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Child Self-Regulation and Behavior Questionnaire and Assessment of Executive Functions Scale: Adaptation Study for 4–6-Year-Old Children*

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Abstract

This research aimed to adapt two measurement tools assessing self-regulation and executive function skills in children aged 4–6 years into the Turkish language. The first scale, "Child Self-Regulation and Behavior Questionnaire" (CSBQ) developed by Howard and Melhuish (2017), assesses children's self-regulation and social development skills based on teachers' opinions. The second sale is the "Assessment of Sensory Processing and Executive Functions in Childhood" (EPYFEI) (Romero-Ayuso et al., 2018). This scale aims to determine the sensory processing and executive function skills of children between the ages of 3 and 11 based on parental opinions. A total of 454 children aged 4-6 attending preschool and kindergarten education in a province in southwestern Türkiye participated in the study. An exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted to evaluate the construct validity of the CSBQ and EPYFEI scales. EFA results of the CSBQ yielded three subscales: cognitive self-regulation, behavioral and emotional self-regulation, and sociability. CFA results showed adequate fit indices for the CSBQ's 15-item, three-factor structure. Additionally, the analysis for concurrent validity revealed a positive and significant relationship between the scale and the Child Behavior Rating Scale. The internal consistency coefficient for the total scale was .84, and for the subscalees, it ranged from .74 to .80. Regarding EPYFEI, the item total correlations of the sensory processing subscale were below .30, and the item variance was below .50. This yielded the removal of the "sensory processing" subscale, and hence the scale was adapted into Turkish as "Assessment of Executive Functions in Childhood" (AEFC). EFA results for the AEFC revealed three factors (executive attention and working memory, emotional and behavioral self-regulation, and inhibitory control). The results of the CFA indicated that the scale's fit indices, consisting of 14 items and three factors, were sufficient. The internal consistency coefficient for the entire AEFC scale was .83, with the subscales ranging from .72 to .84. These findings demonstrated that children's self-regulation skills and social development utilizing CSBQ and executive function skills using the AEFC can be measured validly and reliably.

Keywords: Self-regulation, social development, executive function skill

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Introduction

The emphasis on fostering self-regulation (SR) skills in early childhood is growing steadily. This growing importance is reflected in the increasing advocacy for incorporating SR into early childhood education curricula and programs (Lenes, 2020; Vasseleu, 2022) and studies to develop educational programs to support these skills (Howard, Vasseleu, Batterham, & Neilsen-Hewett, 2020; Tominey & McCelland, 2011). SR skills affect children's approaches to learning. For this reason, supporting these skills in preschool is a building block for achieving more significant gains in education (Bryce, Whitebread, & Szucs, 2015). Self-regulation development, which begins with life, is an integral part of learning and is essential for cognitive, social, and emotional development. This developmental process is shaped by biological and environmental factors that begin to show their effects even before birth (Bronson, 2000). With the influence of these factors, there is an increase in SR skills, especially between the ages of 3 and 7 (Montroy, Bowles, Skibbe, McClelland, & Morrison, 2016). Recent advancements in neuroscience indicate that prioritizing SR in education can enhance children's engagement in learning and establish positive academic pathways, thereby improving school readiness (Blair & Raver, 2014).

Literature Review

Definitions of Self-Regulation

Self-regulation is defined in different ways in literature. According to Bandura (1982), SR is about controlling behaviors and emotions. For Zimmerman (2002), SR is an individual's ability to organize knowledge, actions, and emotions to achieve a goal. Another definition focuses on the 'self,' emphasizing that individuals can control behaviors, emotions, and thoughts. In this sense, SR means the regulation of processes by the self (Baumeister, Schmeichel, & Vohs, 2007). A hierarchical integrated model of SR sheds light on its developmental processes, in which its cognitive, emotional, behavioral, physiological, and genetic levels are mutually influential and bidirectionally and iteratively related (Blair & Ku, 2022).

SR encompasses cognitive, emotional, and behavioral dimensions (Bronson, 2000). EF skills are an aspect of cognitive self-regulation (Roebers, 2017). EF is about organizing the mental processes necessary to exhibit behavior toward complex goals. These high-level SR mechanisms encompass inhibitory control, cognitive flexibility, and working memory processes and play a crucial role in facilitating planning and goal-directed behaviors essential for navigating daily life (Diamond, 2013). EF consists of complex tasks, such as the ability to focus and maintain attention, consider different options, prepare a plan, maintain progress, change behavior to achieve a desired goal, and shift attention as necessary to meet other demands (Buckner, Mezzacappa, & Beardslee, 2009). Attention involves the conscious mental effort through which individuals receive information. It engages all senses, with the attention span varying based on the length, significance, and complexity of the stimulus being processed (Matthews, Ponitz, & Morrison, 2009). Attention is important for understanding classroom rules and social expectations (McClelland & Cameron, 2012). Working memory is the cognitive system responsible for storing and processing new and previously acquired information, enabling individuals to engage more dynamically in tasks. Recalling game rules, taking turns, and participating in group creative activities exemplify working memory in action (McClelland & Cameron, 2012). Inhibitory control acts as an internal force that counteracts impulses, allowing individuals to regulate their behavior, such as raising a hand rather than shouting the answer. It is a learned behavior that involves controlling or inhibiting one's thoughts and feelings. Inhibitory control allows children to adjust or avoid giving the wrong answer (Ponitz, McClelland, Matthews, & Morrison, 2009). The use of EF translates into goal-directed behavior and successful social and academic outcomes (Calkins & Dedmon, 2000; Leerkes, 2000; Paradise, O'Brien, Calkins, & Lange, 2008). Success in school is closely linked to SR skills, encompassing the ability to maintain focus and attention, manage emotions and stress responses, engage in reflective thinking, and foster positive social interactions with teachers and peers (Blair & Raver, 2015). Children utilize cognitive, behavioral, and emotional skills to pay attention to, remember, and respond appropriately to teacher instructions (Raver et al., 2012).

The emotional aspect of SR pertains to one's ability to manage emotions, which enables individuals to express their feelings appropriately and effectively communicate with others. Regulating emotions properly is essential for children's social growth since emotion regulation forms the foundation for children's comprehension and interpretation of social interactions and their reactions in social settings, influencing how others perceive and respond to them (Blair et al., 2014).

