Protective Factors Across School Trajectories: Socioeconomic and Racial Disparities

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Abstract

School dropout constitutes a multifaceted, relational process of disengagement from school, resulting from the interweaving of socioeconomic, cultural, and institutional determinants and the insufficiency of educational structures and support networks [1], which makes it essential to identify vulnerabilities early and strengthen protective factors throughout school trajectories [2]. This study aimed to analyze the influence of race/color and the Socioeconomic Level Index (INSE) on relational protective factors of school trajectories. Accordingly, a sample of 10,000 synthetic data was used, based on 3,678 valid responses/answers from students of four Brazilian states who completed the Relational Factors for the Risk of School Dropout Scale – Alternative version (IAFREE-A). The synthetic data was calculated using the Gaussian Copula technique, which considers the association between the observed variables in the dataset to estimate new responses, generating a new and bigger dataset. This approach was considered due to the General Law of Data Protection (LGPD), ensuring ethical compliance through the use of anonymized data, nationwide data collection using real data is currently being conducted in Brazil. Analyses were conducted in JASP using Kruskal–Wallis tests with Dunn post hoc comparisons (Holm correction) due to non-normality (Shapiro–Wilk), and effect sizes were estimated using eta-squared (η^2), variables were the scores of the 14 attention factors. Results showed that, for race/color, significant differences were found in E-FAM2 ($p<.001$), E-EST2 ($p<.001$), and E-EST3 ($p=.002$). Brown students reported poorer family support and educational expectations than White, while Black and Brown showed more negative perceptions of school belonging. For INSE, lower levels were associated with greater vulnerability across E-FAM1, E-FAM2, E-COM2, E-EST1, and E-EST3 (all $p<.001$), particularly family support. Protecting school trajectories requires intersectional policies strengthening school inclusivity for racial minorities and economically vulnerable students.

Keywords: *School dropout, School trajectories, School vulnerability, Inequality, Student Assessment*

1. Introduction

School dropout is a persistent problem in contemporary educational systems, with consequences that extend beyond students' individual trajectories and directly affect countries' social and economic development [3]. In Brazil, this phenomenon does not affect all students equally, as it follows patterns that expose and reproduce, within the educational system itself, the structural inequalities of society [4]. The racial dimension makes this inequality even more evident, as Black and Brown youth account for the majority of those who do not complete basic education in the country [5], revealing that school retention is conditioned by racial and socioeconomic factors, causing school dropout to transcend the purely pedagogical dimension and come to reflect broader social inequalities existing in the Brazilian context [4].

The literature has advanced our understanding of this phenomenon and reached an important conclusion: school dropout is not an isolated event, but rather the result of a relational and multifactorial process involving socioeconomic conditions, cultural aspects, institutional factors, and weaknesses in student support networks [6]. As demonstrated in studies, it is evident that school disengagement rarely occurs suddenly, but is preceded by a gradual weakening of the bonds established between the student and the various settings that make up their school experience [3],[7]. It is within this set of relationships that both the main risks and the protective factors for educational trajectories are concentrated, understood as relational elements that, when reinforced, promote student retention and continuity in the educational system, even in the face of the adversities they face [2]. In this context, the early

identification of vulnerabilities, combined with the reinforcement of these protective factors, has been identified as one of the most important strategies for combating school dropout [2].

Among the factors that shape this process, race/color and socioeconomic status stand out as particularly significant structural determinants. Early warning systems for school dropout have shown that students in economically vulnerable situations and belonging to racial minority groups face greater difficulties in staying in school, related both to limited material resources and to the weakening of the support networks that sustain school continuity [8]. Although the importance of these variables is increasingly recognized, studies investigating their effects in an integrated and intersectional manner within the Brazilian context remain limited, particularly when the focus is on relational protective factors, rather than solely on risk indicators or academic performance.

Moving in this direction is essential, since understanding the factors that promote school retention is a prerequisite for developing more effective interventions aimed at promoting equity, as advocated by international agendas focused on safeguarding educational trajectories [2]. Thus, the present study aimed to analyze the influence of race/ethnicity and the Socioeconomic Status Index (*Índice do Nível Socio-Econômico* - INSE) on relational protective factors for the educational trajectories of Brazilian students, assessed using the Relational Factors for the Risk of School Dropout Scale – Alternative version (IAFREE-A) [9]. It is worth highlighting that INSE is a composite indicator developed by INEP that classifies students into eight hierarchical groups, from Group I (lowest) to Group VIII (highest), based on the parents' level of education and the household's possession of goods and services, making it a widely used measure to capture socioeconomic stratification in the Brazilian education system [10].

