



Original article

Correlation between emotional intelligence and mathematical performance in university students

Correlación entre inteligencia emocional y desempeño matemático en estudiantes universitarios

Correlação entre inteligência emocional e desempenho matemático em estudantes universitários

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ABSTRACT

Ignorance of the emotional component in teaching processes and the lack of efficient emotional regulation strategies in university students lead to situations of stress, anxiety, fear and negative emotions, which in many cases become responsible for low performance and dropout. academic. In recent years, the role of emotional intelligence in the mathematical performance of elementary school students has been investigated. However, little has been investigated about its role in the performance of university students. The objective of this work is to determine the existence of a statistical correlation between the emotional intelligence coefficient and the numerical-operative mathematical performance of a sample of students who were enrolled in the leveling course in basic mathematics at the National University of Colombia, during the first semester of the year 2021. The research was carried out virtually with a sample of 73 first-semester students of the National University of Colombia. The sampling used was a convenience sampling. Emotional intelligence and numerical-operative mathematical performance questionnaires regulated for Colombia were applied and the data obtained using the RStudio statistical software were analyzed. According to the results obtained, there is no correlation between the numerical-operative mathematical performance and the emotional intelligence coefficient of the studied population. It is worth highlighting the need to continue investigating the role of emotional intelligence in academic processes, since, at a general level, it favors academic performance and quality of life.

Keywords: academic performance; math performance; emotional intelligence; math.

RESUMEN

El desconocimiento del componente emocional en los procesos de enseñanza y la carencia de estrategias eficientes de regulación emocional en estudiantes universitarios conducen a situaciones de estrés, ansiedad, miedo y emociones negativas, que en muchos casos se convierten en las responsables del bajo rendimiento y la deserción académica. En los últimos años se ha investigado sobre el papel de la inteligencia emocional en el desempeño matemático de estudiantes de educación básica. Sin embargo, se ha indagado poco sobre su papel en el desempeño de estudiantes universitarios. El objetivo del presente trabajo es determinar la existencia de una correlación estadística entre el coeficiente de inteligencia emocional y el desempeño matemático numérico-operativo de una muestra de estudiantes que cursaban el nivelatorio en matemáticas básicas de la Universidad Nacional de Colombia, durante el primer semestre del año 2021. La investigación se llevó a cabo de manera virtual con una muestra de 73 estudiantes de primer semestre de la Universidad Nacional de Colombia. El muestreo empleado fue un muestreo por conveniencia. Se aplicaron cuestionarios de inteligencia emocional y desempeño matemático numérico-operativo normados para Colombia y se analizaron los datos obtenidos haciendo uso del software estadístico RStudio. De acuerdo con los resultados obtenidos, no existe correlación entre el desempeño matemático numérico-operativo y el coeficiente de inteligencia emocional de la población estudiada. Vale la pena resaltar la necesidad de seguir indagando sobre el papel de la inteligencia emocional en los procesos académicos, ya que, a nivel general, esta favorece el desempeño académico y la calidad de vida.

Palabras clave: desempeño académico; desempeño matemático; inteligencia emocional; matemáticas.

RESUMO

O desconhecimento da componente emocional nos processos de ensino e a falta de estratégias eficazes de regulação emocional nos universitários conduzem a situações de stress, ansiedade, medo e emoções negativas, que em muitos casos se tornam responsáveis pelo baixo rendimento e abandono acadêmico. Nos últimos anos, o papel da inteligência emocional no desempenho matemático de alunos do ensino fundamental tem sido investigado. No entanto, pouco tem sido investigado sobre o seu papel no desempenho de estudantes universitários. O objetivo deste trabalho é determinar a existência de uma correlação estatística entre o coeficiente de inteligência emocional e o desempenho matemático numérico-operativo de uma amostra de alunos matriculados no curso de nivelamento em matemática básica da Universidade Nacional da Colômbia, durante o primeiro semestre do ano de 2021. A pesquisa foi realizada virtualmente com uma amostra de 73 alunos do primeiro semestre da Universidade Nacional da Colômbia. A amostragem utilizada foi uma amostragem por conveniência. Foram aplicados questionários de inteligência emocional e desempenho matemático numérico-operativo regulamentados para a Colômbia e analisados os dados obtidos com o software estatístico RStudio. De acordo com os resultados obtidos, não há correlação entre o desempenho matemático numérico-operatório e o coeficiente de inteligência emocional da população estudada. Vale destacar a necessidade de continuar investigando o papel da inteligência emocional nos processos acadêmicos, pois, em nível geral, favorece o desempenho acadêmico e a qualidade de vida.

