BMC Psychology

https://doi.org/10.1186/s40359-026-04944-1

Article in Press

A multi-study validation of the Turkish Early Social Cognition Inventory (T-ESCI) in infants and toddlers

Received: 17 February 2026

Accepted: 2 June 2026

Published online: 11 June 2026

Cite this article as: Soy Telli B., Yavaslar Dogru Y., Koc-Arik G. *et al.* A multi-study validation of the Turkish Early Social Cognition Inventory (T-ESCI) in infants and toddlers. *BMC Psychol* (2026). https://doi.org/10.1186/s40359-026-04944-1

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Abstract

Social cognition encompasses various mental abilities and processes through which individuals to understand and engage with others. The Early Social Cognition Inventory (ESCI) assesses skills such as joint attention, imitation, and mental state understanding through parental reports. While the ESCI has shown reliability in English-speaking contexts, this study adapts it for Turkish-speaking children aged 4 to 39 months, focusing on psychometric properties within a non-WEIRD context. In Study 1 ($N = 124$; $M_{age} = 22.35$, $SD = 10$), factor analysis revealed that, unlike the original two-factor model, the Turkish ESCI followed a one-factor structure. Two items with low factor loading was removed, resulting in a 19-item version with strong internal reliability. Study 2 ($N = 122$; $M_{age} = 22.20$, $SD = 10.31$) assessed convergent validity, revealing strong correlations between the ESCI scores and the Modified Checklist for Autism in Toddlers Revised (M-CHAT/R-F). Study 3 ($N = 52$; $M_{age} = 19.56$, $SD = 10.36$) confirmed test-retest reliability over one month. Finally, Study 4 combined data from Studies 1 and 2 ($N = 246$; $M_{age} = 22.28$, $SD = 10.14$) to confirm the internal reliability of the ESCI across various demographic groups, demonstrating its suitability across diverse populations. The Turkish ESCI is thus a valid, reliable tool for assessing social cognition in young children, enabling research into individual and cultural differences in non-Western settings.

A Multi-Study Validation of the Turkish Early Social Cognition Inventory (T-ESCI) in Infants and Toddlers

Social cognition describes a wide variety of mental abilities and processes that people use to communicate with and comprehend others (1). Social cognition includes several mental processes including imitation, joint attention, intentions, emotions, desires, knowledge and beliefs (2–5). Children master different aspects of social cognition from infancy to early childhood (4,5). During this period, social cognition is crucial because it directly relates to numerous areas of child development including executive

functions (6–12), language (13), humor (14), pretend play (15), trust (16), deception (17,18), prosocial behavior (19) and metamemory (20). Therefore, it is regarded as one of the key turning points in understanding the social world.

Standardized behavioral measures in the experiments have dominated the field in the study of social cognition and have led to the development of test batteries for young children (21–23). Although these measures are valid and reliable, they have some limitations in exploring social cognition comprehensively. First, before behavioral measures were developed into a valid and reliable battery (21), social cognition was reduced to only a few tasks such as false belief and/or perspective-taking (24–27), although it is a more comprehensive construct. Even if some batteries relied on multiple socio-cognitive tasks, they mostly focused on older children (21,22). Also, implementation of these batteries is costly due to the materials involved and time-consuming, in some cases requiring multiple lab visits. Second, these tasks are also criticized as requiring high expectations/demands from young children (24,28,29). Third, behavioral measures of social cognition may have limitations in lack ecological validity (30–33). These limitations of behavioral measures of social cognition have led researchers to seek new methods. One of the most important of these methods is the parental reports to assess children's socio-cognitive skills (34–36). These surveys assess the socio-cognitive skills of children between from 2 to 12 years, not only for those with typical development, but also adapted for those with development differences (34,37,38). Additionally, the survey developed by Ekerim Akbulut et al., (2021) enables us to test social cognition through more than one informant as it allows us to obtain information not only from parents but also from teachers. These time-and-cost-effective surveys provide opportunities to assess whether behaviors observed in structured assessment contexts also occur in home or school settings. Furthermore, these surveys have been applied as valid and reliable measurement tools in

many different cultures such as China (40), France (41,42), Iran (43), Poland (38,44), South Korea (45) and Türkiye (39,46).