2. Method

2.1 Participants

The sample consisted of 10,000 synthetic data points generated from 3,678 valid responses from students, with a predominance of females (50.82%), students of brown race (54.88%), and those in Group V of the Socioeconomic Status Index (INSE) (21.66%). In addition, a higher concentration of participants was observed in the Midwest region (44.35%), followed by the Southeast (25.72%). All sociodemographic characteristics are presented in Table 1.

Table 1. Sociodemographic profile of the sample.

Gender	n	%	Race/Ethnicity	n	%
Male	4898	48.98	White	2168	21.68
Female	5082	50.82	Black	2062	20.62
I prefer not to declare	20	0.20	Brown	5488	54.88
			Other	282	2.82
Region of Residence	**n**	**%**	**Socioeconomic Status Index**	**n**	**%**
Midwest	4435	44.35	I	196	1.96
Northeast	1368	13.68	II	1101	11.01
North	1625	16.25	III	1525	15.25
Southeast	2572	25.72	IV	2042	20.42
			V	2166	21.66
			VI	1592	15.92
			VII	1222	12.22
			VIII	156	1.56

2.2 Instruments

The final version of the Scale of Relational Factors for the Risk of School Dropout – Alternative Version (IAFREE-A) [9], an adaptation of the IAFREE originally developed by Vasconcelos et al. [7], aligned with and guided by the concept of School Trajectory Protection. In this sense, the instrument is completed exclusively by students and consists of 46 items, organized into 5 relational dimensions and 14 attention factors. The 5 dimensions are designated as protective dimensions, namely: Student-School (SSc), Student-School Professionals (SP), Student-Family (SF), Student-Community (SC), and Student-Student (SSt), totaling 14 factors of attention: Infrastructure (SSc1); School as a Safe Space (SSc2); Discrimination (SSc3); School Management and Organization (SP1); Pedagogical Quality (SP2); Teacher expectations (SP3); Parenting (SF1); Family support structure (SF2); Family interaction (SF3); Network interaction (SC1); Community relations (SC2); Interpersonal relationships and social skills (SSt1); Expectations regarding education/educational development (SSt2); Belonging/Identification (SSt3). Responses are recorded on a 1-to-4 Likert scale in two formats: frequency (1 = “Never,” 2 = “Sometimes,” 3 = “Frequently,” and 4 = “Always”) and agreement (1 = “Strongly disagree,” 2 = “Disagree,” 3 = “Agree,” and 4 = “Strongly agree”), both accompanied by a pictorial scale. In general, the scores are reversed, with the exception of items Q5 and Q36, whose statements are already negative, such that higher scores indicate greater attention to the educational trajectory, while lower scores reflect lower vulnerability. Additionally, a 33-item sociodemographic questionnaire was administered to characterize the participants’ profiles, covering variables such as gender, race/ethnicity, Socioeconomic Status Index, and others.

2.3 Procedures

The study was conducted in accordance with ethical guidelines for research involving human subjects, as per National Health Council Resolutions No. 466/2012 and No. 510/2016, and was approved by the Human Research Ethics Committee (CEP/UFAL) under approval No. 5.407.594. Thus, data collection was carried out with students in schools from four state school systems, located in the Central-West, Northeast, North, and Southeast regions of Brazil. For this data collection, a specific digital platform was developed for the administration of the IAFREE-A, where students gained access to the platform only after their parents or guardians signed the Informed Consent Form (ICF), and the Informed Assent Form (IAF) was made available on the platform itself for the students.

