


# Annual variations in adolescent socio-emotional skills during and after COVID-19

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## Abstract

The COVID-19 pandemic disrupted adolescents' developmental contexts, limiting social interaction and access to learning environments. This cross-sectional study examined differences in socio-emotional skills among independent cohorts of Brazilian adolescents aged 15 to 17 between 2021 and 2023 (N = 9,769). Analyses of covariance assessed group differences in Amity, Open-mindedness, Self-management, Engaging with others, and Negative-emotion regulation. Results revealed consistent declines in Amity across cohorts and significant differences among 17-year-olds in all domains, particularly in interpersonal and emotional regulation skills. Findings suggest that prolonged social restrictions were associated with reductions in socio-emotional competencies, especially those dependent on peer interaction. Although causal inferences are limited by the design, the results highlight the relevance of contextual factors in adolescent development and underscore the need for targeted school-based interventions to support socio-emotional recovery in the post-pandemic period.

## Key Words

Socio-emotional skills; pandemic; COVID-19; adolescents; Brazil; adolescence.

## Thesaurus

APA Thesaurus of Psychological Index Terms.

## Key Points

- Adolescents showed lower socio-emotional skills after prolonged pandemic restrictions, especially in social and emotional areas.
- Skills related to relationships and emotion regulation were the most affected, particularly among older adolescents.
- Schools play a key role in helping adolescents recover these skills through structured socio-emotional learning and supportive environments.

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## Open Science

This article does not provide access to supplementary materials or the original research data.

## Variaciones anuales en las habilidades socioemocionales de los adolescentes durante y después del covid-19

### Resumen

La pandemia de covid-19 interrumpió significativamente el desarrollo adolescente, limitando las interacciones sociales y el acceso a entornos de aprendizaje. Este estudio transversal examina las diferencias en habilidades socioemocionales entre cohortes independientes de adolescentes brasileños de 15 a 17 años durante los años 2021 a 2023. Utilizando datos de 9769 participantes, se realizaron análisis de covarianza para evaluar diferencias grupales en amabilidad, apertura mental, autogestión, interacción con otros y regulación de emociones negativas. Los resultados indican puntuaciones consistentemente más bajas en amabilidad entre las cohortes, siendo los adolescentes de 17 años quienes mostraron diferencias significativas en todas las habilidades entre 2021 y 2023. Estos hallazgos sugieren que las restricciones sociales prolongadas se asociaron con una disminución de las habilidades socioemocionales en adolescentes, especialmente en los dominios interpersonales. El estudio destaca la importancia de intervenciones específicas para fomentar el desarrollo de habilidades socioemocionales en el contexto pospandémico.

### Palabras clave

Habilidades socioemocionales; pandemia; covid-19; adolescentes, Brasil, adolescencia.

## Variações Anuais nas Habilidades Socioemocionais de Adolescentes Durante e Após a Covid-19


### Resumo

A pandemia de covid-19 impactou significativamente o desenvolvimento de adolescentes, limitando interações sociais e o acesso a ambientes de aprendizagem. Este estudo transversal examina diferenças nas habilidades socioemocionais entre coortes independentes de adolescentes brasileiros de 15 a 17 anos ao longo dos anos de 2021 a 2023. Utilizando dados de 9769 participantes, Análises de Covariância avaliaram diferenças entre grupos nas dimensões de Amabilidade, Abertura ao novo, Autogerenciamento, Engajamento com os outros e Regulação de emoções negativas. Os resultados indicam escores consistentemente mais baixos em Amabilidade entre as coortes, com adolescentes de 17 anos apresentando diferenças significativas em todas as habilidades entre 2021 e 2023. Esses achados sugerem que restrições sociais prolongadas estiveram associadas à redução das habilidades socioemocionais, especialmente nos domínios interpessoais. O estudo destaca a importância de intervenções direcionadas para promover o desenvolvimento dessas competências no contexto pós-pandêmico.

### Palavras-chave

Habilidades socioemocionais; pandemia; covid-19; adolescentes; Brasil; adolescência.

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## Introducción

Adolescence is a critical developmental stage characterized by profound biological, psychological, and social changes. It is during this period that individuals build their identity, strengthen interpersonal skills, and develop socio-emotional skills (SES) (Jiménez *et al.*, 2023). This study focuses on adolescents aged 15, 16, and 17 years, as these ages represent critical phases within middle to late adolescence (Cavioni *et al.*, 2021; Choudhury *et al.*, 2023; Grazzani *et al.*, 2022). At this stage, individuals undergo intense neurobiological maturation, particularly in brain regions involved in self-regulation and decision-making, which increases sensitivity to stress and social influences (Dahl, 2016; Dvorsky *et al.*, 2022). These years are also marked by greater exposure to academic pressures, identity formation, and the pursuit of autonomy, which can heighten vulnerability to emotional and behavioral difficulties (Zhang *et al.*, 2025). Furthermore, peer relationships and school contexts gain central importance, making adolescents more susceptible to both positive and negative social experiences that shape their socio-emotional development (Inchley *et al.*, 2020; Orben *et al.*, 2020).

