcomes of both Vineland scales comparable to one another, they were transformed into functional age equivalents in months (De Bildt & Kraijer, 2003; Sparrow, Carter, & Cicchetti, 1993) for use in subsequent calculations. The correlation of the SED-S overall level and the age equivalent was calculated using Spearman's ρ correlation.

2.5.3. Effect size measures

For Mann-Whitney *U* tests, the correlation coefficient *r* was calculated (Fritz, Morris, & Richler, 2012). The effect size of $r = .10$ (small), $r = .30$ (medium) and $r = .50$ (large). The effect size of the Pearson's *r* correlation and the Spearman's ρ rank correlation of .00 was defined as Zero, $.10 \leq r < .30$ as weak, $.40 \leq r < .60$ as moderate, $.70 \leq r < .90$ as strong, and a correlation at 1.00 was defined as perfect (Dancey & Reidy, 2007). The effect size of Goodman and Kruskal's γ was defined as follows: $.00 \leq \gamma < .10$ as negligible, $.10 \leq \gamma < .20$ as weak, $.20 \leq \gamma < .40$ as moderate, $.40 \leq \gamma < .60$ as relatively strong, $.60 \leq \gamma < .80$ as strong, and $.80 \leq \gamma < 1.00$ as very strong (Rea & Parker, 1992).

3. Results

3.1. Coherence of the SED-S

The internal consistency of the SED-S was determined using Cronbach's alpha. The inter-domain internal consistency of the eight domain scores was excellent, with $\alpha = .94$.

A principle component analysis (PCA) showed that the eight domain scores created a first component that accounted for 72.4 % of the explained variance ($\lambda = 5.79$), whereas the second component accounted for an additional 6.34 % of the explained variance ($\lambda = .51$). The Kaiser-Mayer-Olkin measure was "marvellous" (Kaiser, 1974) at .928 and Bartlett's test of sphericity was significant (χ^2 [28]

Table 3
Associations between SED-S domains (N = 118).

Domains	1	2	3	4	5	6	7
1. Body							
2. Others	.86***						
3. Object	.75***	.78***					
4. Emotions	.63***	.75***	.74***				
5. Peers	.70***	.78***	.69***	.74***			
6. Material	.81***	.78***	.73***	.68***	.83***		
7. Communication	.80***	.82***	.81***	.77***	.78***	.75***	
8. Affect	.74***	.83***	.72***	.85***	.82***	.84***	.83***

*** Significant at $p \leq .001$.

= 770.515, $p = .001$), which indicates that the data were factorizable. The varimax rotation did not detect another component in the set of domains. This suggests that the eight domain scores form a unidimensional concept. An excellent Cronbach's alpha and the one-factor solution of the PCA suggest that the SED-S is a coherent, unidimensional measure.

3.2. Reliability: SED-S inter-domain associations

The eight SED-S domains showed significant positive associations with one another, ranging from a very strong positive association between *Body* and *Other* to a strong positive association between *Body* and *Emotions*. Table 3 reports all inter-domain associations. While some domains showed a consistently strong degree of association with all other domains, for example, *Object* ($\gamma = .75$–$.81$), some domains, such as *Emotions,* varied in the strength of association from one domain to another ($\gamma = .63$–$.85$). The domains were highly yet not perfectly intercorrelated, meaning that each domain added to the concept of emotional development.

3.3. Unidimensionality: Hierarchical cluster analysis (HCA)

Domains that are more homogenous have shorter distances between them, whereas the ones that are more heterogeneous have greater distances between them. A proximity matrix (Table 4) gives insight into the distances between domains. In this hierarchical cluster analysis, the *Emotions* and *Affect* domains were the closest and therefore their distance was set as the starting point (coefficient .00) from which the other distances were compared. Subsequently, the *Others* and *Communication* domains (.07) and *Others* and *Affect* (.07) domains had the shortest distances to each other. The means of the distances were computed for each domain: *Communication* was closest to the core of the emotional development concept (most homogeneous), and *Object* was the furthest away from that concept (most heterogeneous). The core of the concept is defined as the central point at which the eight domains together are most homogeneous. Fig. 1 contains the agglomeration schedule and dendrogram on a cluster reduction.

