Educación XX1
ISSN: 1139-613X
ISSN: 2174-5374
educacionxx1@edu.uned.es
Universidad Nacional de Educación a Distancia
España

Cuadros, Olga; León-del Barco, Benito

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Educación XX1, vol. 27, núm. 2, 2024, Julio-Diciembre, pp. 195-221
Universidad Nacional de Educación a Distancia
Madrid, España

DOI: https://doi.org/10.5944/educxx1.38653

Disponible en: https://www.redalyc.org/articulo.oa?id=70681678008

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ISSN: 1139-613X · e-ISSN: 2174-5374

Discriminant analysis of positive classroom interpersonal relationships and academic performance in Chilean students at school

Análisis discriminante de las relaciones interpersonales positivas de aula y rendimiento académico en escolares chilenos

Olga Cuadros [1*]
Benito León-del Barco [2]

[1] Universidad Católica Silva Henríquez, Chile
[2] Universidad de Extremadura, Spain
*Corresponding author. E-mail: ocuadros@ucsh.cl

Cómo referenciar este artículo/ How to reference this article:

Cuadros, O., & León-del Barco, B. (2024). Discriminant analysis of positive classroom interpersonal relationships and academic performance in Chilean students at school. *Educación XX1*, *27*(2), 195-221. https://doi.org/10.5944/educxx1.38653

Date received: 15/10/2023
Date accepted: 26/02/2024
Published online: 28/06/2024

ABSTRACT

This study proposed to analyse positive dimensions of the interpersonal relationships of students with their peers and teachers in the classroom, in their discriminant role with respect to the differences between levels of academic performance, helping to better understand the relevance of these interpersonal relationships in the educational outcome. An associative design using discriminant analysis was used on a cluster sample of one thousand two hundred seventy-three (n=1273) students with voluntary participation, randomly selected in the second and third level of Basic Education and first and second cycle of Secondary Education (5th grade to 4th grade [levels 5 to 12]) in eight public and private

educational schools that receive state funding from the Chilean government, located in three key regions of the northern macro-zone (Tarapacá) and center of the country (Valparaíso and Metropolitan Region), during 2020 and 2021, corresponding to the pandemic period COVID-19. The mean age was 14.20 years (SD= 2.43; range 10-19); 47.5% (n=605) females, 48% (n=611) males and 4.5% (n=57) with non-binary gender identity. The results point to the identification of approval, instrumental support and affection as dimensions with the greatest predictive capacity in the positive interpersonal relationship with teachers, while with peers with whom they share the classroom, satisfaction, approval and enjoyment of their company stand out. The canonical discriminant function in both models, with teachers and classmates, correctly classifies a significant percentage of students mainly in the notable and outstanding levels of academic performance. These results allow, on the one hand, to recognize favourable aspects for the educational process that occur through interpersonal relationships in the classroom. They also highlight dimensions that are part of the repertoire of expected and intended attitudes and practices within educational interactions, whose influence is recognized for academic achievement.

Keywords: interpersonal relationship, teacher student relationship, academic achievement, discriminant analysis, school

RESUMEN

Este estudio propuso analizar características positivas de las relaciones interpersonales de los escolares con sus pares y profesorado en el aula, en su rol discriminante respecto de las diferencias entre niveles de rendimiento académico, ayudando a comprender mejor la relevancia de estas relaciones interpersonales en el resultado educativo. Se utilizó un diseño asociativo mediante análisis discriminante a una muestra por conglomerados de 1273 alumnos con participación voluntaria, seleccionada aleatoriamente en el segundo y tercer nivel de Educación Básica y primer y segundo ciclo de Educación Media (niveles 5 a 12) en ocho centros educativos públicos y privados que reciben financiamiento estatal del gobierno de Chile, ubicados en tres regiones claves de la macrozona norte (Tarapacá) y centro del país (Valparaíso y Región Metropolitana), durante los años 2020 y 2021, correspondiente al período de pandemia COVID-19 . La edad promedio fue de 14.20 años (SD= 2.43; rango 10-19); 47.5% (n=605) mujeres, 48% (n=611) varones y un 4.5% (n=57) con identidad de género no binaria. Los resultados apuntan a identificar como variables de mayor capacidad predictiva en la relación interpersonal positiva con el profesorado, la aprobación, apoyo instrumental y afecto de parte de estos adultos, mientras que con pares con quienes comparten en el aula, destacan la satisfacción, aprobación y disfrute de su compañía. La función canónica discriminante en ambos modelos, con profesorado y compañeros de curso, clasifica correctamente a un porcentaje significativo de estudiantes principalmente en los niveles notable y sobresaliente de rendimiento académico. Estos resultados permiten, por una parte, reconocer aspectos favorecedores para el proceso educativo que suceden a través de las relaciones interpersonales en el aula. Y destacan, además, dimensiones que son parte del repertorio de actitudes y prácticas esperables e

intencionadas dentro de las interacciones educativas, cuya influencia es reconocida para el rendimiento académico.

Palabras clave: relaciones interpersonales, relación profesor estudiante, rendimiento académico, análisis discriminante, escuela

INTRODUCTION

The concept of academic performance is quite broad and complex, and it has been interpreted according to the significance it holds for different involved audiences (de la Fuente Mella et al., 2021). The operationalization of this concept will therefore respond to the perspective one wishes to emphasize; hence, in this study, we opt for a definition that reflects, as much as possible, the way it has been defined in Chile, opening the possibility for discussion about the diversity of factors that can influence its evidence.