SES, encompassing domains such as Self-management, Open-mindedness, Negative-emotion regulation, Engaging with others, and Amity, are particularly relevant during this stage, as they are vital for fostering resilience, achieving academic success, and maintaining mental health (Feraco & Meneghetti, 2023; Huttunen *et al.*, 2024; John & De Fruyt, 2015; Soto *et al.*, 2011).

Recent evidence indicates that some SES tend to show age-related declines from childhood to adolescence, though trajectories are heterogeneous and skill-specific rather than uniformly linear (Organisation for Economic Co-operation and Development [OECD], 2025; Primi *et al.*, 2016; van de Sande *et al.*, 2023; Vázquez-Moreno *et al.*, 2025). Given these mixed patterns, examining 15-17 year-olds provides an opportunity to observe SES during a window of heightened developmental sensitivity.

The COVID-19 pandemic introduced large contextual stressors (social isolation, school closures, remote learning) that plausibly affected adolescents' SES and mental

health; however, evidence on the magnitude, direction, and persistence of these effects remains mixed and often constrained by study designs (Barcala *et al.*, 2022; Breaux *et al.*, 2023; Rodríguez-Monge *et al.*, 2023). The objective of this study is to assess annual variations in SES among Brazilian adolescents aged 15-17, using data collected over three consecutive years (2021-2023). Although the design is cross-sectional, with independent cohorts each year rather than repeated measures of the same individuals, this approach is widely used to investigate cohort and contextual influences when longitudinal data are unavailable (Twisk, 2013). By comparing age-matched groups across different years, the study aims to explore cohort differences that may reflect both lingering pandemic effects and subsequent recovery, while acknowledging the methodological limits of causal inference (Miyazaki & Raudenbush, 2000).

## Definition of SES and Developmental Trajectories During Adolescence

SES are commonly defined as individual characteristics that originate in the reciprocal interaction between biological predispositions and environmental factors. They are manifested in consistent patterns of thoughts, feelings, and behaviors, continue to develop through formal and informal learning experiences, and influence well-being as well as important socioeconomic outcomes throughout the individual's life (John & De Fruyt, 2015; OECD, 2015).

Historically, the field of SES was characterized by a lack of consensus regarding a definitive taxonomy of core SES, leading to conceptual ambiguity and measurement challenges (Abrahams *et al.*, 2019; Müller *et al.*, 2020). This issue was largely addressed by the Collaborative for Academic, Social, and Emotional Learning (CASEL), which established a dominant framework that organizes competencies into five interrelated domains: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (CASEL, 2020). Concurrently, an alternative categorization emerged from personality and industrial-organizational psychology, reconceptualizing the established Big Five personality traits as malleable competencies. Primi *et al.* (2019) formally proposed this model as the «Socioemotional Five» (SE5), comprising Engaging with Others, Agreeableness, Conscientious Self-Management, Emotion Regulation, and Open-Mindedness. While the CASEL framework is prescriptive and focused on skill acquisition in development, the SE5 framework is descriptive and rooted in the architecture of human personality, offering a robust psychometric structure for assessment.

These models are not contradictory but rather complementary; Casel outlines the how of instruction, whereas the SE5 describes the what of the underlying latent traits being cultivated (Primi *et al.*, 2019).

SES are fundamental to human development, particularly during adolescence, a period marked by profound cognitive, emotional, and social transformations. This developmental stage is shaped by ongoing neurobiological plasticity, including the maturation of the prefrontal cortex and limbic circuits, which play a central role in emotional regulation, impulse control, and decision-making (Dahl, 2016; Steinberg, 2014). Classic theories, such as Piaget's stages of cognitive development (Piaget, 1952) and Vygotsky's (1978) sociocultural theory, highlight adolescence as a critical period for consolidating higher-order thinking and social learning through interactions with peers and adults. Contemporary research further emphasizes that this stage involves significant brain maturation and socioemotional transitions that influence behavior, decision-making, and interpersonal relationships (Bramen *et al.*, 2011; Costa *et al.*, 2019; Dahl, 2016; Eccles *et al.*, 2013; Hills & Byrne, 2010; Soto *et al.*, 2011; Steinberg, 2014; Yurgelun-Todd, 2007).

Recent reviews and empirical studies indicate that certain SES tend to decline in early to mid-adolescence (e. g., social engagement, specific prosocial capacities), stabilizing or recovering later; however, the pattern is heterogeneous and context-dependent (Huttunen *et al.*, 2024; van de Sande *et al.*, 2023; Vázquez-Moreno *et al.*, 2025). Thus, assuming a single «natural trajectory» for all SES is not supported; rather, developmental patterns appear to be skill-specific and strongly influenced by environmental and contextual factors.

## Impact of COVID-19 on SES

The COVID-19 pandemic profoundly disrupted socio-emotional development worldwide. Evidence suggests that the restrictions imposed, such as school closures, social distancing, and prolonged isolation, limited opportunities for individuals to engage in essential social interactions, thereby affecting the acquisition and refinement of SES (Breux *et al.*, 2023; Rodríguez-Monge *et al.*, 2023). These skills, which include emotional regulation, empathy, and cooperative behaviors, are essential not only for healthy psychological adjustment but also as protective factors that foster resilience in times of crisis (Orben *et al.*, 2020; Wang *et al.*, 2021).