2.4 Data Analysis

The analysis procedures were performed in R [11], where synthetic data were generated using the Gaussian Copula technique, based on multivariate normal distributions and the integral probability transformation applied to the original data [12]. The adoption of this approach is justified both from a methodological standpoint, as it preserves the dependency structure among variables, an essential aspect in psychometric data where latent factors emerge from correlations between items [13], [14], and from an ethical standpoint, as it ensures the anonymization of information in compliance with the General Data Protection Law (LGPD) [15]. Thus, the correspondence between the synthetic and original data was assessed using the Hellinger distance, which ranges from 0 to 1, with values close to zero indicating greater similarity between distributions and higher values indicating greater discrepancy [16]. In this study, a value of 0.20 was adopted as the criterion for adequacy.

Based on the generation of synthetic data, statistical analyses were performed using the JASP software [17]. A priori, data normality was assessed using the Shapiro–Wilk test ($p < .05$) [18], and since the assumptions were not met, indicating asymmetry [19], nonparametric tests were chosen, specifically the Kruskal–Wallis test for three or more groups, with application of Dunn’s post hoc test [20] when necessary. Effect sizes were reported using eta-squared and Biserial rank correlation (Dunn post hoc), following the interpretation of thresholds by Serdar et al. [21] for small (0.20), moderate (0.50), and large (0.80) effects. The scores of the 14 attention factors of the IAFREE-A were used as dependent variables for the comparative tests. As independent variables, race/ethnicity and INSE were used, classified on a scale from I to VIII, where I represents the lowest conditions and VIII the highest, based on a composite score comprising variables such as income, education, and assets.

3. Results

The correspondence between the synthetic data and the original data was assessed using the Hellinger distance (Hd), a metric ranging from 0 to 1, in which values closer to zero indicate greater

similarity between the compared distributions. As shown in Table 2, all values found remained below the adopted adequacy criterion (Hd < 0.20), indicating a high degree of similarity between the distributions of the synthetic data and the original data.

Thus, regarding the instrument's dimensions, Hd values ranged from 0.015 (E-EST) to 0.034 (E-COM). Among the factors, however, there was a slightly greater variation, with values ranging from 0.032 (E-ESC2 and E-FAM3) to 0.065 (E-EST2), remaining within the limit considered adequate, reinforcing the quality of the approximation obtained. Meanwhile, race/ethnicity showed Hd = 0.067, while INSE recorded Hd = 0.027, both below the established cutoff point. It is noted that the relatively higher value observed for race/color is possibly related to the greater heterogeneity of this variable in the original sample, which tends to make its synthetic reproduction more complex when compared to more homogeneous distributions.

Table 2. Hellinger distance by dimension, factor, and sociodemographic variables.

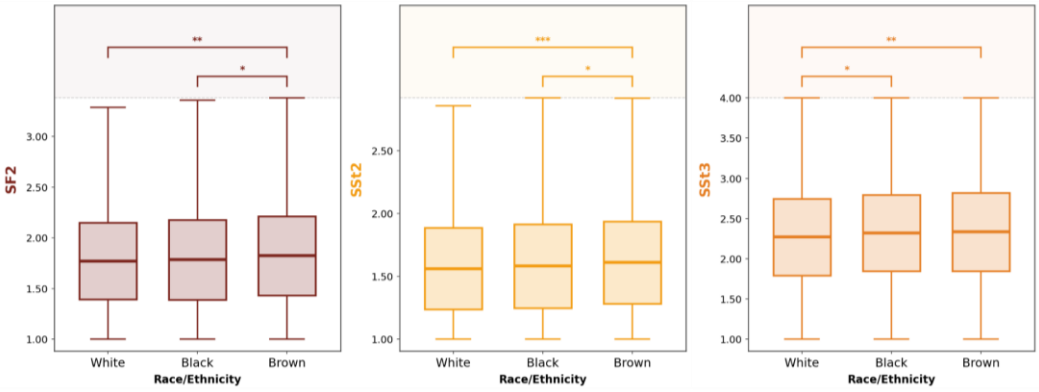
Dimension	Hd	Factor 1	Hd	Factor 2	Hd	Factor 3	Hd
SSc	0.017	*SSc1*	0.035	*SSc2*	0.033	*SSc3*	0.044
SF	0.026	*SF1*	0.039	*SF2*	0.038	*SF3*	0.032
SP	0.021	*SP1*	0.036	*SP2*	0.035	*SP3*	0.032
SC	0.034	*SC1*	0.037	*SC2*	0.033	—	—
SSt	0.015	*SSt1*	0.038	*SSt2*	0.065	*SSt3*	0.043
Variables		*Race*/Ethnicity	0.067	*INSE*	0.027	—	—

Note. Hd: Hellinger distance. INSE: Socioeconomic Status Index.