Academic performance can be defined in terms of the level of knowledge and skills that the student demonstrates developing in a specific area or subject, which is operationalized in a grade through which their performance, achievement, and level attained are evaluated, corresponding with the age norm (Navarro, 2003). The demonstration of this achievement is usually reflected through assessments by various educational stakeholders, mainly teachers, at a quantitative and/or qualitative level (Castrillón et al., 2020). Considering the complexity of the concept, attention has been given to what helps define and better understand which variables influence academic performance in the educational context. In this sense, aspects associated with socioemotional interactions dependent on the educational institution and the classroom have been of interest for a more epistemologically appropriate and contextualized understanding of academic performance (Berger et al., 2011). Recent research has shown effective evidence of the association between academic performance and socioemotional variables, particularly in Chile, but mainly focused on individual factors (Vera-Sagredo et al., 2021). Although the association between academic performance and individual student factors has been widely discussed and accepted, in recent years, the idea that academic performance does not depend solely on individual and cognitive factors has gained strength. Thus, the development of this research field has been expanded, allowing for the systematic study of the relevance of other types of variables in academic performance, such as those related to social interactions with significant individuals linked to the learning process and context. Consequently, the possibility of studying a socioemotional dimension of academic performance has been established; although, often through indirect pathways related to other variables, such as school engagement (Van Mieghem et al., 2018; Miranda-Zapata et al., 2021).

This explanatory line of study regarding academic performance that incorporates the socioemotional aspects, highlights the need to pay attention to the influence that interpersonal relationships that students develop with teachers and peers in their educational environment have, more directly (Mainhard et al., 2018). School connections with these significant individuals promote not only socioemotional development but also a key factor for psychological and social well-being, as well as for student academic performance and achievement (Fabris et al., 2022). Thus, the factor of interpersonal relationships contributes to the construction of an idea of comprehensive quality education in educational contexts, which, at least in Latin America, has been challenging, given the social, political, and economic conditions applied to educational systems in recent decades (Kutsyuruba et al., 2015; Flores, 2023).

Interpersonal relationships in the learning process

In today's world, especially in the context of the COVID-19 pandemic, it is necessary, but also a significant challenge, to consider the socioemotional dimension within teaching and learning processes in classrooms. The pandemic period made it evident that learning environments need to be perceived as safe, trustworthy, and supportive spaces where learning can occur through sharing with others, being valued, and supported (Berger et al., 2011; Abramowski & Sorondo, 2022). The major challenge lies in highlighting the role of key actors, such as teachers and classmates, in creating conditions of well-being, engagement, and connection with school, which has been described as attachment in the classroom or school attachment (Bergin & Bergin, 2009). The acknowledgment of the importance of affectionate and secure relationships that should emerge and develop in the educational context has been a focus of attention in educational research, as what is observed, in some cases, is an expansion of difficulties in managing positive dimensions in interpersonal relationships in the presence of multiple conflicts and negative interactions that distance the student from school as a safe and trustworthy space (Fernández-Menor, 2023).

Interpersonal relationships are conceived as direct exchanges between individuals who, according to a common purpose, such as learning in school, establish a dynamic balance of both positive and negative dimensions. This dynamic balance involves beliefs, motivations, and expectations about the established relationship and the achievement of its joint purpose (Buhrmester & Furman, 1990). According to the quality of interpersonal relationships model proposed by Furman and Buhrmester (1992), positive dimensions such as the ability to enjoy others' company, develop intimate trust, receive emotional support and approval from others, be satisfied with the relationship, receive instrumental help, and perceive

that the interpersonal relationship is based on affection, have significant effects on various aspects of socioemotional development and adaptation. The effects of these quality of interpersonal relationships' indicators are observed in cognitive, emotional, and motivational aspects; that influence personal and socioemotional development, thus promoting a better ability to cope with constant and daily relational challenges (Morales Domínguez & Gaviria Stewart, 2021).

Regarding the understanding of relational antecedents of learning, it is considered that, in the face of the challenges of learning activities in the classroom and school, positive dimensions in interactions resulting from support, approval, and satisfaction with school processes should be able to balance out negative aspects that may arise in the process, such as aggressive pursuit of power, positioning, and conflict among individuals in groups. Comparative studies show that, in this regard, the perception of dimensions associated with conflict and satisfaction is lower compared to the perceived level of conflict, in students at lower levels. This is further observed through methodologies that emphasize, on one hand, a collective view of group interaction, even in educational contexts that reflect a more individualistic approach to analysing educational processes and their achievement indicators. On the other hand, there is a more comprehensive perspective from a socioemotional development standpoint (Fabris et al., 2023). Through quality interpersonal relationships and through the trust they allow, resources and reinforcements promoting good academic performance are conveyed through pathways such as the reinforcement of self-efficacy and psychological safety (Carmeli et al., 2009; Bosman et al., 2021).

The study of the interpersonal dimension linked to academic performance describes socioeducational focuses of attention such as teacher-student interaction (Ramberg et al., 2019), and student-student interaction (Bradley-Dorsey et al., 2022). When positive aspects prevail in these interactions, processes such as student participation (Reyes et al., 2012), success in the implementation of cooperative methodologies such as peer tutoring (Leung, 2015), through which there is evidence of an increase in levels of school well-being and engagement with learning (Kiuru et al., 2020; Wang et al., 2019).