Yet, existing parental reports have neglected socio-cognitive skills under 2 years of age (34–36), even though social cognition develops from birth. For this reason, Hoicka and her colleagues (2022) developed the Early Social Cognition Inventory (ESCI) to examine socio-cognitive development in typically developing children from infancy. This 21-item parental report covers joint attention, imitation, understanding intentional and unintentional actions, desires, emotions, beliefs and false beliefs. Each item asked parents to indicate whether children were aware of their own and others' mental states, including emotions, intention, and beliefs. The ESCI revealed excellent internal reliability (α = .95) with a two-factor structure (social cognition and age) and a medium correlation with a researcher-administered social cognition task battery. Hoicka et al., collected data from English-speaking countries, mostly from the United Kingdom, the United States, Canada, Australia, and Trinidad and Tobago when developing the survey, in contrast to measures of social cognition previously developed by collecting data from one or two countries (34–36). The ESCI was found to be a reliable and valid tool across several cultures. Recently, the ESCI was also found to be a reliable and valid instrument for the assessment of social cognition in autistic children under 5 years of age in Iran (48). Additionally, the ESCI was used to find correlations with humor in young children, and to find humor predicted social cognition 6 months later (14).

A major benefit of the present study will be to examine socio-cognitive development more easily in a non-WEIRD (western, educated, industrialized, rich and democratic) culture, allowing theories and research in social cognition to be more inclusive of cultural differences and similarities. Nielsen et al., (2017) showed 90.52% of high-impact-factor developmental journals published studies conducted in WEIRD countries between 2006 and 2010, while 6.76% published studies conducted in non-

WEIRD countries. This raised questions about the lack of diversity and the neglect of the influence of culture in child development. Indeed, some studies revealed cultural differences in early parental experiences and early social learning between WEIRD and non-WEIRD countries (50,51). For example, in a rural region of Cameroon, children of parents using proximal parenting developed self-regulation skills earlier, while in an urban region of Greece, children of parents using distal parenting developed self-recognition earlier (50). This shows how cultural aspects shape children's cognitive skills. Similarly, differences were found between WEIRD and non-WEIRD countries in the development of social cognition (21,52–54). In individualistic societies such as the United States or Australia (21,54), children understand diverse beliefs before knowledge access, whereas in collectivistic societies such as China, Iran or Türkiye (52,53), children develop knowledge access earlier than understanding diverse beliefs. Indeed, in a study involving 36 countries, Türkiye showed non-WEIRD characteristics (55).

A parent survey developed for 2- to 6-year-olds measuring social cognition (Tahiroglu et al., 2014) was successfully adapted to a Turkish sample (39). However, such a parental survey for younger age groups is not yet available in Türkiye. Therefore, the aim of the present study is to adapt the ESCI to a Turkish sample and explore its psychometric properties among non-English speaking, non-WEIRD children with typical development. This will help determine whether the ESCI is useable across different types of populations, and potentially provide a tool for research based in Türkiye. This study will also allow us to assess the developmental level of the child and explore individual differences in social cognition. To achieve this, Study 1 ($N = 124$) explored the factor structure of the Turkish ESCI (T-ESCI) with Bayesian Structural Equation Modeling (SEM) and internal reliability with Kuder-Richardson-20 (KR20) analysis. Study 2 ($N = 122$) examined the convergent validity of the T-ESCI with the Modified Checklist for Autism in

Toddlers Revised (56), a widely used screening instrument that assesses early social-communication difficulties characteristic of autism spectrum disorder. Because these early social-communicative behaviors overlap conceptually with core components of social cognition (e.g., joint attention and social reciprocity), significant associations were expected. Study 3 (N = 52) analyzed test-retest reliability one month apart. By combining data from Studies 1 and 2, Study 4 (N = 246) checked whether the T-ESCI is internally reliable in terms of demographic variables.

Study 1: Factor Analysis

Participants

Although 171 participants were initially recruited, data from 47 children were excluded from the T-ESCI since they were not in the target group due to their age (47). One additional child was excluded due to having a developmental disorder. The final sample included 124 children (M_{age} = 22.35, SD = 10; 63 boys, 61 girls). Sample size adequacy in confirmatory factor analysis depends on communalities and model determination rather than fixed rules (57). Given that the model was unidimensional and all standardized loadings exceeded .50, indicating strong communalities, the sample was considered sufficient for stable parameter estimation. All participants completed a demographics survey and the T-ESCI (see Table 1). The surveys were created in Google Forms and shared with parents through social media channels (including Facebook, Instagram or WhatsApp). Informed consent was obtained from the parents at the beginning of the survey. The survey took around 10 minutes to complete. Data collection lasted around three months. Parents were not paid for this study. The corresponding author can provide the data upon request.