Adolescents represent a particularly sensitive population in this context. Developmentally, this stage is marked by ongoing neurobiological plasticity, heightened sensitivity

to peer feedback, and increased demands for autonomy, all of which make socio-emotional development especially salient (Dvorsky *et al.*, 2022; Steinberg, 2014). Studies conducted during the pandemic indicate that adolescents experienced significant challenges in maintaining SES, with declines observed in prosocial behaviors, emotional regulation, and interpersonal engagement (Grazzani *et al.*, 2022; Peterle *et al.*, 2022). Such vulnerabilities were intensified by the interruption of in-person schooling and extracurricular activities, contexts that normally provide critical opportunities for practicing and strengthening SES.

Moreover, preliminary evidence points to heterogeneous effects depending on the socio-emotional domain. For instance, while certain skills such as self-regulation deteriorated under chronic stress exposure, others, like problem-solving or adaptive coping, may have been strengthened as protective responses to adversity (Feraco & Meneghetti, 2023). These findings highlight the complex role of SES in adolescence: while susceptible to disruption, they may simultaneously act as resilience-building mechanisms.

The post-pandemic context presents an emerging research challenge. While current literature points to lingering difficulties in social engagement and emotional regulation among adolescents even after restrictions were lifted, systematic evidence remains limited (OECD, 2025; Szwarcwald *et al.*, 2024). More recent studies employing multicenter designs and time-series analyses have begun to reveal contextual variations and differentiated recovery trajectories following school reopening (Anuniação *et al.*, 2025; Lichand *et al.*, 2024).

In Brazil, socioeconomic inequalities, differences in school closure durations, and variability in remote education quality rendered the pandemic's impact heterogeneous. Brazilian studies show that while families may serve as support networks, domestic coexistence also became a source of conflict and stress for many adolescents, affecting well-being and potentially SES (Barros *et al.*, 2021; Szwarcwald *et al.*, 2024). This scenario underscores the importance of interpreting annual differences through the lens of local context and structural inequalities.

## Hypotheses

It is hypothesized that Brazilian adolescents aged 15-17 will show significant group differences in SES across the years 2021-2023, with such variations reflecting both the disruptions and gradual recovery associated with the COVID-19 pandemic. Drawing on the Theory of Stress and Psychosocial Adjustment, it is expected that exposure to

pandemic-related stressors may have influenced the socio-emotional development of these cohorts, leading to measurable differences in SES scores (Wang *et al.*, 2023). Importantly, rather than inferring causal effects, the present study seeks to identify patterns of variation across independent cohorts, while explicitly acknowledging the constraints of the cross-sectional design.

## Method

### Study Design

This study employed a cross-sectional design, drawing on independent samples of adolescents collected in three consecutive years (2021, 2022, and 2023). Each cohort was unique, with no repeated measures on the same participants, which allows for comparisons between groups across years but does not permit inferences about individual-level developmental change.

### Subjects

The sample size of this study was 9769 adolescents, both male and female. The sample was obtained using a convenience sampling method and collected over three years (2021-2023), with different participants each year. This strategy was adopted because the study was carried out in collaboration with educational institutions already participating in a socio-emotional development program, which facilitated access to a large and diverse group of students. Although convenience sampling limits the generalizability of results, it allowed the inclusion of a substantial number of participants across multiple years, increasing the robustness and representativeness of the findings within the Brazilian adolescent school context. The distribution of responses was 983 adolescents in 2021, 7616 in 2022, and 1170 in 2023.

Inclusion criteria required only that participants be adolescents aged 15 to 17 years, as there were no additional requirements for participation. Exclusion criteria were minimal, as the study aimed to maintain broad representativity. Adolescents with incomplete data were not excluded, ensuring that all available responses contributed to the analyses. Furthermore, there were no geographic or school-related restrictions, which allowed for a heterogeneous sample including students from diverse regions and educational contexts. Table 1 presents the distribution of the sample by gender and age.

**Table 1***Outline of Study Sample*

Variable	Category	2021 n (%)	2022 n (%)	2023 n (%)
Gender	Female	557 (56.7)	4.146 (54.4)	596 (50.9)
	Male	426 (43.3)	3.470 (45.6)	574 (49.1)
Age	15 years	275 (28.0)	2.773 (36.4)	469 (40.1)
	16 years	223 (22.7)	2.431 (31.9)	317 (27.1)
	17 years	485 (49.3)	2.412 (31.7)	384 (32.8)

*Note.* n = number; % = percentage.

## Tools

### *Sociodemographic Questionnaire*

A tool developed for this research, aiming to collect information on gender, age, and residence of subjects.