Studies analysing positive teacher-student and student-student relationships describe interactions that allow students to safely navigate the school academic experience (García-Rodríguez et al., 2022). This academic experience incorporates multiple challenges, related to the structural and curricular arrangements of educational establishments that, if not adaptively addressed, can overload students, and affect their mental health (Encina & Ávila, 2015).

Kiuru and colleagues (2020) highlight, in this regard, the importance of the quality of the teacher-student relationship, as it determines the provision of supportive behaviours, affective, and instrumental resources associated with a higher level of

engagement for both parties. When there is a positive relationship between teacher and student, the probability of success in learning activities increases (Longobordi et al., 2021). Support from the teacher, the use of approval/praise and disapproval as opposed to reprimand, as well as other displays of affection and closeness with the student, provide conditions to establish important interpersonal scaffolding contributing to student achievement and satisfaction. They also contribute to the development of a sense of belonging to the educational institution, essential for good performance within the school context (Gillen-O'Neel, 2021).

On the other hand, peer relationships, particularly those who are classmates, have also been assessed in terms of their influence on academic performance (Wang et al., 2018). In terms of identity and socioemotional development, classmates are especially important as they provide companionship, affection, intimacy, help strengthen self-esteem, offer personal validation, and emotional support, especially in the years of primary and secondary education (Furman & Buhrmester, 1992; Wentzel et al., 2021). However, they are also relevant in terms of their behavioural influence, as their actions due to affiliation and group influence have a significant impact on the development of school engagement, a key factor for good educational performance (Wang et al., 2018).

The evidence in the study of interpersonal relationships with peers, observed within the classroom and/or school context, shows that such interactions reflect processes of learning social behaviour, mainly linked to acceptance and modeling among peers (Gallardo et al., 2016). Thus, commitment, and enjoyment of the school experience, which are key to motivation and academic success, are enhanced, nurtured, and enriched based on these prosocial processes of group acceptance (Kingery et al., 2011; Wentzel et al., 2021).

Some descriptions from meta-analytical studies on the subject, for example, those carried out by Korpershoek and colleagues (2020), describe interpersonal relationships with peers as a prerequisite for the overall positive functioning of students in school. These authors highlight the benefits of being part of groups committed to a common purpose for achieving good academic performance. And they consider that, in those cases, the group arbitrates what is academically expected of the individual's behaviour in terms of their performance in the educational context (Korpershoek et al., 2020). Conversely, they describe functioning that can be negative when there is identification, influence, and modeling of social behaviours among peers linked to risk factors (such as alcohol consumption and other psychoactive substances), which end up being obstacles to good academic performance (Gremmen et al., 2019).

Given the evidence described up to this point, interpersonal relationships with classmates and teachers are crucial for strengthening learning processes and directly contribute to students' academic performance. Therefore, this study

aimed to examine the role and effect of interpersonal relationships with classmates and teachers on the academic performance of elementary and secondary school students. Additionally, this purpose focuses on positive dimensions that may help better understand which of them have a greater impact on students' academic performance at the primary (second cycle) and secondary (first and second cycle) education levels, considering the evidence that it is in these stages where the effect of interactions has a greater influence, and students demonstrate greater autonomy to provide self-report measures.

On this basis, two objectives were outlined: (1) to verify if the positive characteristics (companionship, intimate trust, emotional support, approval, satisfaction, instrumental support, and affection) of students' interpersonal relationships with teachers and classmates discriminate between different levels of their academic performance (Sufficient-Notable-Outstanding), and (2) to analyse which positive characteristics of students' interpersonal relationships with teachers and classmates have a greater power of discrimination or quantify better the differences between the different levels of academic performance.

Based on the background review, we aim to establish the hypothesis that certain positive dimensions in interpersonal relationships with teachers and classmates will have a greater capacity to discriminate between different levels of student academic performance.

METHOD

Design

According to the characteristics of the participants and the aim of the study, a cross-sectional ex post facto research design was followed, in which a phenomenon that has already occurred at a specific moment in time was studied, without continuity over time, and the variables under study were not manipulated. Likewise, an associative design was used, through discriminant analysis, to study which positive characteristics of students' interpersonal relationships discriminate the differences between different levels of academic performance. Finally, an online questionnaire methodology was applied for data collection.

Participants

The sample selection was carried out through a multistage cluster sampling and random selection of groups, in schools that had multiple lines in grades from 5th grade to 12th grade. Cluster sampling was carried out by randomly selecting eight

(8) educational centers, according to the information declared in their institutional educational project. The number of participants was determined based on the number of enrolled students (44048), in the second and third levels of Basic Education (5th to 8th grade, corresponding to ages between 11 and 13 years old), and the first and second cycle of High School (1st to 4th year of High School, corresponding to ages between 14 and 17 years old), in public and private schools receiving state funding from the government of Chile. All establishments are in three key regions of the northern (Tarapacá) and central (Valparaíso and Metropolitan Region) macrozone of the country, selected according to their school performance and school coexistence indicators, during the years 2020-2021, reported in standardized national assessments (Ministry of Education MINEDUC, 2021). The sample was selected considering a sampling error of 3% and a confidence level of 96%, which finally constituted a total of 1273 students with voluntary participation in the study. All of them with distribution percentages by levels corresponding to 11.4% for the 5th grade level, 12.8% for 6th grade, 9.5% for 7th grade, 7.8% for 8th grade, 14.5% for the first level of high school, 16.1% for the second level of high school, 16.6% for the third level of high school, and 11.3% for the fourth and last level of high school. The mean age was 14.2 years (SD= 2.43; range 10-19); 47.5% (n=605) female, 48% (n=611) male, and 4.5% (n=57) non-binary.