Measures

Turkish Early Social Cognition Inventory (T-ESCI). The Early Social Cognition Inventory (ESCI) was designed to assess the development of socio-cognitive abilities in 4- to 39-month-olds (Hoicka et al., 2022). The ESCI consists of 21 Yes/No questions for parents to answer. Example questions included “Does your child follow where you point to look at the same things as you?” (Hoicka et al., 2022, p. 1204) or “Does your child understand that sometimes other people have different desires to themselves? E.g., other people might like broccoli, even if they don’t” (Hoicka et al., 2022, p. 1204). Across six studies, the ESCI showed, a two-factor structure, excellent internal reliability, 1-month test-retest reliability, longitudinal stability over six months, reliability across different parental education levels and countries, and positive associations with household income (Hoicka et al., 2022).

Researchers who designed the ESCI in England were contacted and permission was requested to translate the survey into Turkish and use it in Türkiye. After obtaining permission, the survey was translated by the authors. Then, using the back-translation method, two researchers who had never seen the original English version translated it back into English. This back-translated survey was sent to the team that designed the survey to ensure the original version was adhered to. Ethical approval was obtained from XXX University Ethics Committee (Reference number: 2400043418) in accordance with the Declaration of Helsinki.

Table 1

Participants’ Demographic Characteristics

	Study 1	Study 2	Study 3
N	124	122	52
Children's Age			
Mean (months; days)	22;35	22;20	19;56
SD	10	10.31	10.36

Range	4-39	4-39	5-39
Children's Gender			
Female	61	61	24
Male	63	61	28
Child's Language			
Turkish only	99	104	48
Bilingual	25	15	3
Multilingual	-	3	1
Siblings			
Yes	41	32	10
No	82	89	42
Not reported	1	1	-
Childcare hours			
Mean	8.87	8.41	6.56
SD	15.43	16.35	12.98
Range	0-50	0-60	0-50
Not reported	3	1	-
Premature			
Yes[1]	11	9	0
No	113	112	52
Not reported	-	1	-
Parent's Age			
Mean (years)	33.03	32.33	31.35
SD	4.71	3.81	2.93
Range	23-46	20-49	26-38
Not Reported	1	-	-
Parent's Gender			
Female	95	114	49
Male	29	8	3
Parent's Education			

Primary school	3	1	-
Middle school	4	3	1
High school	17	13	5
University degree	68	84	37
Master's degree	25	18	8
Doctorate degree	8	3	1
Monthly income (TL)[2]			
Mean	47,060.18	68,800.88	63,824.1
SD	36,121.957	79,297.46	28,255.0
Range	10,000-235,000	12,000-800,000	25,000-140
Not reported	11	9	4

Note. [1] We included children born prematurely if they had no developmental disorders. [2] The minimum wage was 10,000 in 2023 and 17,000 TL in 2024.

Results

Initially, we checked participants correctly answered one control question in the T-ESCI (If you read this question, please select the answer "No"). Age was calculated in days, allowing us to capture the changes that might occur in a very short time during the early years (47).

Consistent with the original ESCI, we initially tested a two-factor structure comprising social cognition and age (47). Importantly, the age factor is not interpreted here as a substantive latent construct equivalent to social cognition. Rather, because the measure spans a broad developmental period, it likely captures age-related variance associated with developmental progression across items. This interpretation is consistent with Hoicka et al. (2022), who likewise described the first factor as reflecting social cognition more generally and the second as reflecting age in a measure designed to track development.

To examine the factor structure of the T-ESCI in Study 1, we conducted Bayesian SEM in AMOS because the inventory consists of

dichotomous (Yes/No) items (47,58). Consistent with the original ESCI, we initially specified a two-factor model including social cognition and age. During preliminary estimation, the default Random Walk setting did not appear to yield satisfactory sampling behavior. We therefore reduced the tuning parameter from .70 to .40 to improve sampling efficiency and support stable convergence, in line with standard Random Walk tuning principles and prior applied use of this setting in AMOS (47,59). Convergence was monitored using the AMOS convergence statistics, with values closer to 1 indicating better convergence; we evaluated convergence against a criterion of 1.03, which was used as a pragmatic threshold for stable estimation (58,60). Although the model reached convergence under these settings, overall fit was not adequate. Specifically, the posterior predictive p value (PPP) was .00. Because PPP values closer to .50 indicate better fit, whereas values near 0 or 1 indicate poor fit, this result suggested that the hypothesized two-factor model did not fit the data well (61–63).

As we were unable to fit a two-factor model, we then tested a one-factor model designed to assess social cognition more broadly. Within the Bayesian SEM, we altered the Random Walk tuning parameter from 0.7 to 0.4 and we fixed the value of convergence at 1.03 (Gelman et al., 2013). The model attained convergence, with Posterior predictive p value (PPP) of .43, which is acceptable. The DIC value was not calculated since we only evaluated the model with one factor structure. Moreover, the standardized regression weight means (standardized direct effects) showed that items in the T-ESCI loaded onto the Social Cognition factor at values between .27 and .99 (Table 2). Furthermore, the survey items' 95% standardized credible intervals fell between -.27 and .99 for the lower and upper bounds, indicating there might be an uncertainty about the direction of the item loadings’ effects.