### *Semente Battery of Socio-emotional Skills*

The Semente Battery of Socio-emotional Skills used in this study is part of a broader instrument, a program aimed at fostering SES in educational contexts. It consists of 130 items to assess 17 aspects of the five SES: Amity, Engaging with others, Negative-emotion regulation, Self-management, and Open-mindedness. The items were administered using a five-point Likert-type scale, with response options ranging from «1 = Not at all like me» to «5 = Completely like me». To reduce acquiescence bias, all aspects are balanced: they have the same number of positive and negative items. Table 2 presents the validity and reliability indexes of each aspect, showing that the skills Amity, Engaging with others, Self-management, and Open-mindedness had adequate adjustment indexes, and 16 of the 17 aspects of the Semente Battery of Socio-emotional Skills present omega indexes greater than 0.70.

## Data collection and ethics statement

The data used in this study were derived from a private SES development program, aimed at adolescents and implemented in an educational setting. Data collection took place at the beginning of the SES development program in 2021, 2022, and 2023, through a secure virtual platform.

**Table 2***Adjustment indexes and MacDonal's omega of the Semente Battery of Socio-emotional Skills*

Skill family	X <sup>2</sup>	df	CFI	TLI	RMSEA (90 % CI)	Aspect	Ω
Amity	2.383*	206	0.93	0.90	0.082 (0.081-0.084)	Empathy	0.84
						Trust	0.76
						Respect	0.81
Engaging with others	2.962*	167	0.96	0.94	0.059 (0.057 - 0.060)	Social initiative	0.85
						Assertiveness	0.65
						Enthusiasm	0.81
Negative-emotion regulation	6.089*	165	0.87	0.82	0.110 (0.109 - 0.112)	Fear regulation	0.81
						Anger regulation	0.79
						Sadness regulation	0.84
Self-management	13.422*	589	0.92	0.90	0.061 (0.061 - 0.062)	Focus	0.86
						Organization	0.85
						Determination	0.82
						Persistence	0.86
Open-mindedness	4.858*	167	0.97	0.95	0.064 (0.062 - 0.065)	Responsibility	0.84
						Curiosity	0.83
						Creative imagination	0.85
						Aesthetic sensitivity	0.80

*Note.* \* =  $p < 0.05$ ; Ω = McDonald's omega.

The process was fully integrated into the educational program's routine, ensuring that no additional procedures or risks were introduced beyond those inherent to the program's regular activities. Consequently, obtaining additional informed consent from participants was not required, in accordance with Resolution 510/2016 of the National Health Council (Conselho Nacional de Saúde, 2016) and the Declaration of Helsinki (1964/2000; World Medical Association, 2000).

Despite the exemption from informed consent, strict ethical safeguards were implemented to protect the rights and well-being of adolescent participants. Confidentiality and anonymity were ensured through data encryption and the removal of any personally identifiable information before analysis. The research team had no direct access to identifying details, and all results were stored on password-protected servers with restricted access, following international standards for data protection.

## Analysis procedures

We conducted analyses of covariance to investigate whether there were statistically significant differences in the SES scores of subjects aged 15, 16, and 17 years, collected in

2021, 2022, and 2023, after controlling for the gender of the subjects. In the present analyses of covariance, eta squared ( $\eta^2$ ) was used as a measure of effect size to quantify the proportion of variance attributed to the factors under investigation. To interpret the magnitude of these effects, we followed the guidelines provided by Cohen (1988), which suggest that  $\eta^2$  values less than 0.01 indicate a small effect, values between 0.02 and 0.06 represent a medium effect, and values greater than 0.14 are indicative of a large effect.

In the pairwise comparisons conducted as part of the analyses of covariance, we utilized Cohen's  $d$  as the measure of effect size. According to Cohen's (1988) guidelines, a  $d$  value of 0.2 indicates a small effect, 0.5 represents a medium effect, and 0.8 or higher suggests a large effect. The inclusion of effect sizes ( $\eta^2$  and Cohen's  $d$ ) alongside confidence intervals provides a more nuanced understanding of the magnitude of these differences beyond statistical significance.

We assessed data normality using Kolmogorov-Smirnov tests and evaluated the assumption of homogeneity of variance using Levene's test. Bootstrapping procedures (10 000 resamplings; 95 % CI BCa) were performed to obtain greater reliability of the results, correct deviations from normality in the sample distribution, and address differences in group sizes. Additionally, these procedures provided a 95 % confidence interval for the differences between the means (Haukoos & Lewis, 2005; Mokhtar *et al.*, 2023). Considering the heterogeneity of variance, we applied Welch's correction and conducted *post-hoc* evaluations using the Tukey technique (Field, 2024).

## Transparency and Openness

We reported on the development of data collection, measures employed, and analyses conducted according to JARS (Appelbaum *et al.*, 2018). We performed data analyses using R software (version 4.0.0). We did not pre-register the design of this study and its analysis. Materials and analysis code for this study are not available because the data used in this research are part of a SES program implemented with students and are protected to ensure the privacy and confidentiality of the participants. Due to the sensitive nature of the information and the specific educational context, the data cannot be made openly available for public use. Access to these data is restricted to maintain ethical standards and to protect the identities and well-being of the student participants involved in the program.