Instruments

Quality of Interpersonal Relationships Scale: This scale is an adapted version for Chilean school population by Sandoval-Cartes and Berger (2016), derived from the original version Network of Relationships Inventory – Relationship Quality, specifically the NRI-Social Provisions Version (NRI-SPV) (Furman & Buhrmester, 1985) and NRI-RQV (Furman & Buhrmester, 2009) versions. The NRI-RQV questionnaire consists of 30 items, distributed into ten subscales (five related to positive characteristics and five to negative characteristics, with three items per scale (companionship, intimate trust, emotional support, approval, satisfaction, conflict, criticism, pressure, exclusion, and dominance). In the case of the NRI-SPV questionnaire, six items from two of the ten subscales were incorporated. The two selected subscales correspond to positive characteristics of instrumental support and affection. The scale adapted for this study consists of a total of 36 items. This instrument simultaneously evaluates each dimension in the relationship with different significant individuals within the individual's environment (in this case, classmates and teachers) with a scoring from 1 (never or not at all) to 5 (always or excessively). The reliability indices reported in the original study for the scales range from acceptable to good (α=.69 to .93).

Considering the above, in the present study, we worked with the two scales of positive interpersonal relationships, one for classmates and another for teachers. The reliability indices were as follows: positive interpersonal relationships scale with classmates, Cronbach's alpha (α = .93), composite reliability (CR = .96), McDonald's omega (Ω = .93), and average variance extracted (AVE = .60); positive interpersonal relationships scale with teachers (α = .90, CR = .94, Ω = .90, and AVE = .47).

To determine the validity of the scales used in our study, we used goodness-of-fit indices described in Table 1, resulting from confirmatory factor analyses. As we can observe, although an optimal model is not presented, the fit indices approximate the desirable values.

Table 1

Goodness-of-fit indices of the proposed model, Quality of Relationships Scale, adapted version for Chilean school population by Sandoval-Cartes (2016)

Model (7 related factors)	χ^2	χ^2/df	GFI	IFI	TLI	CFI	RMSR	RMSEA
Classmates' subscale	4664.30	10.27	.82	.80	.80	.80	.06	.12
Teachers' subscale	3953.28	7.18	.85	.77	.75	.77	.07	.11

Notes. χ^2 = Chi-square statistic; χ^2/df = Chi-square divided by degrees of freedom; GFI = Goodness-of-fit index; IFI = Incremental fit index; TLI = Tucker–Lewis index; CFI = Comparative fit index; RMSR = Root mean square residual; RMSEA = Root mean square error of approximation.

Academic performance was estimated as the observed variable, resulting from the student's grade point average obtained during the last period of the year prior to data collection. This data was reported by the student. These variable reports numerical information with ranges from 1.0 to 7.0 with a maximum of one decimal place. It corresponds to the single numeric scale system used for reporting academic performance at the national level. In this scale, the value of 1.0 corresponds to the minimum performance obtained, the value of 4.0 corresponds to the minimum passing grade, and the value of 7.0 corresponds to the maximum achievable grade.

Procedure

We followed the ethical guidelines of the American Psychological Association (2010) regarding informed consent from parents or guardians, due to the participants' minority status, and assent from the students for their participation. First, we contacted the schools to explain the study's objectives and request authorization to administer the questionnaires and obtain the grades. The questionnaire was administered during school hours online, using the SurveyMonkey platform, with a duration of about 20 minutes, in an appropriate climate and without distractions, guided by technical support personnel specifically trained for this study. Additionally, anonymity in responses, confidentiality of obtained data, and their exclusive use for research purposes were ensured. The platform settings required each question to be mandatory to prevent leaving questions unanswered and to allow progress in the instrument application. Students who entered their registration but did not want to answer the instrument could exit the application whenever they wished. Under these conditions, a total of 1672 students were registered. Of this number, only 1273 responded to the entire instrument. The remaining 399 records corresponded to those where the student did not want to continue responding to the instrument and abandoned the application. This situation of abandonment of the response process occurred early at the beginning of the survey in most cases. Also included in the records left out of the sample are cases with complete responses but were discarded for not meeting the attentional control criterion in responses. This attentional control criterion corresponds to the introduction of items randomly within the instrument, for which the person had to be alert and not respond in a stereotypical manner (e.g., "Leave this question unanswered. Do not select any response"). Attentional control items were introduced to obtain a partial indicator of data quality, by analysing if the participants were alert during the survey and read the questions before responding. Attentional control items are often used to determine if respondents are answering consciously, are engaged, and thus to mitigate biases during data analysis.

Data analysis

Initially, reliability analyses (Cronbach's Alpha, Composite Reliability, McDonald's Omega, and Extracted Mean Variance) and confirmatory analysis of the instrument are performed to determine if its conceptual structure, as described in the original studies, adequately fits the data.