Internal consistency was evaluated using the Kuder–Richardson Formula 20 (KR-20), a reliability coefficient suitable for dichotomous (e.g.,

yes/no) items, equivalent to Cronbach Alpha (64). As the ESCI consists of binary-scored items, KR-20 was considered the most appropriate index of internal consistency. We also analyzed the link between the age of the children (in days) and the T-ESCI total score with Pearson correlations. Both variables were within a level of skewness widely considered as acceptable ± 2 (65). *KR20* = .91, demonstrating a high level of internal reliability for the T-ESCI items. The two variables showed a very strong positive correlation, $r(124) = .80$, $p < .01$, suggesting T-ESCI scores increased with age. However, Table 2 demonstrates that item 1 had a factor loading of .16 and item 9 had a factor loading of -.11, both of which fall below the acceptable threshold of .30 (66). Therefore, we cut items 1 and 9 and re-ran the SEM. After items 1 and 9 were deleted, the internal reliability score improved from .91 to .93, and the correlation between children's age and total T-ESCI scores also increased from .79 to .81. Additionally, we observed superior fit measures in the Bayesian SEM after item 1 and item 9 were removed. Specifically, the PPP value increased from .43 to .46, which is closer to the ideal range of .50. The standardized regression weight means (standardized direct effects) indicated the remaining 19 items loaded onto the Social Cognition factor, with values ranging from .62 to .98 (Table 2). Furthermore, the 95% standardized credible intervals for the inventory items fell between .44 and .99 for the lower and upper bounds, meaning that all effect sizes are now positive. For these reasons, in the present study, the T-ESCI used 19 items.

Table 2

Factor Loadings (Standardized Regression Weights) and Item-total Correlations for the 21-item Version and for the 19-item Version of the T-ESCI

	21-item version	19-item v

Item	Question	Bayesian SEM standardized regression weights (direct effects)	Item-total correlations	Bayesian S standardi regressi weights (d effects
1	“Does your child follow where you look in order to look at the same thing as you?”[a] (Çocuğunuz sizinle aynı şeylere bakmak için baktığınız yeri takip ediyor mu?)	.27	.11	
2	“Is your child aware of other people’s motives? E.g., that they might give someone a gift in order to make them happy.”[a] (Çocuğunuz diğer insanların güdülerinin farkında mı? Örneğin insanlar, birini mutlu etmek için ona hediye verebilir.)	.94	.70	.93
3	“Is your child aware of their own desires? E.g., prefer chocolate over broccoli.”[a] (Çocuğunuz kendi isteklerinin farkında mı? Örneğin, çikolatayı brokoliye tercih etmek.)	.52	.44	.62

4	“Is your child aware that other people may know the same information they do? E.g., they know where a certain book is kept, and they know their dad knows where that book is kept too.”[a] (Çocuğunuz, diğer insanların da kendileriyle aynı bilgileri bildiklerinin farkında mı? Örneğin, çocuğunuz belirli bir kitabın nerede olduğunu bilir ve babasının da o kitabın nerede olduğunu bildiğini bilir.)	.92	.70	.83
5	“Is your child aware of other people's perspectives? E.g., could they tell sometimes they can see something, but someone else can’t, because it’s not in their line of sight.”[a] (Çocuğunuz başkalarının görüş açılarının farkında mı? Örneğin, kendisinin görebildiği bir nesneyi, başkalarının görüş alanında olmadığı için, aynı nesneyi onların göremeyeceklerini söyleyebilir mi?)	.89	.57	.86

6	"Is your child aware of his/her own mistakes? E.g., if s/he drops something by accident."[a] (Çocuğunuz kendi hatalarının farkında mı? Örneğin, yanlışlıkla bir şeyi düşürürse.)	.84	.61	.80
7	"Does your child perform actions intentionally? E.g., stack blocks on purpose, instead of by trial and error."[a] (Çocuğunuz bilerek, isteyerek eylemlerde bulunuyor mu? Örneğin, deneme yanılma yerine, oyun küplerini amaçlı olarak üst üste dizmek.)	.82	.63	.82
8	"Does your child follow where you point to look at the same things as you?"[a] (Çocuğunuz sizinle aynı şeylere bakmak için işaret ettiğiniz yeri takip ediyor mu?)	.99	.50	.99
9	"Does your child look back and forth between you and an object, instead of only looking at you or only at an object?"[a]	-.11	-.08	-