As being another dimension of SR, behavioral regulation includes, includes focusing on the task, paying attention, complying with instructions, and preventing unwanted actions (Morrison, Ponitz, & McClelland, 2010). These skills are critical in early education, as they lay the foundation for success in both academic and social life (McClelland et al., 2007). Children must effectively direct their attention to specific tasks, manage their behavior, and process and integrate information in school. (Ponitz et al., 2009). Research indicates a correlation between academic achievement, executive functions, and overall school success with behavioral regulation skills (McClelland et al., 2007). Moreover, early mathematics and literacy skills positively correlate with behavioral SR skills assessed directly and by the teacher (Schmitt, Pratt, & McClelland, 2014).

The development of SR skills is closely intertwined with the growth of skills in other domains, including motor, language, cognitive, and social (Kopp, 1989). It is suggested that children with high levels of social-emotional skills and cognitive control are better at participating in academic tasks, following teachers' instructions, making plans, exchanging information with their peers, and modeling appropriate peer behavior (Denham et al., 2013). Children who can regulate their behavior can meet classroom expectations and who do not give up in the face of failure in learning tasks have higher success in school (McClelland, Acock, & Morrison, 2006). For children,who cannot regulate their behavior appropriately, attention problems,weaken their effective learning and decrease their success levels by engaging in off-task behavior (Hughes & Kwok, 2006).

Assessment of Children's Self-Regulation Skills

Children's SR skills are commonly assessed based on the performance and opinions of adults (parents or teachers). In addition, there are also teacher observations of children's performance (Howard et al., 2019; Schmitt et al., 2014). Performance-based measurement tools evaluate children's performance instantaneously and objectively (Howard et al. 2019). Some of these assessment tools include only one aspect of self-regulation skills, such as working memory or inhibitory control (Gerstadt, Hong, & Diamond, 1994; Mischel et al., 1989). For example, the "Day-Night Task" (Gerstadt, Hong, & Diamond, 1994) and Simon Says (Strommen, 1973) scales measure inhibitory control skills, while Memory Battery for Preschool Children (Obalı, 2018) measures working memory auditorily. Others evaluate all dimensions: inhibitory control, working memory, and attention flexibility. The Head-Toes-Knees-Shoulders (HTKS) test (McClelland et al., 2014), which was developed to evaluate the cognitive flexibility, inhibitory control, and working memory skills of preschool children (Ponitz, McClelland, Matthews, & Morrison, 2009; Gonzales et al., 2021), is widely used in studies in the literature (Becker, Miao, Duncan, & McClelland, 2014; İvrendi, 2011; Sezgin & Demiriz, 2015).

In the domestic literature, there are measurement tools adapted to Turkish (Batum & Yağmurlu, 2007; Çiftçi, Uyanık, & Acar, 2020; Ecirli & Ogelman, 2015; Fındık Tanrıbuyurdu & Güler Yıldız, 2014; Sezgin & Demiriz, 2016) or developed (Bayındır & Ural, 2016; İvrendi & Erol, 2018; Yılmaz & Zembat, 2021) to determine children's SR skills based on adult opinions. For example, Çiftçi, Uyanık, and Acar (2020) adapted the Childhood Executive Functions Inventory (Thorell & Nyberg, 2008) scale into Turkish. This scale consists of two factors (Working Memory and Inhibitory Control) and 24 items. The results showed that this scale can be used to evaluate the executive functions of 4–6-year-old children validly and reliably. As an example of scale development studies, İvrendi and Erol (2018) developed the "Self-Regulation Skills Scale for 4–6-Year-Old Children-Teacher Form". This scale has three factors, "attention, working memory, and inhibitory control," and includes 22 items. Their results indicated that children's SR skills can be validly and reliably measured by using this instrument (İvrendi & Erol, 2018, p. 184). Although there has been an increase in scales developed and adapted for children's SR skills in Türkiye, they still appear to be limited in number.

The scales based on adult opinions can produce comprehensive data with minimum time and cost (Howard et al., 2019). Evidence showed that measurement tools based on teacher opinions were more effective in predicting children's skills than task-based assessment (Duncan, McClelland, & Acock, 2013; Suchodoletz et al., 2013). For example, when the predictive levels of teacher-rated, observed, and directly evaluated behavioral SR skills for academic success in preschool children were investigated, teacher evaluations were found to be the strongest predictor of children's literacy skills (Schmitt et al., 2014). It is also important to note that parent and teacher evaluations might be sensitive to biases and more process-oriented (Howard & Melhuish, 2017). For example, teachers and parents may interpret the same behavior differently, as their evaluations can be influenced by their distinct daily interactions and experiences with the child. This variance in interpretation can also extend to how they assess items on the same scale (McClelland, Ponitz, Messersmith, & Tominey, 2010). On the other hand, different sources of information, such as parents or teachers, allow data about the child's SR to be collected from large samples in a relatively short time. Considering the positive and negative aspects of scales to evaluate children's SR skills, it is stated that data obtained from multiple information sources and the use of more than one stakeholder in the data collection process is a valuable strategy when making decisions about these skills (Nelson, Robinson, & Hart, 2005; Smith-Donald, Raver, Hayes, & Richardson, 2007).

There is increasing evidence that SR skills are critical to children's lifelong success, including academic and social skills (Amani, Koruzhdeh, & Taiyari, 2019; Finders, McClelland, Geldhof, Rothwell, & Hatfield, 2021; Lipsey et al., 2017) Research findings have proved SR skills' relationship with several areas of development, such as school achievement (math and reading achievement), false-belief understanding (FBU) and social competence. (McClelland, Acock, Piccinin, Rhea, & Stallings, 2013; Razza & Blair, 2009). Moving from the importance of SR skills in children's lives, it seems necessary to enrich measurement tools to obtain information about such skills from multiple sources, such as parents and teachers. Toward this end, this study aimed to adapt two scales into Turkish. The first one is the "Child Self-Regulation and Behavior Questionnaire" (CSBQ) scale developed by Howard and Melhuish (2017) to evaluate children's SR and social skills. The second one is the Assessment of Sensory Processing and Executive Functions in Childhood" (EPYFEI) scale developed by Romero-Ayuso et al. (2018) to determine children's executive function skills based on parental opinions. Adapting these two scales to Turkish diversifies the self-regulation measurement tools available in the literature from different aspects. First, these scales are short and quickly applicable, and thus, they are convenient in terms of time and effort for teachers and parents. Second, these scales allow obtaining data about children's SR skills from both teachers and parents, yielding information from multiple sources. Third, CSBQ includes all SR dimensions and can provide a holistic view of children's SR skills.