Subsequently, three statistical analyses were conducted in the study: (1) ANOVA with partial eta squared effect size test; (2) discriminant analysis to examine which

positive characteristics of students' interpersonal relationships with teachers and classmates discriminate between different levels of their academic performance (Sufficient-Notable-Outstanding). In this discriminant analysis, Academic Performance was included as the dependent variable, grouped into different levels according to the following grade intervals obtained by students: between 3 - 4.90 sufficient level of academic performance, between 5 - 5.90 notable level of academic performance, and between 6 - 7 outstanding level of performance. The grade report corresponds to the educational period in which remote schooling activities were conducted due to the health provisions associated with the COVID-19 pandemic.

Based on this result, the positive subscales of the Scale of Quality of Relationships, adapted version for Chilean school population by Sandoval-Cartes and Berger (2016), were included as independent and predictive variables: 1. Quality of relationships with teacher: companionship (COT); intimate trust (ITT); satisfaction (SAT); emotional support (EST); approval (APT); instrumental support (IST); affection (AFT). 2. Quality of relationships with classmates: companionship (COC); intimate trust (ITC); satisfaction (SAC); emotional support (ESC); approval (APC); instrumental support (ISC); affection (AFC).

Assumptions of linearity and normal distribution were considered for conducting the discriminant analysis. The data were subjected to the Kolmogorov-Smirnov test to analyse normal distribution, revealing $p > .05$ and normality for all observed variables. Similarly, the p-value > .05 obtained in the Box's M test demonstrated the equality of covariance matrices across groups. (3) To complement the discriminant analysis with other multivariate data analysis tests, a multinomial logistic regression analysis was conducted, calculating the odds ratios. In these analyses, academic performance grouped into three levels (Sufficient, Notable, and Outstanding) was included as the prediction variable, and the positive characteristics of students' interpersonal relationships with teachers and classmates were included as predictor variables.

The statistical analyses were conducted using the SPSS version 21.0 software for PC and the Free JASP.

RESULTS

Positive interpersonal relationships with teachers predicting performance level: Discriminant analysis

Table 2 displays the means and standard deviations of each of the positive subscales of the Scale of Quality of Relationships with teachers, based on different performance levels. Students with an outstanding performance level obtain higher average scores than the notable level group and the sufficient level group in all subscales. On the other hand, the sufficient level group obtains higher scores than the notable level group in all positive relationships, except for emotional support (AEP) and instrumental support (AIP).

Table 2

ANOVA Test Results, Means, and Standard Deviations of Positive Subscales of the Scale of Quality of Relationships with teachers based on Different Performance Levels

	Academic Performance Levels			ANOVA		
Positive Subscales	**Sufficient *M(SD)***	**Notable *M(SD)***	**Outstanding *M(SD)***	**F**	**p**	**η^2 *p****
COT	2.51 (0.98)	2.45 (0.99)	2.58 (0.97)	2.049	.129	.003
ITT	1.47 (0.68)	1.47 (0.73)	1.58 (0.76)	2.906	.055	.005
SAT	2.98 (1.07)	2.95 (1.15)	3.23 (1.11)	8.081	.000	.013
EST	1.73 (0.82)	1.77 (0.92)	1.98 (1.02)	6.237	.002	.010
APT	2.30 (1.05)	2.22 (1.00)	2.54 (1.07)	10.99	.000	.017
IST	3.15 (1.06)	3.21 (1.09)	3.49 (1.00)	10.47	.000	.017
AFT	2.93 (0.98)	2.88 (1.11)	3.17 (1.07)	8.395	.000	.013

Note. Quality of relationships with teachers: Companionship (COT); intimate trust (ITT); satisfaction (SAT); emotional support (EST); approval (APT); instrumental support (IST); affection (AFT).

*Partial eta squared effect size test: if 0.06 ≤ η2 < .14, the effect is moderate; and if η2 ≥ .14, the effect is strong.

Next, the possible differences between the means of the three performance levels were examined regarding scores on the positive subscales of the Scale of Quality of Relationships with teachers. An analysis of variance (ANOVA) was conducted, revealing significant differences between the three performance levels for the following subscales: satisfaction (SAT) (Wilks λ =.99, F= 8.08, $p < .001$, η^2 =

.13); emotional support (EST) (Wilks λ =.99, F= 6.237, p < .001, η^2 = .10); approval (APT) (Wilks λ =.98, F= 10.993, p < .001, η^2 = .17); instrumental support (IST) (Wilks λ =.98, F= 10.477, p < .001, η^2 = .17); affection (AFT) (Wilks λ =.98, F= 8.395, p < .001, η^2 = .13).

Once differences between the means of the three groups of academic performance levels were demonstrated, the discriminant analysis was used to analyse which positive subscales of the Scale of Quality of Relationships with teachers explain these differences to a greater extent. Table 3 shows the structure matrix created in the discriminant analysis. The maximum number of discriminant functions or linear combinations is one less than the number of groups assigned to the dependent variable. Which function has the highest discriminatory power, and will we use to interpret the data? The analysis of discriminant functions indicates that Function 1 has the highest discriminatory power among the three performance levels.