## Results

In the analysis of covariance conducted, significant differences were observed in SES depending on the year and age of the participants. For Open-mindedness, the results indicate significant group differences among 17-year-olds across cohorts (table 3), higher scores in 2021 ( $M = 73.81$ ,  $SD = 15.11$ ) compared to 2022 ( $M = 71.49$ ,  $SD = 15.79$ ) ( $p = 0.017$ ,  $d = 0.015$ ) and 2023 ( $M = 69.76$ ,  $SD = 13.99$ ) ( $p = 0.004$ ,  $d = 0.028$ ) (table 4 and figure 1).

For Self-management, table 3 shows that 17-year-old participants exhibited significant differences in scores. These differences are observed between 2021 ( $M = 65.82$ ,  $SD = 14.92$ ) and 2022 ( $M = 62.90$ ,  $SD = 15.68$ ) ( $p = 0.001$ ,  $d = 0.19$ ) (table 4 and figure 1). The Cohen's  $d$  for this decrease indicating a small effect size. Although the decrease is statistically significant, it should be interpreted with caution given the relatively small magnitude of the effect.

**Table 3**

*Results of analyses of covariance performed with SES in 2021, 2022, and 2023, separated by age*

SES separated by age		F (df)	p	$\eta^2$
Open-mindedness	15 years	1.331 (5; 2.056)	0.248	0.001
	16 years	2.050 (5; 1.675)	0.069	0.001
	17 years	4.523 (5; 1.994)	< 0.001	0.006
Self-management	15 years	3.094 (5; 2.285)	0.050	0.003
	16 years	1.917 (5; 1.970)	0.147	0.002
	17 years	9.547 (5; 2.257)	< 0.001	0.008
Negative-emotion regulation	15 years	1.914 (5; 2.012)	0.148	0.002
	16 years	0.509 (5; 1.556)	0.601	0.001
	17 years	3.540 (5; 1.842)	0.029	0.004
Engaging with others	15 years	1.068 (5; 1.918)	0.434	0.001
	16 years	3.224 (5; 1.475)	0.040	0.009
	17 years	7.607 (5; 1.702)	0.001	0.007
Amity	15 years	7.607 (5; 2.098)	0.001	0.007
	16 years	3.449 (5; 1.601)	0.032	0.004
	17 years	8.330 (5; 1.826)	< 0.001	0.009

*Note.* df = degrees of freedom;  $p$  = statistical significance;  $\eta^2$  = eta squared. The analyses were statistically controlled for sex.

In terms of Negative-emotion regulation, although no significant differences were found in participants aged 15 and 16, those aged 17 showed a significant difference (table 3).

A decrease is observed in 2023 ( $M = 48.99$ ,  $SD = 16.53$ ) compared to 2021 ( $M = 51.57$ ,  $SD = 17.50$ ) ( $p = 0.030$ ,  $d = 0.15$ ) (table 4, and figure 1). The Cohen's  $d$  for the 2021-2023 comparison representing a small effect size.

**Table 4**

*Descriptive Statistics of SES for Samples Collected in 2021, 2022, and 2023 with Statistically Significant Results*