With regard to the comparative analyses, for the Race/Ethnicity variable, the Kruskal-Wallis test indicated statistically significant differences in SF2 ($H(2) = 15.34$; $p<0.001$; $\eta^2 = 0.001$), SSt2 ($H(2) = 19.13$; $p<0.001$; $\eta^2 = 0.002$), and SSt3 ($H(2) = 12.60$; $p=.002$; $\eta^2 = 0.001$). Next, Dunn's post hoc test (with Holm correction) was applied to examine paired comparisons between the groups. In this context, regarding the SF2 factor, brown students reported a negative perception of the support structure at home, compared to white students ($z = -3.444$; $p=.002$) and Black students ($z = -2.750$; $p=.012$).

Similar results were found for the SSt2 factor, in which brown students also reported negative perceptions regarding expectations regarding education, when compared to white students ($z = -4.062$; $p<.001$) and Black students ($z = -2.687$; $p=.014$). In contrast, regarding the SSt3 factor, related to feelings of belonging and identification, Black and brown students had higher scores, that is, less positive impressions, than white students ($z = -2.424$; $p=.031$ and $z = -3.524$; $p=.001$, respectively).As illustrated in Figure 1, higher scores reflect greater perceived vulnerability, with Brown students consistently presenting the highest scores across SF2, SSt2, and SSt3, followed by Black students, indicating that racial minority groups experience greater relational vulnerability within the school context.

Fig. 1. Boxplots of factors showing statistically significant differences across Race/Ethnicity categories.

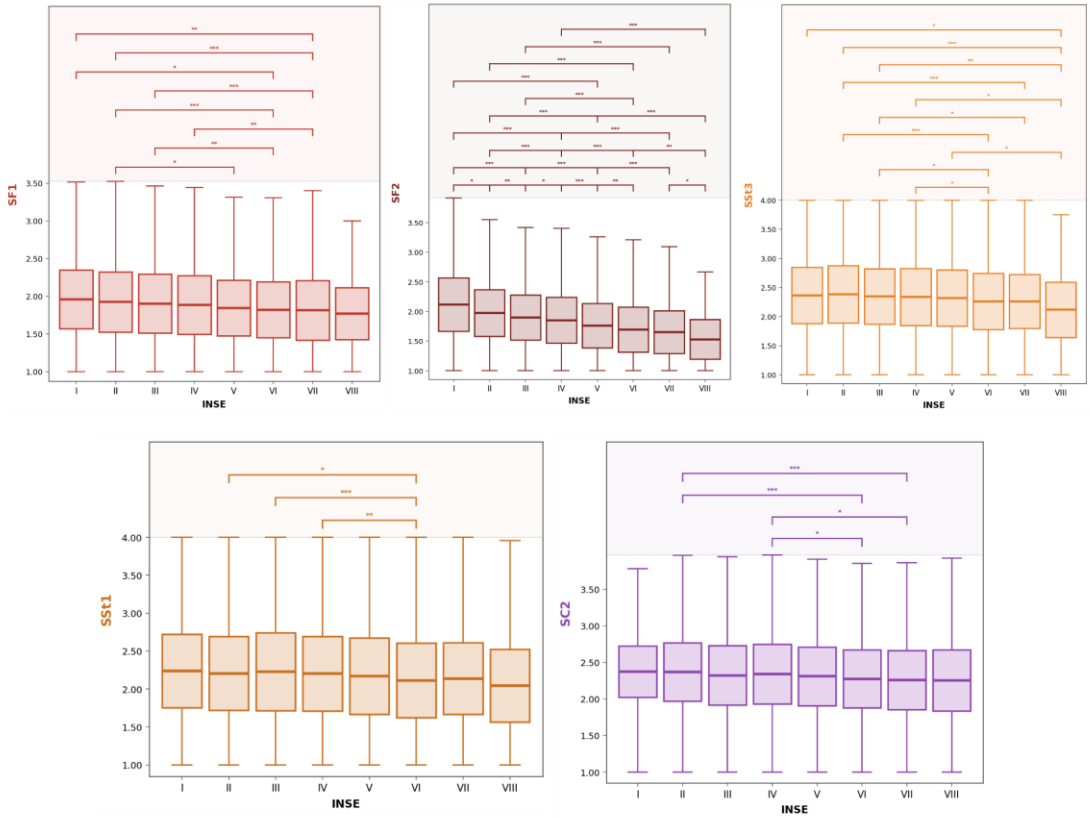


Note. *: p<.05; **: p<.01; ***: p<.001.