	(Çocuğunuz yalnızca size veya bir nesneye bakmak yerine, sizinle nesne arasında ileri geri bakıyor mu?)			
10	"Does your child understand that sometimes things aren't as they appear? E.g., something that looks hard might feel soft."[a]	.77	.54	.71
	(Çocuğunuz, bazen nesnelerin göründüğü gibi olmadığını anlıyor mu? Örneğin, sert görünen bir şey yumuşak olabilir.)			
11	"Does your child copy others in order to achieve the same goal? E.g., copying pressing a button to make a song play on a toy."[a]	.81	.58	.74
	(Çocuğunuz aynı hedefe ulaşmak için başkalarını kopyalıyor mu? Örneğin, birisi şarkı çalmak için oyuncağın düğmesine bastığında, aynı hareketi kopyalama.)			
12	"Is your child aware that sometimes other people don't have the same beliefs as them? E.g., your child might	.87	.51	.91

	think dogs are the best animal, but they understand that their sister thinks cats are the best animal."[a] (Çocuğunuz bazen diğer insanların kendileriyle aynı kanıya/düşünceye sahip olmadığının farkında mı? Örneğin, çocuğunuz köpeklerin en iyi hayvan olduğunu düşünebilir, ancak kız kardeşinin kedilerin en iyi hayvan olduğunu düşündüğünü anlar.)			
13	"Is your child aware of their own emotions? E.g., happy, sad, angry, etc."[a] (Çocuğunuz kendi duygularının farkında mı? Mutlu, üzgün, kızgın vb.)	.89	.67	.86
14	"Does your child point to get something from you? E.g., to get a toy that is out of reach."[a] (Çocuğunuz sizden bilgi almak için parmağıyla işaret ediyor mu? Örneğin,	.97	.65	.96

	ulaşamadığı bir oyuncağı almak için.)			
15	“Does your child understand that sometimes other people have different desires to themselves? E.g., other people might like broccoli, even if they don’t.”[a] (Çocuğunuz, bazen diğer insanların farklı istekleri olduğunu anlıyor mu? Örneğin, kendisi sevmese bile, başkaları brokoliyi sevebilir.)	.91	.67	.83
16	“Does your child point to share information with you? E.g., point to show you a dog in the park.”[a] (Çocuğunuz sizinle bilgiyi paylaşmak için parmağıyla işaret ediyor mu? Örneğin, parktaki bir köpeği size göstermek için işaret etmek.)	.99	.71	.94
17	“Is your child aware of other people’s emotions? E.g., happy, sad, angry, etc.”[a] (Çocuğunuz diğer insanların duygularının farkında mı?	.81	.60	.77

	Örneğin, mutlu, üzgün, kızgın vb.)			
18	“Is your child aware that other people may have the same beliefs as them? E.g., that dogs are the best animals.”[a]			
	(Çocuğunuz diğer insanların kendileriyle aynı kanıya/düşünceye sahip olduğunun farkında mı? Örneğin, kendileri gibi başkaları da köpeklerin en iyi hayvanlar olduğunu düşünebilir.)	.95	.65	.95
19	“Is your child aware that sometimes other people don’t know the same information they do? E.g., child might know where a toy is, but dad might not.”[a]			
	(Çocuğunuz bazen başkalarının kendileriyle aynı bilgileri bilmediğinin farkında mı? Örneğin, çocuğunuz oyuncağın nerede olduğunu biliyor olabilir ama babası bilmiyor olabilir.)	.93	.71	.89

20	"Does your child understand what it means for others to make mistakes? E.g., that they dropped a plate by accident."[a] (Çocuğunuz hata yapmanın başkaları için ne anlama geldiğini anlıyor mu? Örneğin, başkasının kazara bir tabak düşürmesi.)	.92	.67	.86
21	"Does your child perform actions with specific goals in mind? E.g., stacking blocks specifically to make a house."[a] (Çocuğunuz belirli hedefleri göz önünde bulundurarak eylemler gerçekleştiriyor mu? Örneğin, bir ev yapmak için blokları üst üste dizmek.)	.77	.57	.71

Note. Turkish versions of the items are in parentheses. [a](Hoicka et al., 2022, p. 1204)

Discussion

Study 1 found 19 of the 21 T-ESCI items established a united scale with a one factor structure. The T-ESCI showed good internal reliability. Although the original ESCI obtained a two-factor structure (Hoicka et al., 2022), we obtained a one factor structure, suggesting age of emergence was not as

strong a factor for Turkish children as it was for English-speaking children. Study 2 examined the convergent validity of the ESCI with a measure we believe captures social cognition in a separate sample.