3.4. Convergent validity: association between the SED-S and ID

The children's ($N = 117$) mean age did not differ statistically across varying severity of ID (df[3], $F = 1.484$, $p = .223$). The SED-S overall level had a strong negative association with the severity of ID ($G = –.69$, $p < .001$). Fig. 2 shows the distribution of the SED-S overall level clustered by severity of ID. For example, all participants at SED-S-5 had a mild ID, but some participants had a lower level of emotional functioning (SED-S-1 to SED-S-4). Similarly, the SED-S domains showed strong negative associations with the severity of ID. Notably, the strength of this association varied per domain, that is, the *Emotions* domain showed a moderate association with the severity of ID, whereas the *Material* domain showed the strongest. Table 5 reports the associations of the SED-S (overall level/domains) with the severity of ID.

These findings suggest that the more severe the children's ID, the lower their emotional functioning, not only in general, but also separately on each domain of emotional functioning. The severity of the children's ID was linked to lower emotional functioning, more so for *Body* and *Material* and less so for *Object* and *Emotions*. As expected, the SED-S overall level was related to the severity of ID; this indicates good convergent validity.

3.5. Divergent validity

3.5.1. Association of the SED-S with chronological age

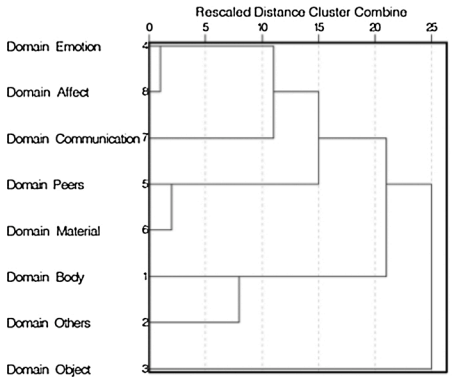
The mean ranks of the SED-S grouped by chronological age were distributed non-similarly for all groups, and showed a non-significant difference ($H[4] = 9.25$, $p = .055$). Thus, no statistically significant association between chronological age and SED-S overall score was detected. This indicates that emotional development appears to be independent of chronological age.

3.5.2. Association of the SED-S with adaptive functioning

The SED-S overall level had a strong positive monotonic relationship with the Vineland age equivalent (ρ [46] = .614, $p < .001$). Fig. 3 depicts this finding. The developmental age ranges of the lower SED-S levels (SED-S-1 to SED-S-3) did not correspond to the age equivalents observed by the Vineland Adaptive Behavior Scales (Table 6). In the current sample, the children's adaptive functioning was further developed than their emotional functioning. This difference was most apparent for children with the lowest emotional

Table 4
Proximity matrix of the SED-S domains.

Domains	1	2	3	4	5	6	7	8
1. Body	.000							
2. Others	.078	.000						
3. Object	.400	.591	.000					
4. Emotions	.635	.235	.957	.000				
5. Peers	.522	.226	1.000	.243	.000			
6. Material	.130	.183	.539	.478	.122	.000		
7. Communication	.157	.070	.443	.209	.183	.191	.000	
8. Affect	.417	.070	.878	.000	.096	.122	.096	.000



Agglomeration schedule to dendrogram (Fig. 1)

Stage	Cluster Combined		Coefficients
	Cluster 1	Cluster 2	
1	4	8	.00
2	5	6	.04
3	1	2	.19
4	4	7	.25
5	4		.33
6	1	4	.48
7	1	3	.58

Fig. 1. Dendrogram of the SED-S domains.