When considering the Socioeconomic Status Index (INSE) variable, there were statistically significant differences in the factors SF1 (H(7) = 48.35; p < .001; η^2 = 0.004), SF2 (H(7) = 399.1; p<.001; η^2 = 0.039), SC2 (H(7) = 33.94; p<.001; η^2 = 0.003), SSt1 (H(7) = 32.62; p<.001; η^2 = 0.003), and SSt3 (H(7) = 43.41; p<.001; η^2 = 0.004). When Dunn's post-hoc test was applied, considering the Parenting factor (SF1), Group I had higher scores compared to Groups VI (z=3.272; p=.023) and VII (z=3.602; p=.008), suggesting a greater perception of a family environment that does not fully value education and personal development among students from lower socioeconomic backgrounds. Group II, in turn, differed from groups V (z=3.264; p=.023), VI (z=4.147; p<.001), and VII (z=4.622; p <.001), while Group III had higher scores than Groups VI (z=3.722; p=.005) and VII (z=4.242; p<.001), and Group IV also differed from Group VII (z=3.556; p=.009).

As for the Family support structure (SF2), Group I scored higher than all other groups, with Group II (z=2.508; p=.049), Group III (z=4.219; p<.001), Group IV (z=5.391; p<.001), V (z=7.565; p<.001), VI (z=9.088; p<.001), VII (z=9.831; p<.001), and VIII (z=9.009; p<.001). Group II obtained higher scores than groups III (z=3.180; p=.007), IV (z=5.583; p<.001), V (z=9.993; p<.001), VI (z=12.59; p<.001), VII (z=13.53; p<.001), and VIII (z=9.026; p<.001). Meanwhile, group III scored higher than groups IV (z=2.452; p=.049), V (z=7.303; p<.001), VI (z=10.26; p<.001), VII (z=11.36; p<.001), and VIII (z=7.690; p<.001), and group IV differed from groups V (z=5.224; p<.001), VI (z=8.517; p<.001), VII (z=9.769; p<.001), and VIII (z=6.783; p<.001). Group V also differed from groups VI (z=3.745; p=.001), VII (z=5.372; p<.001), and VIII (z=4.853; p<.001), while groups VI (z=3.322; p=.005) and VII (z=2.472; p=.049) obtained higher scores than group VIII. All these high scores indicate that the lower the students' socioeconomic status, the greater their perception of a lack of resources and support within the family context. As shown in Figure 2, scores tend to decrease progressively from Group I to Group VIII, suggesting that students from lower socioeconomic backgrounds report greater vulnerability across the relational factors of their school experience, reinforcing the role of economic disadvantage as a structural determinant within the educational context.

Fig. 2. Boxplots of factors showing statistically significant differences across INSE categories.



Note. *: p<.05; **: p<.01; ***: p<.001.

With regard to Community relations (SC2), significant comparisons were limited to groups II and IV. Group II had higher scores than groups VI (z=4.152; p<.001) and VII (z=4.253; p<.001), a pattern also observed in group IV compared to groups VI (z=3.356; p=.020) and VII (z=3.488; p=.013), indicating a greater perception of distance between the school and the community among students from lower socioeconomic backgrounds. Regarding Interpersonal relationships and social skills (SSt1), it was observed that group II had higher scores than group VI (z=3.256; p=.029), a result also observed in group III (z=4.331; p<.001) and in group IV (z=3.585; p=.009), suggesting that students from lower socioeconomic backgrounds perceive more conflictual interpersonal relationships, with less empathy and greater communication difficulties.