Study 2: Convergent Validity

Participants

Based on a power analysis, 84 children were considered sufficient to detect a two-tailed medium correlation (r =.3) (Hoicka et al., 2022; Tahiroglu et al., 2014) with α = .05, power = .80 (67). N = 122 parents of children participated (M_{age} = 22.20, SD = 10.31; 61 boys, 61 girls), with recruitment conducted as in Study 1. Participants were excluded for reporting incorrect birth dates (2); failing the control question (1); and due to a developmental disorder (1). All participants completed a demographics survey (Table 1).

Measures

ESCI. Parents completed the final 19-item T-ESCI through Google Forms online.

Modified Checklist for Autism in Toddlers Revised (M-CHAT/R-F). This parent-report tool was adapted to Turkish for children in risk with pervasive developmental disorders (68) and used to screen the development of Autism Spectrum Disorder in typically developing children under 36 months (56). The M-CHAT/R-F consisted of 20 Yes/No questions for parents to answer. Example questions included “If you point at something across the room, does your child look at it? (For example, if you point at a toy or an animal, does your child look at the toy or animal?)” (Robins et al., 2001, p. 142) or “Does your child play pretend or make-believe? (For example, pretend to drink from an empty cup, pretend to talk on a phone, or pretend to feed a doll or stuffed animal?) (Robins et al., 2001, p. 142). Although M-CHAT/R-F is not a social cognition survey, 8 items are similar to the ESCI.

Therefore, the researchers who developed the autism version of the ESCI applied M-CHAT/R-F to test convergent validity of the ESCI, following Sadeghi et al., (2024). It was also previously administered to a large sample of typically developing children in Türkiye for screening purposes (56), thus, children do not need to show atypical development to be eligible.

Results

Internal reliability for the 19 T-ESCI items was excellent, $N = 122$, KR20 = .93. Internal reliability for the 20 MCHAT/R-F items was good, $N = 122$, KR20 = .83. Total scores on the MCHAT/R-F strongly correlated with the T-ESCI (Spearman's *rho* = .72, $p < .01$). However, as age in days positively correlated with both the T-ESCI ($r = .85$, $p < .01$) and MCHAT/R-F ($r = .70$, $p < .01$), we ran partial correlation between the T-ESCI and the MCHAT/R-F controlling for age in days. A partial Pearson's correlation found a significant moderate correlation between the T-ESCI and the MCHAT/R-F ($r' = .52$, $p < .001$) when age in days was controlled for.

Discussion

Study 2 found the T-ESCI and MCHAT/R-F were correlated well, even when controlling for age, indicating convergent validity. Study 3 examined whether parents were consistent while evaluating their children's socio-cognitive skills 1 month later. Therefore, parents in Study 2 were contacted twice to determine test-retest reliability.

Study 3: 1-month Test-Retest Reliability

Participants

Based on a power analysis, 29 children were considered sufficient to detect a two-tailed large correlation ($r = .50$) (Hoicka et al., 2022; Mayes et al., 1994; Tahiroglu et al., 2014), with α = .05, power = .80 (67). For test-retest reliability, only participants who shared their contact information in Study 2 were contacted again by email or telephone to repeat the T-ESCI after 1

month. Fifty-two participants repeated the survey. Demographics information is in Table 1. Each participant who repeated the survey received a shopping gift card.

Measures

ESCI. Parents repeated the final 19-item T-ESCI through Google Forms online one month after initial completion

Results

A Pearson correlation analysis found total T-ESCI scores at Times 1 and 2 were collinear ($r = .91$, $p < .001$). The T-ESCI at Times 1 and 2 were significantly and strongly correlated, even when age in days at both times points controlled ($r' = .73$, $p < .001$). We also checked whether any difference occurred in T-ESCI scores at Times 1 ($M = 11.44$, $SD = 5.22$) and 2 ($M = 12.06$, $SD = 4.92$). The paired-sample t test demonstrated a significant difference ($t = 2.02$, $p = .049$), suggesting scores increased with age.

Discussion

Even when controlling for age, Study 3 showed parents exhibited very good test-retest reliability over a one-month period, and children's scores increased with age. In Study 4, we combined data from participants in Studies 1 and 2 to investigate the internal reliability of the ESCI and potential differences across various demographic groups.

Study 4: Demographics Differences

Participants

Posthoc power analyses found 128 children were required for a two-tailed medium correlation ($f = .25$) with $\alpha = .05$, power = .80 (67). We combined data from Studies 1 and 2 ($N = 246$, see Table 1) to detect demographic differences.

Measures

ESCI. See Study 1.