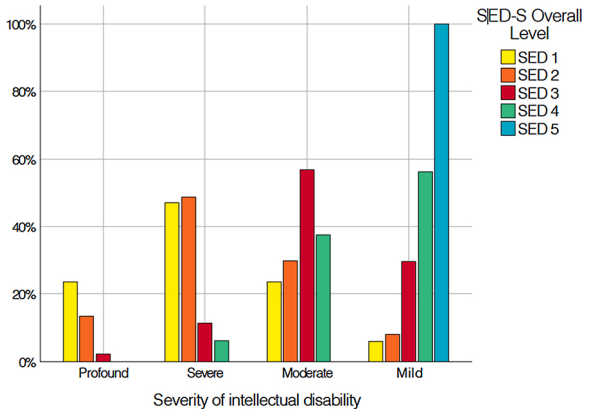


Fig. 2. Percentages of children grouped in overall SED-S level clustered by severity of ID (N = 117). Note. Each SED level accumulates to 100 %.

Table 5
Association of SED-S overall level and domains with severity of ID (N = 117).

Gamma (*G*)	SED-S overall level	Body	Others	Object	Emotions	Peers	Material	Commu-nication	Affect
Severity of ID	– .69***	– .70***	– .62***	– .47***	– .38***	– .54***	– .71***	– .69***	– .60***

*** Significant at $p \leq .001$.

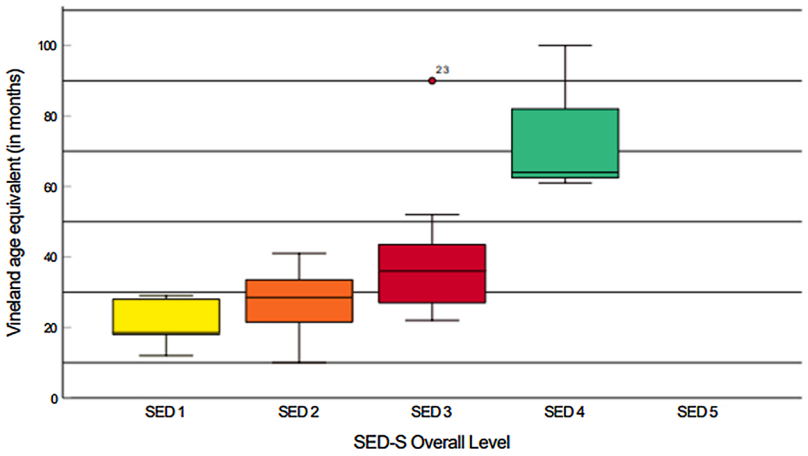


Fig. 3. Boxplot with 95 % confidence intervals of the relationship between the SED-S overall level and the Vineland age equivalent.

functioning.

These finding also support the convergent validity: when the emotional age increases so does the person's adaptive skills. But, as there is disparity in the age equivalents, this also supports the partial independence of the emotional development construct.

3.6. Associations between the SED-S and comorbid diagnoses

3.6.1. Association of the SED-S with ASD

The relationship between the SED-S and ASD was examined. First, children with and without ASD were compared with controls for any differences in age and severity of ID. Children without ASD ($M_{age} = 9.99$, $SD = 3.80$, $n = 78$) and with ASD ($M_{age} = 10.33$, $SD = 4.13$, $n = 39$), did not statistically differ in age ($M_{age} = -.35$, 95 % *CI* [– 1.87, 1.17], $t[115] = -.45$, $p = .653$), nor did the two groups statistically differ in severity of ID ($U = 1499.50$, $z = -.01$, $p = .990$); that is, the median for both groups was set at moderate ID.

Subsequently, the two groups were compared with regard to their SED-S *overall levels*, as well as their *domain levels*. Table 7 reports the associations and effect sizes. The two groups, non-ASD (*median* = 3) and ASD (*median* = 2), statistically differed in overall level ($U = 1056$, $z = -2.82$, $p = .005$, $r = .26$). Regarding domain levels, most domains showed a negative association with the incidence of ASD. The biggest differences between groups were found in domains *Others, Emotions,* and *Peers*, whereas no statistical difference was detected in the domains *Body*, *Object,* and *Material* (Table 6).