Table 3

Structure Matrix. Variables ordered by the size of the correlation with the discriminant function

	Functions	
	***Function* 1**	**Function 2**
Approval (APT)	0.85*	0.45
Instrumental Support (IST)	0.84*	-0.21
Affection (AFT)	0.75*	0.28
Satisfaction (SAT)	0.74*	0.21
Emotional Support (EST)	0.65*	-0.13

Note. * Greater absolute correlation between each variable and the discriminant function.

Function 1 explains a higher percentage of variance than the other functions, shows a higher canonical correlation and distance between discriminated groups (Wilks' Lambda closer to 0). Additionally, the Chi-square analysis presents the highest level of significance. Function 1 (% of variance= 92.3, canonical correlation= .153, Wilks' λ: .97, F =31.706, df=14, p =.004). Therefore, according to Function 1, the variables with the highest predictive capacity are: approval (APT), instrumental support (IST), and affection (AFT). In essence, students with outstanding performance level would be characterized primarily by the approval of the teacher, instrumental support, and the affection provided by the teacher.

In Table 4, it is observed that the discriminant canonical function correctly classifies 34.2% of sufficient level students, 27% of notable level, and 50.1% of outstanding level. Average gains in prediction are higher than the 33% we would guess by chance in the sufficient and outstanding levels. These percentages indicate that these dimensions of positive interpersonal relationships with teachers mainly help us discriminate among outstanding level students.

Table 4
Classification results using the discriminant function

		Predicted membership group		
	Academic Performance	**Sufficient**	**Notable**	**Outstanding**
%	Sufficient	34.2	30.1	35.6
	Notable	35.5	27.0	37.5
	Outstanding	26.6	23.3	50.1

Finally, the multinomial regression analysis showed satisfactory fit (χ^2 = 31.833(14*), p* = .004; *R* Nagelkerke = .033) allowing correct classification of 70.5% of cases. Specifically, for the model outcome with the sufficient reference category, parameter estimates reveal that instrumental support from teachers (Wald = 3.201, *p* =.044) is significantly and directly associated with outstanding performance level. The model's OR estimates inform that the probability of having an outstanding level is 1.4 times higher in students with instrumental support from teachers. For the model outcome with the notable reference category, parameter estimates reveal that teacher approval (Wald = 3.902, *p* = .048) is significantly and directly associated with outstanding performance level. The model's OR estimates inform that the probability of having an outstanding level is 1.2 times higher in students with teacher approval.

Positive interpersonal relationships with classmates predicting performance level: Discriminant analysis

In Table 5, the means and standard deviations of each of the positive subscales of the Scale of Quality of Relationships with classmates are observed, based on different performance levels. Students with an outstanding performance level obtain higher average scores than the notable level group and the sufficient level group in all subscales. On the other hand, the sufficient level group obtains higher

scores than the notable level group in all positive relationships, except for emotional support (ESC) and affection (AFC).

Table 5

ANOVA Test Results, Means, and Standard Deviations of each of the positive subscales of the Scale of Quality of Relationships with classmates based on Different Performance Levels

	Academic Performance Levels			ANOVA Test		
Positive Subscales	**Sufficient** ***M(SD)***	**Notable** ***M(SD)***	**Outstanding** ***M(SD)***	***F***	***p***	**η^2 p***
COC	2.81 (1.00)	2.73 (1.07)	3.06 (1.07)	10.86	.000	.017
ITC	1.66 (0.95)	1.59 (0.86)	1.78 (0.97)	4.634	.010	.007
SAC	2.89 (1.09)	2.82 (1.19)	3.19 (1.16)	12.48	.000	.020
ESC	1.72 (0.94)	1.75 (0.95)	1.92 (1.02)	3.810	.022	.006
APC	2.15 (1.01)	2.09 (1.01)	2.42 (1.05)	11.83	.000	.019
ISC	2.62 (1.14)	2.55 (1.02)	2.82 (1.03)	7.903	.000	.012
AFC	2.48 (1.13)	2.49 (1.08)	2.77 (1.08)	8.782	.000	.014

Note. Quality of relationships with classmates: Companionship (COC); intimate trust (CIC); satisfaction (SAC); emotional support (AEC); approval (APC); instrumental support (AIC); affection (AFC).
*Partial eta squared effect size test: if .06 ≤ η^2 < .14, the effect is moderate; and if η^2 ≥ .14, the effect is strong.

The analysis of variance (ANOVA) found significant differences between the three performance levels for all subscales: companionship (COC) (Wilks' λ =.98, *F*= 10.863, *p* < .001, η^2 = .17); intimate trust (ITC) (Wilks' λ =.99, *F*= 4.634, *p* = .010, η^2 = .07); satisfaction (SAC) (Wilks' λ =.98, *F*= 12.483, *p* < .001, η^2 = .20); emotional support (ESC) (Wilks' λ =.99, *F*= 3.810, *p* = .022, η^2 = .06); approval (APC) (Wilks' λ =.98, *F*= 11.833, *p* < .001, η^2 = .19); instrumental support (ISC) (Wilks' λ =.98, *F*= 7.903, *p* < .001, η^2 = .12); affection (AFC) (Wilks' λ =.98, *F*= 8.782, *p* < .001 η^2 = .14). Once the existence of differences between the means of the three groups of academic performance levels was demonstrated, the discriminant analysis was conducted, indicating that Function 1 has the highest discriminatory power among the three performance levels (% of variance= 93.8, canonical correlation= .161, Wilks' λ: .97, *F* =35.096, df=14, *p* =.001).