Results

Reliability within different demographic groups. The T-ESCI's internal reliability was excellent for parents with a university degree or higher (master's, doctorate) ($N = 206$, $KR20 = .93$), and without a university degree ($N = 40$, $KR20 = .91$). The T-ESCI's internal reliability was also excellent for monolingual ($N = 203$, $KR20 = .93$), and multilingual ($N = 43$, $KR20 = .91$) children.

Demographic differences. We conducted ANCOVAs with T-ESCI scores as the dependent variables; either child gender, language (mono or multilingual), siblings, or parent gender as the independent variable; and child age in days as a covariate. None of the demographic variables were significant (child gender, $N = 246$, $p = .297$; language, $N = 246$, $p = .498$; siblings, $N = 244$, $p = .945$; and parent gender, $N = 246$, $p = .085$). We also performed linear regression analysis with the T-ESCI as the dependent variable; child age in days as independent variables in step 1; and either parent age, childcare hours, or monthly income, as the independent variable in step 2. All demographic variables were within a level of skewness widely considered acceptable ± 2 (65), except for monthly income. Therefore, we normalized monthly income with a cube root (71). None of the demographic variables were significant (parent age, $N = 220$, $\beta = -.022$, $p = .666$; childcare hours, $N = 220$, $\beta = .005$, $p = .735$; monthly income $N = 220$, $\beta = -.028$, $p = .298$).

Discussion

The T-ESCI demonstrated internal consistency across subgroups defined by parental education and children's linguistic background (monolingual or multilingual). There were no demographic differences across child gender, language, siblings, parent gender, parent age, parent education, weekly

childcare hours and monthly income. This suggests the T-ESCI is a valid and reliable social cognition measure across various demographics groups.

General Discussion

Our study showed that the 19-item, 1-factor T-ESCI is a reliable and valid measure of social cognition from 4- to 39-month-old Turkish children. The T-ESCI showed convergent validity with the M-CHAT/R-F when controlling for age. Furthermore, test-retest reliability after 1 month also showed a strong correlation when age was controlled, and ESCI scores increased with age, converging with the original ESCI (Hoicka et al., 2022). Finally, the T-ESCI was reliable and valid across different parental education levels, and across mono- and multi-linguals. Furthermore, there were no demographic differences based on the above variables, or child gender, parent gender, having siblings, parent age, childcare hours, or income.

Comparing to the original ESCI, the T-ESCI had a 1-factor structure, as opposed to the two-factor structure of the English version (Hoicka et al., 2022). In English-speaking children, social cognition is structurally differentiated based on age (older/younger) (Hoicka et al., 2022), whereas the T-ESCI demonstrated a one-factor structure suggesting children tend to perform better on the survey as they get older, but no distinct age-specific factor was found. Interestingly, items 1 and item 9 were removed from the T-ESCI due to poor links with other items. Item 1 was “Does your child follow where you look in order to look at the same thing as you?” and Item 9 was “Does your child look back and forth between you and an object, instead of only looking at you or only at an object?” There may be a few reasons why these items were not related to other items. First, these were two of the three items without examples. It may have, therefore, been unclear to parents what this items meant. Another possibility is that Turkish parents have more dyadic rather than triadic engagements with their children. This may happen so rarely that they did not notice their child's gaze shifting back and forth between an object and themselves. Indeed, a

recent study found differences in the way parents from two different cultures, indigenous Wichi and Eurodescendant Spanish speaking communities, interact with their children in Argentina (72). Wichi parents formed dyadic engagement with their children, while Euro-descendant parents formed triadic engagements. Notably, other joint attention items in the survey (e.g., Items 8, 14, and 16) showed strong factor loadings in the Turkish sample, suggesting that caregivers are indeed able to observe and report certain forms of joint attention behavior. A more plausible explanation is that the poorly performing items may require the observation of subtler or less frequently occurring behaviors (e.g., spontaneous gaze alternation without explicit prompting), whereas better-performing items involve more overt, goal-directed, and easily observable behaviors such as pointing or following pointing. Thus, item content and observability, in addition to cultural interaction patterns, may jointly account for the differences in factor loadings.

Finally, the demographic differences findings were consistent with the original survey except for one demographic variable: in the original study, children with siblings had higher scores (Hoicka et al., 2022). This may be due to both the larger sample size in the original study and cultural differences as the sample consists of many countries.

There are numerous benefits of adapting the ESCI to Turkish. First, social cognition can be examined for the first time in infants as young as 4 months in Türkiye. This will provide us knowledge about how social cognition develops in children under 2 years of age. Second, a notable benefit is that the ESCI has been validated in a non-WEIRD country. Nielsen et al. (2017) pointed out that the publication of more research in high-impact developmental journals in WEIRD countries leads to the generalization and acceptance of the developmental skills of western children there as a norm. This can lead to an underestimation of culture-specific developmental changes in non-WEIRD countries.