Method

In this scale adaptation study, CSBQ and EPYFEI were adapted to Turkish. The scale adaptation process was carried out in accordance with the steps defined by Karagöz and Bardakçı (2020). These steps are as follows: adaptation translation of the original scale into Turkish, comparison of the translations, back translation of the scale, determination of the draft form of the translated scale, examination of language equivalence, conducting reliability and validity analyses, and finally, presentation of the final scale.

Participants

In the first half of the 2021-2022 academic year, 454 children aged 4-6 attending preschool schools affiliated with the Ministry of National Education in a province in the southwestern part of Türkiye participated in the research. The study utilized an easily accessible sampling method, including teachers and parents who volunteered to participate.

Before initiating the research, ethical approval and permission to conduct this study were secured from the Provincial Directorate of National Education. The administrators of the schools were informed about the research. Afterward, information about the study was shared with the teachers at the school. Teachers and parents who wished to participate in the study were requested to fill out the scales.

Teachers were asked to complete scales for 10 typically developing children (5 girls, 5 boys) in their classrooms, a process designed to ensure a diverse and representative sample.

Among the children participating in the study, 47.4% (n=215) were girls, while 52.6% (n=239) were boys. Regarding age distribution, 32.2% (n=146) of the children were aged 48-60 months, and 67.8% (n=308) were aged 60-72 months. Regarding preschool attendance, 66.1% (n = 300) of the children had attended for one year, 13.4% (n = 61) for two years, and 20.5% (n = 93) for three years.

The mean age of the mothers participating in the study was calculated. 18% (n=82) of the mothers were between 20-30 years of age, 60.6% (n=275) were between 31-40 years of age, and 21% (n=97) were over40 years of age. The mean age of the fathers was as follows: 7.7% (n=35) were between 20-30 years of age, 55.9% (n=254) were between 31-40 years of age, and 36.3% (n=165) were 40 years of age or older. Among the mothers participating in the study, 9.9% (n=45) were primary school graduates, while 61.5% (n=279) held university degrees. Similarly, among the fathers, 17% (n=77) were primary school graduates, and 54.4% (n=247) were university graduates.

Data Collection Tools

Personal Information Form

The researchers created this form to obtain information about the socio-demographic features of children and parents. The parents filled in this form, which included items related to the child's gender, age, years of attending preschool education, the parents' age and education level, and monthly income.

Child Self-Regulation and Behavior Questionnaire (CSBQ)

Within the scope of this research, "Child Self-Regulation and Behavior Questionnaire" (CSBQ) developed by Howard and Melhuish (2017) to evaluate the self-regulation and social development skills of 3–6-year-old children, was adapted into Turkish for 4–6-year-old children. Three-year-old children were not included in this study because the low rate of three-year-olds attending preschool in Türkiye makes it challenging to reach this age group. As seen in the Ministry of Education 2021/22 academic year's Statistical Regional Units Classification, the schooling rate is 11.45% for the 3-year-old group and 56.77% for the 4-5 age group (MEB Statistics, 2022). Teachers fill out CSBQ for children. This scale has 34 items, a four-factor structure, and a 5-point Likert-type feature (1 = Never, 5 = Always). The cognitive self-regulation subscale (Cronbach's Alpha = .87) includes behaviors related to control over thinking and attention (e.g., persists in difficult tasks, chooses activities on one's own). The emotional self-regulation subscale (Cronbach's Alpha = .83) consists of behaviors related to control over emotional reactions (e.g., getting over sadness quickly and not easily upset by minor events). The behavioral self-regulation subscale (Cronbach's Alpha = .89) has items related to control over impulsive behaviors (e.g., waiting for one's turn, sitting still). The sociability subscale (Cronbach's Alpha = .74) includes behaviors related to the ease and quality of social interactions (e.g., plays easily with other children) (Howard & Melhuish, 2017).

Child Behavior Rating Scale (CBRS)

This study examined the concurrent validity of the CSBQ scale using the CBRS, which teachers completed for children. The CBRS, adapted into Turkish by Sezgin and Demiriz (2016), consists of two factors and 17 items: Behavior regulation and social skills. The behavior regulation subscale includes 10 items about working memory, inhibitory, and attention control skills. There are 7 items in the social skills subscale, which encompasses children's social skills, such as following instructions, cooperating, waiting their turn, and using verbal or physical violence against other children. The Cronbach Alpha reliability coefficient of the CBRS subscales was between .84 and .96. The test-retest reliability of the scale was found to be 0.75 (Sezgin & Demiriz, 2016). In this current study, the internal consistency coefficient of CBRS was calculated (Cronbach's Alpha = .88).

Assessment of Sensory Processing and Executive Functions in Childhood"(EPYFEI)

"Assessment of Sensory Processing and Executive Functions in Childhood" (EPYFEI) scale developed by Romero-Ayuso et al. (2018) to evaluate the sensory processing and executive functions of children aged 3–11 years was adapted into Turkish for children aged 4-6. As explained below, the results of

this study's analyses led to the renaming of the scale as Assessment of Executive Functions. The scale, which was filled out by parents considering the child, had a five-factor structure: (1) executive attention, working memory, and initiation of actions; (2) general sensory processing; (3) emotional and behavioral self-regulation; (4) control, correction of actions, and problem-solving; and (5) inhibitory control. It comprises 34 items with a 5-point Likert feature (1 = Never, 5 = Always). Cronbach's Alpha values range between 0.74 and 0.94.

Data Collection Process

Adaptation Process of Scales into Turkish

This study aimed to adapt two scales into Turkish: CSBQ and EPYFEI. The scale adaptation process consisted of the translation of the original scale into Turkish, comparison of the translations, back translation of the scale, determination of the draft form of the translated scale, examination of language equivalence, conducting reliability and validity analyses (Karagöz & Bardakçı, 2020). In the translation stage, the Forward-Backward Translation Method was used. This method requires a single translator or a group of translators to translate the test from the source to the target language. Then, another group of translators evaluates the equivalence of the two test versions (Hambleton et al., 2005). These experts could be linguists, researchers, or academicians who are experts in the field measured by the scale and know both languages well (Karagöz & Bardakçı, 2020). In this study, the scale was translated into Turkish by a linguist, then translated from its Turkish form back into its original language, and the consistency of the scale items in both forms was tested to create the most appropriate Turkish version. Following this, opinions were obtained regarding content and language consistency from four faculty members who work in the field of preschool education and are fluent in both languages, as well as a preschool teacher with a master's degree. The experts examined whether the scale items reflected their original language counterparts and content validity. The suggested corrections were made in line with the experts' opinions, and the ready-to-implement form of the scale items was obtained. In the next stage, the scale form was filled out by four preschool teachers working to test the comprehensibility of the items.