As shown in Table 6, according to Function 1, the variables with the highest predictive capacity are: satisfaction (SAC), approval (APC), and companionship (COC). In essence, students with an outstanding performance level would be

characterized primarily by satisfaction, approval, and enjoyment of the time spent in the company of their classmates.

Table 6
Structure Matrix. Variables ordered by the size of the correlation with the discriminant function

	Functions	
	Function 1	**Function 2**
Satisfaction (SAC)	0.86*	0.17
Approval (APC)	0.84*	0.19
Companionship (COC)	0.80*	0.12
Affection (AFC)	0.71*	0.47
Instrumental Support (ISC)	0.68*	-0.04

Note. *Greater absolute correlation between each variable and the discriminant function.

Finally, in Table 7, it is observed that the discriminant canonical function correctly classifies 30.1% of sufficient level students, 41% of notable level, and 48.2% of outstanding level. Average gains in prediction are higher than the 33% we would guess by chance in the notable and outstanding performance levels. These percentages indicate that these dimensions of positive interpersonal relationships with classmates mainly help us discriminate between notable and outstanding level students.

Table 7
Classification results using the discriminant function

		Predicted membership group		
	Academic Performance	**Sufficient**	**Notable**	**Outstanding**
%	Sufficient	30.1	37.0	32.9
	Notable	25.1	41.0	33.9
	Outstanding	20.8	31.0	48.2

Finally, the multinomial regression analysis showed satisfactory fit (χ^2 = 35.448(14), *p*= .001; *R* Nagelkerke = .036), allowing correct classification of 70.7% of cases. Specifically, for the model outcome with the notable reference category, parameter estimates reveal that approval from classmates (Wald = 4.175, *p* = .041) is significantly and directly associated with outstanding performance level. The model's OR estimates inform that the probability of having an outstanding level is 1.3 times higher in students with higher scores in the variable of classmates' approval.

DISCUSSION AND CONCLUSIONS

The objectives of this study focused on the discriminant analysis of positive characteristics (companionship, intimate trust, emotional support, approval, satisfaction, instrumental support, and affection) in the interpersonal relationships of students with teachers and classmates, based on different levels of academic performance (Sufficient-Notable-Outstanding). Likewise, it aimed to identify which of these characteristics showed greater discriminatory power or quantification of differences between academic performance levels.

After conducting descriptive and multivariate analyses (using discriminant analysis and multinomial logistic regression, calculating odds ratios) to classify and establish the distribution probabilities of positive dimensions in the relationship with teachers and peers, based on levels of student academic performance, the results obtained are consistent with previous empirical evidence. This prior evidence indicates the relevance of positive interpersonal relationship dimensions with educational actors (particularly peers and teachers) in relation to academic performance (Froiland et al., 2019; Kiuru et al., 2020; Leung et al., 2021; MacCann et al., 2020). From the results obtained, it can be specifically distinguished that the significant relationship of academic performance with positive dimensions of interpersonal relationships related to providing support, affection, containment, enjoying the company of others, trusting others, and being satisfied and approving of the conditions with which we relate to others, allows for emphasis on certain socio-emotional competencies that are not only desirable within teaching and learning processes but are systematically reinforced pedagogically in daily schoolwork. The dimensions found can be linked to intentional strategies within curricular frameworks such as those of the Chilean educational system (Ministry of Education, Curriculum and Evaluation Unit, [UCE for its acronym in Spanish] , 2021), making some of these strategies, such as collaborative teamwork, mediations, tutorials, and others, which inherently involve the dimensions highlighted by the study, validated, and gain greater relevance within educational work (Alzahrani et al., 2019).

Positive dimensions with peers and teachers thus constitute a specific focus of schoolwork and are part of the repertoire of expected, reinforced, and reflected values and behaviours within regular school practices.

Based on our results and the contrast with previous evidence, we can specifically consider, regarding the specific dimensions of positive interpersonal relationships (satisfaction, approval, companionship, and affection in the case of peers, and approval, instrumental support, satisfaction, and emotional support in the case of teachers), that these dimensions primarily promote supportive relationships that satisfy students' basic psychological and social needs (Froiland et al., 2019). When these needs are met, students feel connected to their teachers and peers, reinforcing and promoting socially appropriate behaviours and engagement processes with learning and learning activity within a positive classroom climate (Ahn et al., 2021).

Considering the results found, we highlight the fact that student academic performance is benefited when relationships with peers and teachers are particularly characterized by three specific aspects: satisfaction with relationships, perception of approval, and provision of support. These aspects are relevant insofar as they energize the bonds themselves, framing a social dimension of performance that helps better understand that academic achievement depends not only on individual psychological and cognitive factors but also on socio-emotional ones (Vera-Sagredo et al., 2021).

Regarding the relationship with teachers, the social and instrumental support they offer to their students, which constitutes one of the significant results of the study, can be associated with intentional pedagogical objectives, considering that in their teacher training these competencies are highlighted as desirable within pedagogical practices (Rubio-González and Cuadra-Martínez, 2022). As perceived support and satisfaction from and towards the figure of the teacher increase, levels of psychological security and tranquility increase, leading to better concentration on tasks when learning (Ahn et al., 2021).