These findings suggest that children with ASD generally had a lower level of emotional functioning than children without ASD, which was indicated throughout most domains. Hence, ASD had a small-to-medium influence on the *Others*, *Emotions,* and *Peers* domains.

3.6.2. Association of SED-S with visual and/or auditory impairment

Children with visual and/or auditory impairment ($n = 9$) were compared with children without these impairments ($n = 108$) on their SED-S overall level and domains. Children with ($M_{age} = 9.00$, $SD = 4.15$) and without visual and/or auditory impairment ($M_{age} = 10.19$, $SD = 3.88$), did not differ statistically in age, ($M_{age} = -1.19$, 95 % *CI* [– 3.86, 1.49], $t[115] - .882$, $p = .379$), nor did the groups statistically differ in severity of ID ($U = 418.50$, $z = -.685$, $p = .494$). The children with visual and/or auditory impairment ($M_{SED} = 2.64$, *median* = 3) did have a significantly lower overall level of emotional functioning ($U = 295.50$, $z = -2.04$, $p = .041$, $r = .19$) than children without such impairment ($M_{SED} = 1.89$, *median* = 1). This difference between groups was also apparent in the *Others* domain, but not in the remaining domains (Table 8).

4. Discussion

This study examined the reliability and validity of the SED-S in children with ID. The scale had excellent internal consistency, and the items loaded on a single factor, suggesting that the eight domains of the SED-S form a coherent, unidimensional measure. The diverse group of children who participated in this study varied in chronological age, severity of ID, and medical history, and came from two different European countries. This diversity aids the generalization of the findings to the wider population of children with ID. The ecological validity of this measure is high because it assesses observed behaviours exhibited in a set period of time (Brewer & Crano, 2014). The domains were highly, but not perfectly, intercorrelated, which lends support to the reliability of the SED-S as each domain adds to the concept of emotional. The internal consistency and validity (convergent/divergent) of the SED-S indicates that the SED-S can be used as a reliable instrument to gain insight and awareness about the basic needs of children with ID. Furthermore, the findings endorse the assertion that emotional development should be seen as a different construct from cognitive development. This result is consistent with previous research by Sappok et al. (2019) in a sample of typically developing children, who reported high internal consistency and validity of the SED-S.

In regards to internal consistency, this study indicated that the *Object* domain is the furthest away from that concept of emotional (most heterogeneous). Sappok et al. (2019) found that the items in the *Object* domain are not very age specific, with an agreement of 66.9 % with chronological age, and that some items should be rephrased in a future version of the SED-S. If the *Object* domain is non-specific in terms of chronological age or emotional level, and this makes it inconsistent with the other domains, this would explain why it is the most heterogeneous of the domains. The *Object* domain is based on the developmental milestone of object and person permanence. Object permanence may refer to a cognitive component as a developmental milestone rather than to an emotional

Table 6
Descriptive data of the Vineland age equivalents with cases grouped by SED-S overall level (N = 48).

SED-S overall level	n	Developmental age SED-S (in months)	Vineland age equivalent	
			M	*SD*
1	6	0–6	20.67	6.56
2	24	6–18	27.63	7.80
3	15	18–36	39.20	16.93
4	3	36–84	75	21.70
5	0	84–144	–	–

Note. *M* = Mean, *SD* = Standard Deviation.

Table 7
Comparison between non-ASD and ASD group on overall level and domain levels (N = 117).

Statistic	Overall level	Body	Others	Object	Emotions	Peers	Material	Communication	Affect
U	1056**	1259.0	1071.0**	1199.0	969.0**	1074.0**	1211.5	1156.0*	1139.5*
z	– 2.82	– 1.61	– 2.73	– 1.96	– 3.31	– 2.67	– 1.85	– 2.19	– 2.31
p-value	.005	.107	.006	.050	.001	.007	.064	.029	.021
r	.26	–	.25		.31	.25	–	.20	.21

Note. The distributions of the overall level and domain levels were the same across both categories, non-ASD and ASD.
* Significant at $p \leq .05$.
** significant at $p \leq .01$.