Finally, the Turkish and English forms of the scales were filled out for 30 children one week apart by teachers whose native language is Turkish and who have a good command of English. According to Karagöz and Bardakçı (2020), to state that the Turkish scale is linguistically equivalent to the original scale, there must be a positive and high-level relationship between the calculated total scores of the two scales. If the Pearson correlation coefficient is between .70 and 1.00, the language equivalence of the scale is high (Karagöz & Bardakçı, 2020). Hence, the Pearson Product Moment Correlation Coefficient between the total scores obtained from the Turkish and English forms of the scales was calculated. The results were as follows: .96 for the CSBQ scale and .95 for the EPYFEI scale. Based on these values, it can be concluded that the scale had language validity. After these procedures, the final version of the scale, ready for application, was obtained, and the scales were filled out for 454 children aged 4-6 who were attending preschool education.

In the second stage, the surface and content validity were examined. Using Lawshe (1975), one of the analysis methods, experts evaluated each item of the scale by classifying it as "not suitable, partially suitable, or appropriate" and stating their suggestions for possible corrections. Similar ratings are available in the literature (Erol & İvrendi, 2018). The final iteration of the scale was crafted by reviewing expert feedback and making appropriate adjustments to the items within the predetermined framework.

In the next phase of the validity study, the scales' construct validity was examined through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Additionally, the Child Behavior Rating Scale was used to assess concurrent validity only for the CSBQ. It is suggested that the number of participants for EFA should be at least 300 and between 5 and 10 people per item (Tabachnick & Fidell, 2015). The number of participants in this study (n=454) meets this suggestion. In determining the items to be included in the scale, attention was paid to ensure that the item factor loadings were at least .30 (Tabachnick & Fidell, 2015), the eigenvalue for the factors was greater than 1, and the items loaded on each factor were consistent in terms of meaning and content (Büyüköztürk, 2012). In EFA, the Principal Component Analysis and Varimax orthogonal rotation method were

chosen, which reduces the number of variables and allows for collecting the most information with the fewest items (Erkuş, 2016). There is a similar use of the Varimax orthogonal rotation method in scale development studies (Atan & Buluş, 2021; Kurnaz, 2019). There are seven-factor extraction methods in exploratory factor analysis. When factor extraction methods were compared, it was stated that principal component analysis was the method that explained the variance in the structure to be measured the most under all conditions (Karaman, Atar, & Aktan, 2017) and is the most frequently used method (Büyüköztürk, 2002; Henson & Roberts, 2006; Velicer & Jackson, 1990).

In the CFA, $\chi 2$/sd, RMSA, AGFI, GFI, CFI, NNFI, IFI, PNFI, PGFI, NNFI, and SRMR values were examined. The value ranges given by Çokluk, Şekercioğlu, and Büyüköztürk (2015) regarding the fit indexes were considered when evaluating CFA results.

The third stage of the adaptation process consisted of reliability analysis. The reliability of both scales was evaluated by calculating the internal consistency coefficients using Cronbach's Alpha. A scale with .80 and above Cronbach's Alpha (α) coefficient is highly reliable (Kalaycı, 2009). Therefore, an α value above .80 was considered as a criterion in this study. The research data were analyzed using SPSS 22 and AMOS 20 programs.

Findings

Results related to the Content and Face Validity of CSBQ and EPYFEI

Based on the experts' opinions on each item, the content validity index (CVI) was calculated, and the results are given in Table 1.

Table 1.
Results regarding the Content Validity Index of CSBQ and EPYFEI

	CSBQ				EPYFEI			
Item Numbers	U	KU	UD	KGO	U	KU	UD	KGO
Item 1	5	0	0	1.00	5	0	0	1.00
Item 2	5	0	0	1.00	5	0	0	1.00
Item 3	5	0	0	1.00	5	0	0	1.00
…..								
Item 10	5	0	0	1.00	4	1	0	0.60
….								
Item 15	4	1	0	0.60	5	0		1.00
…..								
Item 34	5	0	0	1.00	5	0	0	1.00

*U = Suitable, KU = Partially Appropriate, UD = Not Applicable, KGO = Scope Validity Rate

According to Table 1, 5 experts evaluated items of the CSBQ and EPYFEI was determined to be .98 for both scales. The experts' evaluation of face validity stated that the items measure the relevant structure.

Results Regarding the Validity of the Child Self-Regulation and Behavior Questionnaire (CSBQ)

Exploratory Factor Analysis (EFA) of CSBQ

EFA was conducted to determine the construct validity of the CSBQ. While selecting the number of factors, many values were taken into consideration, aiming to reach the most information with the least number of items (Büyüköztürk, 2002). In terms of KMO, it has been stated that 50 and above is an acceptable value (Çolakoğlu & Büyükekşi, 2014). In this regard, the number of items was reduced using the Varimax orthogonal rotation method through Principal Component Analysis to retain the most informative items while minimizing redundancy. Twelve items were eliminated from the measurement tool due to low item-total correlation values (<.30), item variance (<.50), and overlapping features. The remaining items exhibited a Kaiser-Mayer-Olkin (KMO) value of .86 and a Bartlett Sphericity Test value of .000 ($p < .05$), indicating the suitability of the data for factor analysis (Kalaycı, 2016). In the Common Variance Table, which elucidates how much variance each item explains, lower values (e.g., below .30) suggest poor fit with other items. An item-test correlation value above .30 indicates a sufficient relationship between the item and the structure to be measured

(Tabachnick & Fidell, 2015). The common variance values of the scale items ranged from .43 to .71. Factor determination relied on factors with eigenvalues exceeding 1, and the scatter plot is depicted in Figure 1.