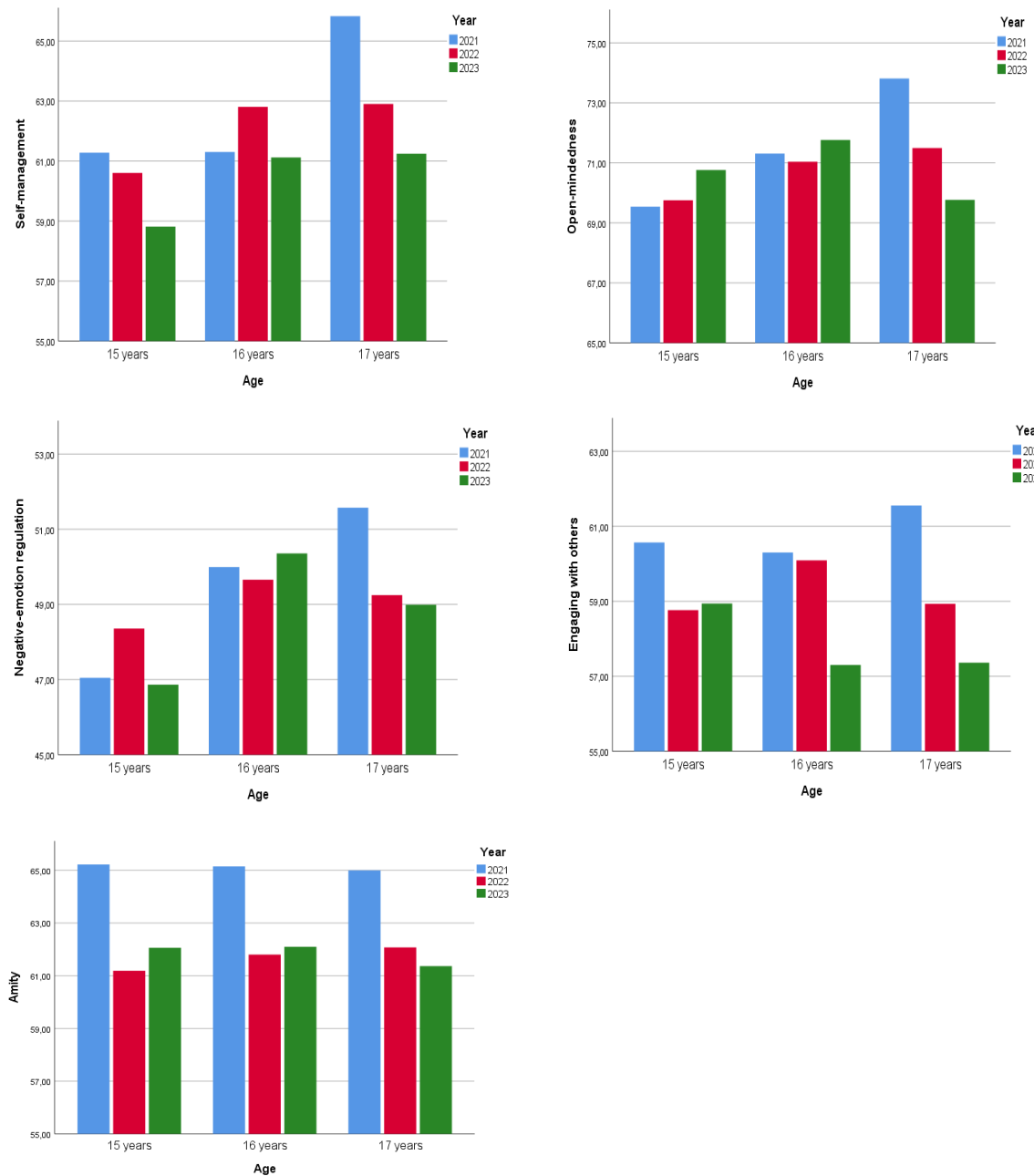
M (SD)				Pairwise comparisons	Tukey's post-hoc		
					p	CI (95 %)	d
Open-mindedness	17 years	2021	73.81 (15.11)	2021-2022	0.017	0.332 – 4.603	0.15
		2022	71.49 (15.79)	2022-2023	0.567	-1.046 – 3.587	0.11
		2023	69.76 (13.99)	2021-2023	0.004	0.925 – 6.551	0.28
Self-management	17 years	2021	65.82 (14.92)	2021-2022	0.001	0.947 – 4.958	0.19
		2022	62.90 (15.68)	2022-2023	0.219	-0.550 – 3.823	0.11
		2023	61.24 (13.65)	2021-2023	0.219	-0.550 – 3.823	0.32
Negative-emotion regulation	17 years	2021	51.57 (17.50)	2021-2022	0.117	-3.329 – 4.428	0.14
		2022	49.24 (17.13)	2022-2023	0.673	-1.258 – 3.846	0.02
		2023	48.99 (16.53)	2021-2023	0.030	0.236 – 6.451	0.15
Engaging with others	16 years	2021	60.29 (14.69)	2021-2022	1.000	-2.625 – 3.022	0.01
		2022	60.09 (14.12)	2022-2023	0.039	0.094 – 5.366	0.20
		2023	57.30 (15.32)	2021-2023	0.149	-0.643 – 6.500	0.20
	17 years	2021	61.55 (14.27)	2021-2022	0.004	0.717 – 5.051	0.15
		2022	58.93 (14.67)	2022-2023	0.508	-0.996 – 3.677	0.12
		2023	57.36 (12.77)	2021-2023	0.001	1.403 – 7.047	0.31
	15 years	2021	65.21 (12.62)	2021-2022	< 0.001	1.510 – 6.425	0.07
		2022	61.18 (13.98)	2022-2023	0.884	-2.819 – 1.103	0.06
		2023	62.05 (12.87)	2021-2023	0.032	0.190 – 6.028	0.25
Amity	16 years	2021	65.14 (12.93)	2021-2022	0.026	0.244 – 5.385	0.25
		2022	61.80 (13.23)	2022-2023	1.000	-2.863 – 1.944	0.02
		2023	62.09 (14.09)	2021-2023	0.257	0.925 – 5.635	0.22
	17 years	2021	64.99 (12.50)	2021-2022	< 0.001	1.249 – 5.111	0.22
		2022	62.07 (13.16)	2022-2023	1.000	-1.849 – 2.351	0.05
		2023	61.36 (12.62)	2021-2023	0.004	0.858 – 6.004	0.29

*Note.* M = mean; SD = standard deviation;  $p$  = statistical significance; CI = confidence intervals;  $d$  = Cohen's  $d$ . The analyses were statistically controlled for sex.

For Engaging with Others, significant differences were observed within the 16-year-old ( $p = 0.040$ ) and 17-year-old groups ( $p = 0.001$ ) across cohorts (table 3). In the pairwise comparisons presented in table 4, a year-on-year decline in this SES can be observed. Some of these comparisons are statistically significant, although they reflect small effect sizes.