Table 8
Comparisons SED-S overall level between children without and with visual and/or auditory impairment (N = 117).

Statistic	Overall Level	Body	Others	Object	Emotions	Peers	Material	Commu-nication	Affect
U	295.50	336.50	287.00	337.50	347.50	385.50	359.50	341.50	333.50
z	– 2.04	– 1.63	– 2.14	– 1.60	– 1.47	– 1.06	– 1.34	– 1.53	– 1.63
p-value	.041*	.104	.033*	.110	.141	.287	.181	.125	.103
r	.19		.20						

Comparisons SED-S overall level between children without and with visual and/or auditory impairment (N = 117).
* Significant at $p \leq .05$.

component.

In terms of convergent validity, the finding that the SED-S overall and domain scores showed moderate-to-strong negative correlations with severity of ID is supportive of the significant inter-relationship between cognitive and emotional functioning.Greenspan, Wieder, and Simons (1998) argue that affect is the basis for intellectual growth, since it acts as a stimulus to engage in purposeful interaction with others. Causal and symbolic thinking then contribute to learning about our ability and the impact we have on others. The capacity to regulate emotions through interactive experiences also plays a significant role in the development of attention and is necessary in learning how to differentiate and label our internal states and later to develop a theory of mind. Besides the moderate-to-strong associations between emotional and cognitive development, the results show that the level of emotional development adds further insight that cannot be explained by the severity of ID alone. In line with what Došen (2007) originally proposed, the results of the current study support the importance of assessing the level of emotional development in addition to the cognitive level in people with intellectual disabilities.

The current study explored the divergent validity of the association between emotional development and adaptive functioning. Emotional development showed a positive monotonic relationship with adaptive functioning. This is consistent with an earlier validation study by La Malfa, Lassi, Bertelli, Albertini, and Došen (2009), who examined the relationship between the Vineland Adaptive Behavior Scale and the Scheme of Appraisal of Emotional Development (SAED) and found a correlation of $r = .657$. In line with these results, in the present study the level of emotional development increased along with adaptive age. This indicates good convergent validity, as emotional development and adaptive functioning should be related. On the other hand, emotional development was not perfectly in line with adaptive functioning, which indicates that it is partly independent and therefore demonstrates a good divergent validity as well. Accordingly, emotional development should be considered to contribute important information about the emotional needs of children with ID. Interestingly, the children's level of adaptive functioning was higher than their level of emotional development, which was particularly the case for children at the lowest developmental stages. Došen (2005b) argues that emotional and social development should be in line, apart from situations where there is maladaptive behaviour/psychiatric disorder. It could be that the high prevalence of ASD in this sample can account for this finding. Future studies with larger samples can clarify this issue. The non-significant association between emotional development and chronological age indicates good divergent validity.

The sample in the current study predominantly included children who were in the first four stages of emotional development but it lacked the fifth developmental age group concerned with Reality Awareness, possibly due to the fact that only children younger than 18 years were included. With this underrepresentation of the fifth SED-S level, limited inferences can be made about the association of emotional and adaptive functioning in this area. To assess the fifth level, the chronological age range could be broadened to young adulthood. However, an alternative explanation could be that collecting the data within care organisations created a bias, as children within the fifth stage do not receive care from these organisations. Future studies could consider recruiting in outpatient settings as well. After the proposed extension of the SED-S to include older developmental stages up to 18 years, the new version should be tested on typical and non-typical groups.