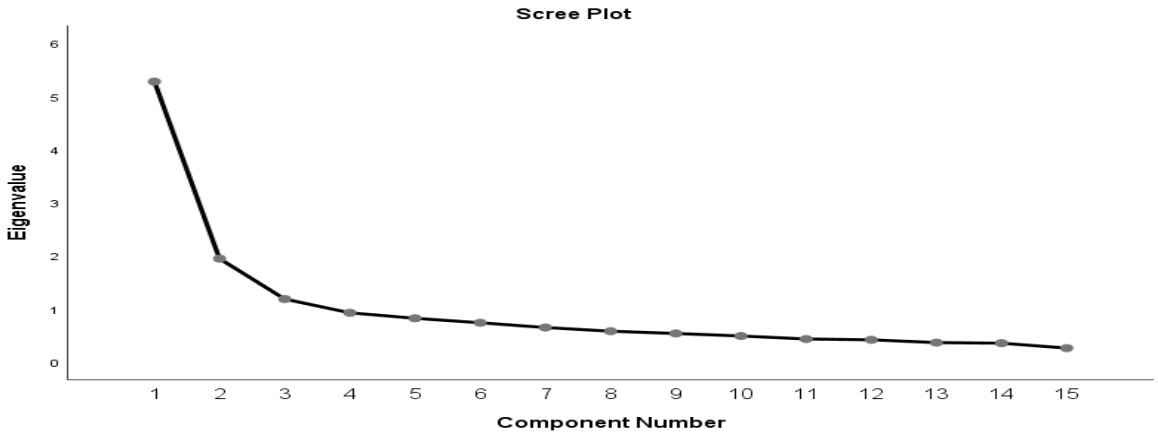

Figure 1. CSBQ factor analysis line chart

According to Figure 1, the scale appears to have a three-factor structure as it is not separated by an obvious line after the third point. Results related to these components are presented in Table 2.

Table 2.
Number of Factors Based on Eigen Value Statistics and Explained Variance Ratio

	Initial Eigenvalues			Eigen Sums of Square Loadings		
Subscales	Sum	Variance%	Totaled%	Sum	Variance%	Totaled%
Cognitive self-regulation	5.277	35.181	35.181	2.960	19.730	19.730
Behavioral and emotional self-regulation	1.946	12.975	48.156	2.886	19.240	38.970
Sociability	1.186	7.909	56.065	2.564	17.095	56.065

Upon examination of Table 2, three factors with eigenvalues exceeding 1 and their respective variance ratios are delineated. The cognitive self-regulation factor elucidated 35.181% of the total variance, the behavioral and emotional self-regulation factor expounded 12.975% of the total variance, and the sociality factor accounted for 7.909% of the total variance. Subsequently, the rotation process was executed to attain meaningful factors and ascertain the inclusion of items within each factor, as depicted in Table 3.

Table 3.
Factor Loadings of the Items in the Rotated Principal Component Analysis Method of the CSBQ Scale

			Factors		
Child Self-Regulation and Behavior Questionnaire			1	2	3
Cognitive self-regulation	I1	Persists with difficult tasks. .	.746	.358	.160
	I2	Does not need much help with tasks. .	.704	.081	.013
	I3	Persists with tasks until completed.	.700	.302	.253
	I4	Chooses activities on their own.	.670	.146	-.043
	I5	Likes to work things out for self.	.624	.215	.143
Behavioral and emotional self-regulation	I6	Is impulsive, acts without thinking.	.162	.096	.795
	I7	Restless, does not keep still for long.	.200	-.177	.723
	I8	Shows wide mood swings.	-.003	.160	.722
	I9	Often loses temper, has tantrums.	-.003	.223	.712
Sociability	I10	Will play easily with new children.	.152	.776	-.032
	I11	Has regular friends.	.093	.655	-.032
	I12	Liked by other children.	.376	.653	.185
	I13	Gets on well with other children.	.215	.620	.381
	I14	Offers to help others.	.407	.575	.126
	I15	Shares sweets or toys with other children.	.358	.551	.265

According to Table 3, the load values were between .74 and .62 for the cognitive self-regulation subscale (5 items), .79 and .71 for the behavioral and emotional self-regulation subscale (4 items), and .55 to .77 for the sociability subscale (6 items). The factor loading values varied between .55 and .77.

Confirmatory Factor Analysis of CSBQ

CFA was implemented to evaluate the model derived from EFA. The data collected from 282 children not included in EFA was used for CFA, and goodness of fit values were examined. The value ranges given by Çokluk, Şekercioğlu, and Büyüköztürk (2015) regarding the fit indexes were considered when evaluating CFA results (Table 4).

Table 4.
Findings regarding the fit index

Fit Indexes	Perfect Fit Criterion	Good Fit Criterion	Value	Fit Level
$\chi 2/sd$	$0 \leq \chi 2/sd \leq 2$	$2 \leq \chi 2/sd \leq 3$	2.974	good fit
RMSEA	.00 ≤ RMSEA ≤ .05	.05 ≤ RMSEA ≤ .08	.08	good fit
AGFI	.90 ≤ AGFI ≤ 1.00	.85 ≤ AGFI ≤ .90	.85	good fit
GFI	.95 ≤ GFI ≤ 1.00	.90 ≤ GFI ≤ 95	.90	good fit
CFI	.95 ≤ CFI ≤ 1.00	.90 ≤ CFI ≤ .95	.90	good fit
IFI	.95 ≤ IFI ≤ 1.00	.90 ≤ IFI ≤ .95	.90	good fit
PNFI	.95 ≤ PNFI ≤ 1.00	.50 ≤ PNFI ≤ .95	.69	good fit
PGFI	.95 ≤ PGFI ≤ 1.00	.50 ≤ PGFI ≤ .95	.63	good fit
NNFI	.95 ≤ NNFI ≤ 1.00	.90 ≤ NNFI ≤ .95	.90	good fit
SRMR	.00 ≤ SRMR ≤ .05	05 ≤ SRMR ≤ .10	.07	good fit

The fit indices, $\chi 2/sd$= 2.974, RMSEA=.08, AGFI=.85, GFI=.90, CFI=.90, IFI=.90, PNFI=.69, PGFI=.63, NNFI=.90, and SRMR=.07 values show a good fit criterion. Based on these values, it can be stated that CFA results confirm the scale structure with a 15-item- three-factor structure.