Third, the relationship with other cognitive structures known to be related to the development of social cognition under 3 years of age such as executive functions (11), deception (17) or metamemory (20) can be more easily studied within a Turkish context. This may reduce the sampling bias emphasized by Nielsen et al. (2017) and allow for cultural comparisons of other cognitive constructs related to social cognition. Therefore, future studies can investigate which factors contribute to the development of social cognition, and whether social cognition contributes to other cognitive constructs within Türkiye, allowing us to better understand how universal or culture-dependent socio-cognitive development is. Indeed, several studies found the sequence in which children acquire socio-cognitive skills with age is different in western (21,54) and non-western countries (52,53). In Western countries, children acquire socio-cognitive skills in the sequence of diverse desires, diverse beliefs, knowledge access, false beliefs and hidden emotions (21,54), while in non-Western countries, including Türkiye, knowledge access precedes diverse beliefs (52,53). Lastly, using surveys to measure social cognition is both economical and time efficient. Unlike behavioral measures of social cognition (21,22), larger samples are achievable in a short time (14).

The current study has some limitations. The most important limitation is that, in contrast to the original study (Hoicka et al., 2022), instead of using behavioral measures of social cognition for convergent validity, we used a different parental survey (56). This may have led to the issue of social desirability. Some parents may answer “Yes” to more questions to be socially desirable, therefore, we may find a significant correlation between parental surveys. In addition, some parents may be more observant of their children’s behaviors. Notably, the use of multiple surveys for convergent validity is widely used in the developmental field and has several benefits such as systematic data collection, analysis of complex samples or analysis of non-experimental cross-sectional and longitudinal data (73). Future

studies could look at whether the T-ESCI relates to behavioral measures of social cognition. Second, our study does not provide data from a second parent for inter-observer reliability. The reliability of these single-parent data may be questionable. However, in our study we included control questions to check whether parents actually read the items, so we can assume participants read and understood each item. Furthermore, we provided 1-month longitudinal data which showed consistent reporting by parents. Future research may investigate how social cognition develops within the same children over a longer time period. Third, divergent validity was not examined in the current study. Moreover, divergent validity analyses were also not reported in the original development of the ESCI (47). One possible reason for this is the lack of appropriate measurement instruments that are unrelated to social cognition but applicable across a wide developmental range (4–39 months), which spans both infancy and early childhood. However, future studies should examine the divergent validity of the T-ESCI using at least performance-based measures that are theoretically unrelated to social cognition. Finally, measurement invariance across cultural or demographic groups was not examined at the level of the factor model. Specifically, we did not test whether the T-ESCI operates equivalently across groups in terms of factor loadings or latent means. Consequently, potential group differences may be influenced not only by true differences in the underlying construct but also by untested measurement non-invariance. Future research should address this issue by applying more advanced techniques, such as moderated nonlinear factor analysis, to ensure that the scale functions equivalently across different populations and to obtain more accurate comparisons between groups (74–76).

Conclusions

The T-ESCI is a valid and reliable tool to measure social cognition in typically developing Turkish children from 4 to 39 months. It enables us to

investigate individual differences in social cognition across a wide age range. In addition, the T-ESCI will allow us to make cultural comparisons about the development of social cognition in children growing up outside of WEIRD cultures.

Declarations

Abbreviations

ESCI: The Early Social Cognition Inventory

T-ESCI: The Turkish Early Social Cognition Inventory

M-CHAT/R-F: The Modified Checklist for Autism in Toddlers Revised

WEIRD: Western, educated, industrialized, rich, democratic

SEM: Structural Equation Modeling

KR20: Kuder-Richardson-20

Ethics approval and consent to participate

Ethical approval was obtained from Nevsehir Haci Bektas Veli University Ethics Committee (Reference number: 2400043418) in accordance with the Declaration of Helsinki.

Consent for publication

We thank all parents for participating. Informed consent was obtained from the parents at the beginning of the survey.

Availability of data and materials

Data for this study are available by emailing the corresponding author.

Competing interests

We declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Funding

No funding was received for conducting this study.

Authors' contributions

B.S.T and Y.Y.D contributed to study conception and design. B.S.T, Y.Y.D and G.K.A prepared the surveys online and collected data. Data analyses were performed by B.S.T and Y.Y.D. The manuscript was written by B.S.T., the parts of Method and Result sections were written by Y.Y.D and the abstract was written by G.K.A. E.H gave constructive feedbacks and edited the final manuscript. All authors read, gave feedbacks and approved the final manuscript.

Acknowledgements

We thank Birsu Kandemirci and Muazzez Aytemür for helping with the translation process of the survey.

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