On the Belonging/Identification factor (SSt3), Group I scored higher than Group VIII (z=3.071; p=.041), while Group II scored higher than Groups VI (z=4.490; p<.001), VII (z=4.229; p<.001), and VIII (z=4.257; p<.001), and Group III scored higher than Groups VI (z=3.329; p=.020), VII (z=3.101; p=.041) and VIII (z=3.658; p=.006). In turn, Group IV obtained higher scores than Groups VI (z=3.101; p=.041) and VIII (z=3.513; p=.011), while Group V stood out with higher scores compared to Group VIII (z=3.245; p=.026), suggesting that the lower the students' socioeconomic status, the lower their sense of belonging and identification with the school environment.

4. Discussion

The close correspondence between the synthetic data and the original data indicates that the synthetic generation process successfully preserved the sample's distributional structure without introducing distortions that could compromise the analyses performed. Recent evidence demonstrates the effectiveness of using synthetic data both in medical contexts and in reproducing complex behavioral patterns [21], [22], with similarities between those studies and the present one. Furthermore, beyond being a satisfactory methodological result, this finding has significant ethical relevance, as the use of these data enables robust statistical analyses while simultaneously strengthening the protection of participants' privacy. In this context, the slightly higher value observed for race/ethnicity, for example, should not be interpreted as a limitation of the method, but rather as a reflection of the greater heterogeneity of this variable in the original sample, a characteristic that makes its reproduction more complex, as well as reinforcing its centrality to the study's objectives, since the indices remained within the established adequacy limits.

Based on this premise, and ensuring the consistency of the data, the analyses show that the school experience, particularly among mixed-race students, is marked by relational vulnerabilities that manifest themselves both in the family environment and in the expectations formed regarding the future. Within the family context, these students perceive fewer resources and less support at home to sustain their educational trajectory, a pattern that can be interpreted as a reflection of historical conditions of exclusion that limit not only access to material goods but also the presence of educated role models within the family unit, which, in turn, compromises the concrete and symbolic support that the family can offer the student [24]. Furthermore, this context fosters a more uncertain perception of the concrete benefits of schooling, contributing to a cycle in which social vulnerability also translates into less subjective investment in one's own educational trajectory [8].

Furthermore, low expectations are directly linked to a weakened sense of belonging in school. Students from racial minorities reported a greater sense of not belonging compared to white students, a condition that influences fundamental aspects of their educational trajectory, such as motivation, attendance, and retention. Recent evidence suggests that this process tends to intensify across educational levels [25] and stems not only from abstract identity conflicts but also from concrete experiences of exclusion and devaluation encountered in daily school life [8]. The fact that race/color-related effects were concentrated primarily in subjective and affective dimensions, such as support, expectations, and belonging, rather than in more objective aspects of the school structure suggests that racial inequalities are expressed above all in students' daily experiences. Precisely for this reason, these processes tend to elude more traditional educational indicators, even though they have a decisive impact on the continuity of the educational journey.

Similarly, socioeconomic inequalities also revealed a broad pattern of relational vulnerability. It was observed that the lower the students' socioeconomic status, the more negative their perceptions of family support, community ties, and school integration were. The perception of insufficient resources in the home environment appears to affect not only the material conditions for studying but also the

possibilities for emotional support and involvement in school life, a situation that should not be interpreted as a lack of interest on the part of families, but rather as a consequence of contexts in which the demands of survival limit the concrete conditions for participating in their children's educational journey [26].

At the same time, the greater perceived distance between schools and communities in lower-income groups suggests weaknesses in the connection between educational institutions and the social environment in which these young people live, fostering disengagement when schools fail to engage with students' experiences, cultural references, and everyday realities [6]. Consequently, the combination of these material, relational, and emotional factors helps us understand that school dropout rarely occurs abruptly. In many cases, it is preceded by a gradual and silent process of subjective withdrawal, marked by low participation, difficulties in integration, and strained relationships with peers and teachers, aspects that often go unnoticed by conventional educational indicators [27].

That safeguarding students' educational trajectories requires recognizing that school retention is, above all, a relational issue, and that effective interventions must address the conditions that make the school environment a welcoming, inclusive, and meaningful space for all students, regardless of their racial background or economic status. Future research with longitudinal designs and more regionally diverse samples could deepen our understanding of the mechanisms through which these inequalities are consolidated or mitigated over time, contributing to the development of educational policies that are more equitable and sensitive to the heterogeneity of the Brazilian context.

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