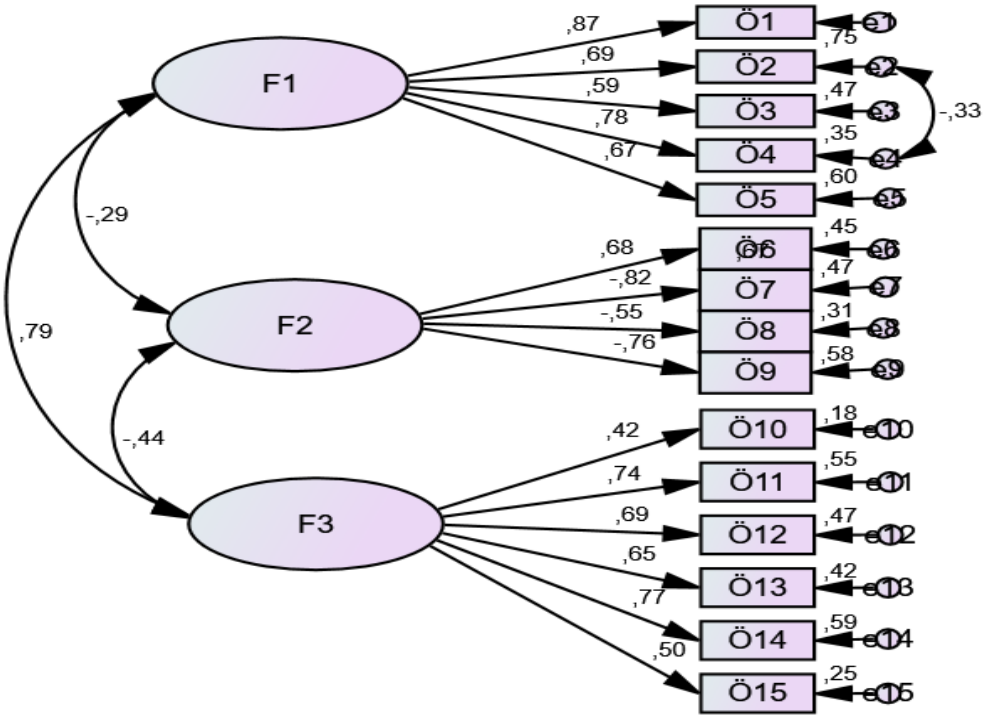

Figure 2. Path diagram obtained by confirmatory factor analysis

Note: Factor 1=Executive attention, Working memory, Factor 2=Emotional and behavioral self-regulation, Factor=3 Inhibitory control.

The CFA results in Figure 2 demonstrated that factor validity verified the scale with 15-item- 3 subscale structure of the CSBQ scale. Findings regarding the concurrent validity of the CSBQ are presented in Table 5.

Table 5.
Correlation Analysis Results for the Child Behavior Rating Scale and the CSBQ (N=454): Concurrent Validity

Subscales	CBRS Behavior	CBRS Social Skills	CBRS Total	Cognitive Self-regulation	Behavioral and emotional	Sociability	CSBQ Total
CBRS-Behavior	1						
CBRS-Social Skills	.717**	1					
CBRS- Total	.958**	.888**	1				
Cognitive Self-regulation	.715**	.553**	.701**	1			
Behavioral and emotional self regulation	.382**	.585**	.495**	.285**	1		
Sociability	.570**	.558**	.608**	.610**	.308**	1	
CSBQ Total	.718**	.728**	.775**	.817**	.675**	.833**	1

***p<.01*

According to Table 5, the highest correlation between the CSBQ and CBRS was between the behavior subscale of the CBRS and the cognitive self-regulation subscale of the CSBQ (r = .71, p<0.01). A high positive correlation was found between the total scores of the CBRS and CSBQ (r = .77, p < .01).

Reliability Results of CSBQ

Cronbach's Alpha value was used to examine the scale's internal consistency coefficient, which is presented in Table 6.

Table 6.
Measurement Tool Statistics and Internal Consistency Coefficients

Subscales	Average	Variance	Standard deviation	Number of Items	Internal Consistency (Cronbach Alpha) Coefficient
Cognitive self-regulation	19.2599	12.533	3.54016	5	.78
Behavioral and emotional self-regulation	16.3436	11.961	3.45849	4	.74
Sociability	24.1696	13.527	3.67797	6	.80
CSBQ Total	59.7731	68.723	8.28995	15	.84

Table 6 indicates that the CSBQ scale's internal consistency coefficient is .84, and its subscale coefficients are between .74 and .80.

Results Regarding the Validity of the "Assessment of Sensory Processing and Executive Functions in Childhood"(EPYFEI) Scale

Exploratory Factor Analysis (EFA) of EPYFEI:

EFA was implemented to investigate the construct validity of the EPYFEI. In determining the appropriateness of the data for factor analysis, a KMO value of .50 and above is acceptable (Çolakoğlu & Büyükekşi, 2014). The Varimax orthogonal rotation method was applied using Principal Component Analysis. Twenty items with item-total correlation values below .30, item variance below .50, and overlapping features were removed from the measurement tool. Sample items related to the "sensory processing" subscale, which is included in the original name "Assessment of Sensory Processing and Executive Functions in Childhood"(EPYFEI) of the scale developed by Romero-Ayuso et al., (2018), are as follows: "Has problems in visually recognizing objects. Touches or rubs the body part touched by someone. He usually leans on himself or an object or wall to support his head and body. Has problems climbing stairs, moving around, stumbling, or having difficulty going down a slide in the park or elsewhere." It contains a total of 7 items. Since the item total correlation values of the sensory processing subscale were below .30 and the item variance was below .50, this dimension was removed from the scale. The author who developed the scale was contacted about this issue, and it was stated that the subscale or the number of items could be reduced by making the necessary analyses during the intercultural adaptation process. As a result of the analysis, the "sensory processing" part

was removed from the name of the adapted scale, which led to the scale being renamed as AEFC. From here on, this scale was addressed as AEFC.

Upon examination of the remaining items, it was found that the data was suitable for factor analysis, with the Kaiser-Mayer-Olkin (KMO) value of the scale being .84. The Bartlett Sphericity Test value is .000 ($p < .05$). The common variance values of the scale items range between .40 and .68. Factor determination relied on examining the scatter plot and considering factors with eigenvalues exceeding The scatter plot is provided in Figure 3.

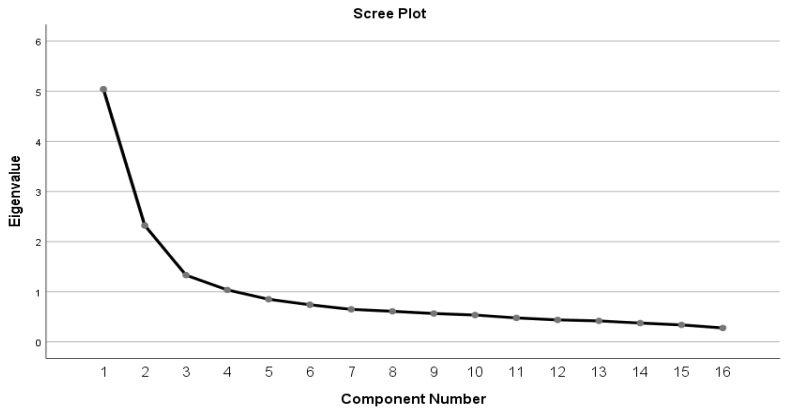

Figure 3. AEFC factor analysis line chart

According to Figure 3, the scale appears not to be separated by a very clear line after the third point; therefore, it can be said that the scale has a three-factor structure. Data related to these components are presented in Table 7.