The current work demonstrated differences between children with and without ASD. As individuals with both ID and ASD likely display severely impaired adaptive functioning, they are more prone to develop challenging behaviours (Mutsaerts, Heinrich, Sterkenburg, & Sappok, 2016), and it is therefore particularly important to examine their level of emotional functioning. In this study, the children with ASD had a lower level of emotional functioning than the children without ASD. This was consistent with the findings reported by Sappok et al. (2013), who used the SAED in an adult population. The *Body, Object,* and *Material* domains seem not to be affected by ASD. Greater focus on lower scores on the other domains when reporting the assessment outcomes may therefore

contribute to early screening of ASD and may contribute to the understanding and prevention of challenging behaviour.

A possible limitation of the current work is the sample size, as the sample of children with a visual or auditory impairment was very small. Regardless, visual and/or auditory impairment was found to have a negative effect on emotional functioning, specifically for *Others* (relating to significant others). This supports the finding of Hoevenaars-van den Boom et al. (2009) that visual impairment hinders communicating and interacting with other people. As visual and/or auditory impairment are often not assessed in persons with intellectual disabilities (Evenhuis et al., 2007), a low score on the *Others* domain may support the importance of conducting visual and/or auditory assessments. However, these findings need to be regarded very cautiously, and future studies should include a larger sample of children with visual and/or auditory impairments.

Although there may be some cultural differences between Switzerland and the Netherlands, the study design was the same, with similar distributions in gender and severity of intellectual disabilities. One cultural aspect could be underreporting of challenging behaviour, since it was reported in only 15 % ($n = 17$: $n = 6$ in Switzerland, $n = 11$ in the Netherlands) of the cases. One possible explanation is that the prevalence may have been underreported due to cultural differences in defining challenging behaviour. In the GermanGerman version of the questionnaire, challenging behaviour is called 'verhaltensstörung', which translates to *behaviour disorder*. Although the German version could be used in Switzerland, it is uncommon to refer to challenging behaviour as a behaviour disorder, and therefore the prevalence of challenging behaviour may be lower than reported elsewhere. Second, in Switzerland most interviews were taken with caregivers, whereas in he Netherlands the majority of the interviews were conducted with parents. Because the SED-S items are based on observable behaviour, that different informants can provide valuable results that can all be used in the assessment. Furthermore, in the Netherlands, two informants who knew the child well participated, and in Switzerland there was one informant. For practical reasons, only one informant participated in Switzerland data collection. Although there is no reason to believe that the results here would have been different, in future studies we recommend that two informants be interviewed as this can contribute to more reliable scoring of the SED-S.

4.1. Recommendations

In order to provide more evidence for the comorbidity of ASD and visual and auditory impairments with emotional functioning, a larger sample of children with ID and other disorders/impairments is needed, since these comorbidities were shown to influence their emotional functioning. Furthermore, the *Object* domain of the SED-S should be analysed in more detail. It is recommended that the SED-S be used in daily caregiving to provide adequate care that matches the emotional needs of individuals with ID. With a disharmonious profile, it remains important to analyse the results carefully so they contribute to appropriate support and mental health.

5. Conclusions

The SED-S was found to be reliable and valid among children with ID. The convergent validity was good and there was a strong intra-domain consistency, indicating that the SED-S is a reliable instrument. The divergent validity was high in the low IQ range but not in the high IQ range. The SED-S differentiates well from adaptive functioning in the lower range of the scale, but does not differentiate from adaptive functioning in the higher range of the scale. Furthermore, the SED-S discriminates well between the presence and absence of ASD and visual and/or auditory impairments. Due to the indicated convergent validity, the SED-S can be used to identify the emotional needs of children with ID and detect early signs of possible mental health problems. Early assessments of emotional functioning, especially if challenging behaviour occurs, combined with matching interventions, may help to prevent behavioural and mental health difficulties and may contribute to the well-being of children with intellectual disabilities.

Author contribution

JH, JV and SZ collected the data. JH wrote the first version of the introduction. GK conducted the data analyses and wrote the first version of the methods and results section. PS wrote the second version of the paper. MH contributed to writing the discussion. Thereafter all authors contributed in all parts of the article. PS coordinated the study.

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Declaration of Competing Interest

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