According to Strati and colleagues (2017), the instrumental support of teachers is positively associated with students' levels of engagement in learning activities since resources are provided that facilitate the development of mental and behavioural actions that facilitate learning and are reflected in performance, decreasing the likelihood that students feel incapable of evaluatively addressing the effective demonstration of what they have learned.

Approval emerges as a relevant positive dimension both with teachers and peers when its discriminatory role on student academic outcomes is analysed. Specialized literature highlights that the approval and acceptance offered by these close figures in the classroom have motivational effects that enhance the learning process (Kindermann, 2016). This author describes the influence of other significant people in academic activities and emphasizes a motivational pathway

and a sense of belonging to the school, through which approval, satisfaction, and enjoyment of the relationship with others within the classroom contribute to academic performance. It is because of this positive perception of being accepted and approved, students increase their enjoyment and motivation to attend school, and it is this sense of positive connection with the school and its reference group that promotes situations, actions, and processes through which the performance conditions of students are improved, since they increase their attitude of openness to better use learning opportunities (Eisenberg et al., 2003).

In particular, the dimensions found in the relationship with teachers (approval, instrumental support, affection, satisfaction, and emotional support), which have greater discriminatory capacity in the different levels of academic performance, especially at the outstanding level, become relevant insofar as they highlight focal points in teacher-student interactions. Therefore, they should be included in the curricula of pedagogy programs as a fundamental part of the teacher training process, considering their contribution to improving academic performance through interpersonal interaction (García-Vila et al., 2022). Moreover, they contribute to the promotion of positive and nurturing school climates through the expression of socio-emotional attitudes and resources that provide learning opportunities in warm and comfortable environments for all participants in these processes. The student perception that highlights affective elements, satisfaction, and support in the relationship with their peers within the learning process, in turn, increases the likelihood that the classroom climate is perceived as a motivating stimulus for student engagement with school and their commitment to it, through which this commitment is key to forming safe environments that foster learning and achievement (Wang et al., 2018).

Limitations

The study presented several limitations, with the most significant being the use of self-reports as the method of data collection. Regarding self-reports for evaluating interpersonal relationships, it is a measure subject to a specific and subjective perception of the students. Caution must be exercised with the Quality of Relationships Scale regarding its validity for generalizing results, as it does not present an optimal model, although the fit indices approximate desirable values. Additionally, a limitation is perceived in that the grades obtained by students during the period preceding data collection correspond to educational processes developed during the period of remote education due to the COVID-19 pandemic, implying that due to various connectivity and socio-sanitary conditions, certain criteria for attendance and evaluation were flexibilized globally, affecting the reported student academic performance for this period. Therefore, academic

performance in this study reflects distributions biased towards passing grades. There was practically no academic failure, considering the total average obtained in the subjects corresponding to the period preceding data collection. Several countries, including Chile, during the pandemic established curricular prioritization criteria and flexibilization of evaluative criteria which are likely to be influencing factors in the reported academic results, which must be taken into consideration considering the obtained results (Leiva-Guerrero et al., 2022). To further analyse this result and limitation, a future line of research that allows for the continuation of this study should consider replicating it in a context of normal class development, without restrictions such as those experienced during the pandemic period.

Other limitations stem from the cross-sectional design, which hinders making further inferences about the relationship between study variables. Lastly, it is important to note that the sample is restricted to three Chilean regions that met the selection indicators according to the study hypothesis, but it is not representative given the coverage scope of the present study. Therefore, it would be optimal to replicate the study by incorporating a broader, nationally representative sample.

Conclusions

The positive dimensions of interpersonal relationships with classmates and teachers, constitute educational dimensions that are intentionally social and curricular, aimed at contributing to school coexistence and learning; thus, their contribution to academic performance seems highly pertinent through these channels, in light of evidence from models that highlight them as such (Burack et al., 2013; Cerda et al., 2018; Díaz-Vargas et al., 2023; Quílez-Robres et al., 2021). In this sense, the study contributes in a novel way to the specific identification of positive dimensions relevant in initial teacher training processes and continuous training of teachers. These dimensions can enable critical reflection on adjustments and decisions regarding socio-emotional engagement between students and between students and teachers. Promoting this reflection within the framework of policies aimed at strengthening the teaching profession (especially in Chile) promotes giving greater importance to those positive aspects that configure good practices of educational interaction and strengthen teaching-learning processes.

The results of this study allow, on one hand, to recognize aspects favourable to the educational process that occur through interpersonal relationships in the classroom, but also highlight aspects that are part of the repertoire of expected attitudes and practices within educational interactions contributing to achievement and performance. In this regard, they open a window of optimism to emphasize that, despite the attention that school violence and conflict may attract due to their emergence and critical level regarding the decline in academic performance both

nationally and internationally, a positive dimension of interpersonal relationships in school remains essential and carries greater weight, worthy of highlighting, promoting, and cultivating. Therefore, we consider that these findings may be of interest to education faculties and teacher training, allowing teachers in training to reflect on the fact that their positive interactions and attitudes within their teaching practices are valuable and essential for the learning process and educational achievement of their students.

ACKNOWLEDGMENTS

The authors acknowledge the collaboration of the school communities and students in the study. This study was funded by the National Agency for Research and Development (ANID) of Chile, through project INITIAL FONDECYT No. 11200088 entitled “Relationships between school stress and the quality of interpersonal relationships with psychological well-being and academic performance: A comprehensive school experience in Chilean schools”.

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