Table 7.
Number of Factors Based on Eigen Value Statistics and Explained Variance Ratio

	Initial Eigenvalues			Eigen Sums of Square Loadings		
Subscales	Sum	Variance%	Totaled %	Sum	Variance%	Totaled %
Executive attention, working memory	4.637	33.120	33.120	4.637	33.120	33.20
Emotional-behavioral self-regulation	2.293	16.376	49.496	2.293	16.376	49.496
Inhibitory Control	1.256	8.971	58.467	1.256	8.971	58.467

Table 8.
Factor Loadings of the Items in the Rotated Principal Components Analysis Method of the AEFC Scale

		Factors		
	Assessment of Executive Functions in Childhood	1	2	3
Executive attention, working memory	I1 Has difficulties in understanding the instructions he/she is given to perform tasks	.785	.122	.085
	I2 Has difficulty following a conversation, activity, or instructions.	.771	.157	.101
	I3 Has problems in selecting the essential information or necessary objects to perform a task or solve a problem.	.760	.117	.132
	I4 Has difficulties doing things that require mental effort.	.751	.119	.048
	I5 Has difficulties performing activities that involve several steps.	.694	.018	.005
	I6 Has difficulties remembering information while he/she is performing another activity.	.676	.120	.080
Emotional-behavioral self-regulation	I7 Protests when does not get own way.	.085	.786	.233
	I8 Reacts inappropriately to criticism.	.171	.760	.121
	I9 Hasrapid mood swings.	.019	.738	.173
	I10 Cries and/or gets frustrated easily.	,268	.704	.169
Inhibitory Control	I11 Usually hums or makes noises while he/she performs tasks and should be silent.	.058	.177	.809
	I12 Seeks activities involving jumping, crawling, pressing, pushing, or pulling	.157	.227	.772
	I13 Has difficulties staying still.	.071	.117	.728
	I14 Acts without planning what he/she has to do, in an impulsive way	.212	.263	.538

In Table 7, three factors had eigenvalues greater than 1. The total variance explained by each subscale was 33.12% for executive attention and working memory factor, 16.376% for emotional-behavioral self-regulation, and 8.97% for inhibitory control. These three factors explained 58% of the total variance. The findings related to the factor loadings are shown in Table 8.

According to Table 8, the factor loadings for the executive attention and working memory factor (6 items) range from .67 to .78, for the emotional and behavioral self-regulation factor (4 items) range from .70 to .78, and the inhibitory control factor (4 items) load values vary between .53 and .80.

Confirmatory Factor Analysis (CFA) of AEFC: Confirmatory factor analysis was conducted to evaluate the model obtained from EFA. The data collected from 282 children not included in EFA were used for CFA, and goodness-of-fit values were examined. The value ranges given by Çokluk, Şekercioğlu, and Büyüköztürk (2015) regarding the fit indexes were considered when evaluating CFA results Table 9.

Table 9.

Findings regarding the fit index

Fit Indexes	Perfect Fit Criterion	Good Fit Criterion	Value	Fit Level
$\chi 2/sd$	$0 \leq \chi 2/sd \leq 2$	$2 \leq \chi 2/sd \leq 3$	2.591	good fit
RMSEA	.00 ≤ RMSEA ≤ .05	.05 ≤ RMSEA ≤ .08	.07	good fit
AGFI	.90 ≤ AGFI ≤ 1.00	.85 ≤ AGFI ≤ .90	.86	good fit
GFI	.95 ≤ GFI ≤ 1.00	.90 ≤ GFI ≤ 95	.90	good fit
CFI	.95 ≤ CFI ≤ 1.00	.90 ≤ CFI ≤ .95	.91	good fit
IFI	.95 ≤ IFI ≤ 1.00	.90 ≤ IFI ≤ .95	.90	good fit
PNFI	.95 ≤ PNFI ≤ 1.00	.50 ≤ PNFI ≤ .95	.91	good fit
PGFI	.95 ≤ PGFI ≤ 1.00	.50 ≤ PGFI ≤ .95	.70	good fit
NNFI	.95 ≤ NNFI ≤ 1.00	.90 ≤ NNFI ≤ .95	.90	good fit
SRMR	.00 ≤ SRMR ≤ .05	05 ≤ SRMR ≤ .10	.08	good fit

According to Table 9, the fit indices, $\chi 2/sd$= 2.591, RMSEA=.07, AGFI=.86, GFI=.90, CFI=.91, IFI=.90, PNFI=.80, PGFI=.70, NNFI=.90 and SRMR=.08 values show good fit criterion.

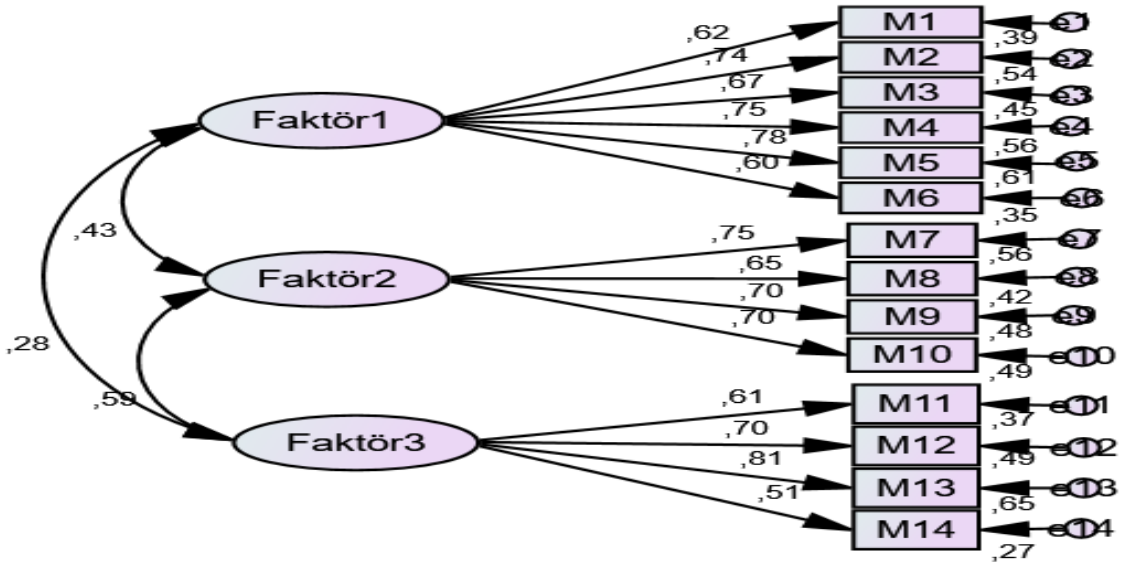

Figure 4. Path diagram obtained by confirmatory factor analysis

Note: Factor 1=Executive attention, Working memory, Factor 2=Emotional and behavioral self-regulation, Factor=3 Inhibitory control.