**Figure 1**

*SES averages for subjects aged 15, 16, and 17 years – Data collected in 2021, 2022, and 2023*



Finally, Amity showed a significant downward trend across all ages (table 3). Unlike what was observed in the other competencies, the pairwise comparisons for the 15- and 16-year-old groups in the domain of Amity reveal a decline in scores from 2021 to 2022, followed by a slight increase between 2022 and 2023 (table 4, and figure 1). This modest

improvement over the last two years is not evident in the comparisons involving 17-year-old adolescents.

## Discussion

The present study examined SES in Brazilian adolescents during a period marked by the lingering effects of the COVID-19 pandemic. The analyses provide insights into how adolescents navigated critical developmental tasks under conditions of social disruption. The findings are discussed in light of developmental theory and prior empirical research, with particular attention to how contextual stressors may have shaped differences across cohorts.

The results show that the Amity scores collected in 2021 were higher when compared to the scores collected in 2022 and 2023 at the three ages tested. We found no statistically significant differences between the Amity scores for 2022 and 2023, despite the fact that mean scores in 2023 were slightly higher than those observed in 2022 among 15- and 16-year-old adolescents. The Amity skill emerges from emotional interactions with others and from experiences in everyday life. These results are consistent with recent evidence suggesting that adolescents exhibit lower levels of prosocial attributes, influenced by the COVID-19 pandemic (Barcala *et al.*, 2022; Cruz *et al.*, 2023; Wang *et al.*, 2021; Wiguna *et al.*, 2020).

The challenges imposed by the pandemic coincide with a critical developmental stage for adolescents, where SES play a key role in fostering resilience and managing stress. Social isolation, a cornerstone of the public health response to COVID-19, disrupted peer relationships, limiting opportunities for adolescents to practice empathy, conflict resolution, and cooperative behavior in real-life settings (Anuniação *et al.*, 2025; Sabou *et al.*, 2025). This disruption may have interfered with the expected processes of socio-emotional development during adolescence, potentially generating consequences that extend beyond the pandemic (Cruz *et al.*, 2023). Research indicates that adolescents rely heavily on peer feedback to refine their SES (Feraco & Meneghetti, 2023; Orben *et al.*, 2020), a process interrupted by prolonged school closures and remote learning environments.

Isolation measures also made it difficult to resolve conflicts, fights, and disagreements in person. Although it was possible to resolve conflicts online, the characteristics of this type of communication made it difficult to develop strategies that facilitate active

listening and non-verbal communication, which are essential for developing empathy, trust, and respect. Furthermore, digital disinhibition can facilitate the breakdown of social bonds, as online interaction often lacks the nuance and depth of face-to-face interactions, making it more difficult to strengthen relationships (Cruz *et al.*, 2023). Our findings may be partly impacted by increased access to electronic devices during lockdown. This is likely to increase adolescents' exposure to adverse political information and violent video games, which are risk factors for decreased prosocial behavior (Gentile *et al.*, 2009; Krahé & Möller, 2011; Padilla-Walker *et al.*, 2015).

These results may tentatively suggest that the deprivation of face-to-face interactions during the COVID-19 pandemic, combined with the increased reliance on online communication, played a role in the lower prosocial behaviors observed among adolescents. However, because variables such as social media use were not directly measured in this study, these interpretations should be considered exploratory hypotheses. Future research is needed to examine more systematically whether the characteristics of digital interactions, such as reduced empathy and greater anonymity, help explain declines in prosocial tendencies.

The recovery in agreeableness observed in 2023 may be related to the implementation of socioemotional support programs in schools, aimed at developing SES. Furthermore, the return to regular social interactions and in-person school activities may have favored the reestablishment of interpersonal relationships, as well as the development of resilience among adolescents, allowing them to adapt to the challenges of the post-pandemic period and recover essential SES (Perasso *et al.*, 2023; Singh *et al.*, 2022).

In the context of Negative-emotion regulation, 17-year-olds showed a significant decrease in scores between 2021 and 2023. This aligns with studies showing that chronic exposure to stress, such as that induced by the pandemic, can heighten emotional dysregulation, particularly in later adolescence (Peterle *et al.*, 2022; Romero-García *et al.*, 2020). Adolescents who faced significant losses, whether of loved ones, economic stability, or academic opportunities, likely experienced compounding stressors that exacerbated difficulties in managing negative emotions. Such outcomes highlight the necessity of targeted interventions aimed at bolstering emotional regulation skills as part of post-pandemic recovery programs for youth.

Another notable finding is that Engaging with others scores decreased significantly in 2023 compared to 2021 and 2022, especially among 16- and 17-year-olds. This pattern suggests that while the initial phases of the pandemic were marked by adaptation to

remote learning and social distancing, the prolonged nature of these disruptions may have eroded adolescents' capacity or motivation to engage in social activities. The gradual return to in-person interactions, while beneficial, may not have fully compensated for the long-term effects of isolation, such as social anxiety or a preference for online communication (Peterle *et al.*, 2022).