Based on these CFA results, it can be concluded that the factor validity of fourteen items in the measurement tool was ensured.

Reliability Results of AEFC Scale

Cronbach's Alpha value was computed and presented in Table 10 to determine the scale's internal consistency coefficients.

Table 10.
Internal Consistency Coefficients of AEFC

Subscales	Average	Variance	Standard deviation	Number of Items	Internal Consistency (Cronbach's Alpha) Coefficient
Executive attention, working memory	9.7687	13.591	3.68660	6	.84
Emotional-behavioral self-regulation	14.0176	12.463	3.53033	4	.78
Inhibitory Control	13,6101	14,018	3.74401	4	.72
AEFC Total	30.1410	68.585	8.28160	14	.83

Table 10 shows that the AEFC scale's internal consistency coefficient is .83, and the internal consistency coefficients of its subscales range between .72 and .84.

Discussion, Conclusion, and Suggestions

In recent years, there has been an increase in studies on children's SR skills, leading to the need for scale studies developed or adapted for assessing these skills. In this study, two scales were adapted to Turkish. The first scale is CSBQ, developed by Howard and Melhuish (2017). The second scale is the EPYFEI, developed by Romero-Ayuso et al. (2018) and renamed AEFC after the analysis results of this study. For both scales, expert opinion was taken for the items to determine the content validity index. After these procedures, exploratory factor analysis and confirmatory factor analysis were conducted to examine the scales' construct validity. The concurrent validity was examined only for the CSBQ scale.

The results showed that the content validity index of the CSBQ scale was sufficient. The factor analysis of the CSBQ showed that the scale has a three-factor structure, considering the factors with eigenvalues greater than 1 and the scatter plot. The CSBQ scale consists of three factors: cognitive self-regulation (5 items), behavioral and emotional self-regulation (4 items), and sociability (6 items). CFA results of the CSBQ scale indicated that the scale had a good fit with the 15-item three-factor structure. The result of the concurrent validity between the CSBQ and CBRS scales demonstrated that the highest relationship was between the behavior subscale of the CSBR scale and the cognitive self-regulation subscale of the CSBQ scale.

In terms of the reliability of the CSBQ, the internal consistency coefficient (Cronbach's Alpha value) of the total scale (.84) and its subscales of cognitive self-regulation (.78), behavioral and emotional self-regulation (.74), and sociability (.80), respectively, are at a good level. There are other studies in which the CSBQ is used as a measurement tool (Howard, 2020; Huang, Geng, & Siraj, 2022; Williams & Bentley, 2021). For example, in their study, Williams and Bentley (2021) used three subscales of CSBQ. They found that Cronbach's Alpha values were 0.87 for the cognitive self-regulation dimension, 0.91 for the behavioral self-regulation dimension, and 0.83 for the emotional self-regulation dimension.

When the results of the AEFC scale were examined, it was found that the content validity index of the AEFC scale was at a sufficient level. The factor analysis conducted to determine the construct validity of the AEFC demonstrated that the scale has a three-factor structure, considering the factors with eigenvalues greater than 1 and the scatter plot. The AEFC consists of the executive attention and working memory factor (6 items), emotional and behavioral self-regulation factor (4 items), and inhibitory control factor (4 items). The values found as a result of CFA for the AEFC scale are similar to those of Çokluk et al. (2012) according to the value ranges given for fit indices. Hence, it was concluded that the scale had a good fit with the 14-item three-factor structure. In terms of the reliability of the AEFC, the internal consistency coefficient (Cronbach's Alpha value) of the whole scale (.83) and its subscales of executive attention and working memory (.84), emotional, behavioral self-regulation (.78), and inhibitory control (.72) are good, respectively. The total and subscales of this

measurement tool are highly reliable, as these values correspond to the high-reliability interval stated in the literature (Kalyacı, 2016). There are other studies in which AEFC was used as a measurement tool, and the sample group consisted of children outside the preschool period (6-11 years old) (Romero-Ayuso et al., 2020; Romero-Ayuso et al., 2023).

Considering all the findings of both scales, it is evident that the values related to the adapted CSBQ and AEFC measurement tools are within a highly reliable range. The CSBQ and AEFC measurement tools contribute to the field because they are time-saving, short, and quickly applicable and can be used in low-resource environments. As a result, it has been determined that the self-regulation and social development skills of 4–6-year-old children can be assessed validly and reliably by using CSBQ, based on teachers' opinions, and the executive functions of 4–6-year-old children can be determined validly and reliably, based on parents' opinions, by using AEFC.

This study is limited to 454 children with middle socioeconomic levels, their parents, and their teachers who attend preschool education in a district in the southwest of Turkey in the 2021-2022 academic year. Future studies would help verify the internal consistency and validity of the scale with data collected from sample groups with different socioeconomic and sociocultural characteristics. It has been stated that the original version of the CSBQ (Howard & Melhuish, 2017) and AEFC (Romero-Ayuso et al., 2018) scales can also be applied to children in the 3-year-old group. For this reason, in future studies, the validity and reliability of these scales can be conducted for 3-year-old children. In addition, developing performance-based scales or carrying out adaptation studies may help add measurement tools to the literature to determine children's SR skills.

The measurement tools adapted in this study can contribute to planning different studies regarding children's SR, such as relational or semi-experimental ones, in the literature. For instance, these scales can be used for relational research with various variables, such as children's cognitive skills (like problem-solving, reasoning, and academic skills), social skills (like behavioral issues and helpful behaviors), and motor skills that might be associated with the dimensions of SR. Moreover, these tools can promote efforts to identify children at risk regarding SR skills and the planning and implementation of intervention training programs to improve such skills.

Acknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

Author Contributions: Conceptualization, E.D.C. and A.İ.; methodology, E.D.C..; validation, E.D.C.; analysis, E.D.C.; writing, review and editing, E.D.C. and A.İ.; supervision, A.İ.; project administration, A.İ.

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Data Availability Statement: Data generated or analyzed during this study should be available from the authors on request.

Conflict of Interest: Authors should declare that there is no conflict of interest among authors.

Generative Artificial Intelligence Statement: No artificial intelligence-based tools or methodologies were utilized in any stage of this research.

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