Adolescents are particularly susceptible to the cascading effects of stress, given their ongoing brain development and reliance on social contexts for skill acquisition (Feraco & Meneghetti, 2023; Venkatesh & Edirappuli, 2020). Interventions that address both individual competencies and broader social support systems are critical for mitigating the lasting impacts of the pandemic on adolescent development (Ayllón-Salas & Fernández-Martín, 2024).

The findings of this study have significant implications at multiple levels. Theoretically, they reinforce the understanding that the development of SES does not occur in isolation but is deeply influenced by contextual factors and disruptive external events such as the COVID-19 pandemic. By suggesting possible links between social isolation, disruptions in daily interactions, and adolescents' emotional regulation and social connectedness, this study contributes to the discussion on socio-emotional development in crisis contexts, without making causal claims. Practically, the results highlight the importance of universal, preventive interventions aimed at strengthening adolescents' SES within the school environment. Such programs remain relevant beyond the specific context of the pandemic, as they provide ongoing support for healthy development and resilience in the face of everyday stressors and future challenges. Strategies such as socio-emotional education programs, safe interaction spaces, and teacher training in emotional regulation skills can be crucial in mitigating the observed negative effects. From a policy perspective, these findings underscore the urgency of designing public policies that prioritize adolescents' emotional well-being in post-crisis scenarios, including the implementation of accessible psychological support services in schools and the development of curricula that explicitly integrate socio-emotional education. Overall, this study not only provides empirical evidence on the effects of the pandemic on Brazilian youth but also offers a framework for understanding and addressing the aftermath of global crises in the socio-emotional development of future generations.

### Limitations to Generalizability

Although the sample size is large and diverse, its unequal distribution across groups represents a limitation. Moreover, the findings may not necessarily generalize beyond

the specific population of Brazilian adolescents studied, as differences in socio-emotional development across countries and cultural contexts may lead to distinct outcomes.

Regarding methodological aspects, the use of analyses of covariance and a large sample strengthens the robustness of the analyses; however, the unique contextual factors of this study, particularly pandemic-related stressors and their impact on adolescents' daily lives, are intrinsic to the Brazilian context and may limit generalizability to settings where such conditions were not present.

By addressing these limitations, we aim to provide a clearer understanding of the scope within which our conclusions can be reasonably applied.

## Conclusions

This study examined annual variations in SES among Brazilian adolescents aged 15 to 17 between 2021 and 2023, a period encompassing both the direct effects of the COVID-19 pandemic and the subsequent recovery phase. The findings revealed consistent differences across three core domains: Amity, which declined across all age groups; Engaging with others, with more pronounced reductions among 16- and 17-year-olds; and Negative-emotion regulation, which showed a significant drop particularly among 17-year-olds. Additional variations were observed in Open-mindedness and Self-management, especially at age 17, although with effects of lesser magnitude.

These results reinforce that SES do not evolve linearly but are sensitive to crisis and recovery contexts, with certain domains, particularly those related to social interaction and emotional regulation, demonstrating heightened vulnerability. Such findings align with the study's initial aim of understanding how the pandemic and its aftermath affected different dimensions of SES in adolescents, underscoring the need for greater attention to interpersonal and regulatory skills in public policy and school-based programs.

From a practical standpoint, the development of universal and preventive interventions within the school environment becomes a priority, focusing on three key areas: 1) Promotion of kindness and prosocial behavior, through cooperative activities, community service projects, and restorative practices. 2) Strengthening of negative emotion regulation, including socio-emotional education programs targeting stress coping strategies, mindfulness, and conflict resolution. 3) Enhancement of in-person social engagement, through safe interaction spaces, encouragement of extracurricular activities, and support for students exhibiting signs of withdrawal or post-pandemic social anxiety.

While the present study contributes to the understanding of annual SES variations, future research should advance in multiple directions: multicenter studies with larger and more balanced samples; longitudinal designs integrating measures of stress and resilience; and qualitative approaches that capture the perspectives of students, educators, and families. Comparative investigations across regions or countries may also offer insights into how cultural, socioeconomic, and educational factors modulate socio-emotional development. Finally, it is essential to assess the effectiveness of school-based intervention programs, identifying which strategies most effectively restore and enhance the skills found to be most compromised.

In summary, this study indicates that the pandemic's impact on adolescents' SES was significant but not uniform, and that the challenges observed in Amity, Engaging with others, and Negative-emotion regulation should guide the formulation of educational policies and practices. Investing in these areas is crucial not only to repair the effects of the health crisis but also to strengthen adolescents' socio-emotional development in the face of future adversities.

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## Transparencia

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### Conflictos de interés

Los investigadores no reportan ningún tipo de conflicto de interés.

### Datos abiertos de la investigación

Los autores no permiten acceso abierto a los datos de la investigación en tanto pertenecen a los usuarios de la plataforma.

### Pares revisores del artículo (comité científico)

**Abílio Alfonso Lourenço**, Universidad de Minho, Portugal.

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### Revisión académica (revisión de escritorio)

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### Revisión editorial

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