Palavras-chave: desempenho acadêmico; desempenho matemático; inteligência emocional; matemática.

INTRODUCTION

Traditionally, rational intelligence has been overvalued, even when it is not clear that it acts as a guarantor of academic success (Maryani, Pramudya & Slamet, 2019). This tendency to overvalue the intellectual has led to education ignoring the emotional aspect of students, under the idea that the emotional sphere belongs to a private sphere of the person and, therefore, is independent of the processes educational. Ignorance of the emotional component in teaching-learning processes and the lack of efficient emotional regulation strategies in university students lead to situations of stress, anxiety, fear and negative emotions. In many cases, these situations become responsible for low performance and academic dropout (Casabianca, 2015; Ministry of National Education, 2020).

Currently, emotions play an important role in our culture, which has led to these extreme rationalist ideas, which ignore and underestimate the role of emotions, gradually disappear. With its gradual disappearance, the acceptance of the emotional sphere has been achieved as a fundamental part of the human being and its personal development. In addition, the door has been opened to new and exciting research on the role of emotional intelligence in academic performance and mathematical performance.

In recent years, multiple investigations have been carried out around the world that investigate the role of emotional intelligence in the mathematical performance of basic education students (Salcedo & Pérez, 2020; Ilyas, Ma'rufi, & Basir, 2019). However, the research falls short when trying to study the presence of this relationship in university students. This work responds to the lack of studies that address the relationship between emotional intelligence and mathematical performance in university students in Colombia.

Emotional intelligence refers to the ability to manage, identify and understand one's own emotions and those of others (Ilyas *et al.*, 2019). It is described from the interaction of five different competencies: self-awareness, which refers to recognizing one's own strengths and weaknesses; self-regulation, referring to the mastery of internal resources and impulses; motivation, understood as the emotional trend that guides behavior; empathy, defined as awareness of the feelings and emotional needs of others; and social skills, which are understood as the ability to induce responses in others (Salcedo & Pérez, 2020).

In addition to the five previously described competencies, Mercado and Ramos (2001) add communication, considering it as a relevant element that, according to Peng *et al.* (2020), is the basis of social and affective relationships, which intervenes through language, in the processes of emotional and behavioral self-regulation.

On the other hand, the objective of teaching mathematics in secondary education is to offer students problem-solving skills through the acquisition of basic arithmetic, geometric and logical skills, required in daily life. These competencies favor the development of analytical thinking, which is essential to face and solve problems, understand the relationships of the environment and the relationships between the different areas of knowledge (Toraman, Orakçý & Aktan, 2020).

In Colombia, the Ministry of National Education categorizes mathematics as a basic and transversal fundamental competence of education. Since the beginning of the republic, the importance of its teaching was argued, given its relationship with the development of logical thinking and its contribution to the advancement of science and technology. However, its social role in the consolidation of democratic values was later included as an

additional reason, given that mathematical knowledge is necessary for citizens to perform critically, creatively, and actively in their social and political life, as well as to interpret the information necessary for decision-making (Ministry of National Education, 2020).

Faced with the transversality of mathematics in the curriculum and in daily life, Niebles, Martínez & Niebles (2019) propose a reciprocal relationship between learning mathematics, language and behavioral and emotional self-regulation. The authors point out that these skills are important in academia, since mathematical language derives from them, which makes it possible to establish efficient communication processes with other people in the academic and work environment, as well as the exercise of emotional and emotional self-regulation. behavioral, mediated by language in numerical thinking tasks. In addition, language, as a regulator of behavior, intervenes in metacognitive, metalearning and emotional regulation processes, which are essential to achieve academic achievement.

However, despite the important role of mathematics, for many students it is a source of fear, anxiety, frustration and negative emotions, which in many cases become the cause of poor performance and poor academic results (Salcedo & Perez, 2020; Ilyas *et al.*, 2019), and can even trigger desertion. Faced with this problem, it has been proposed that models that take into account the emotional state and encourage confidence and the use of self-regulation strategies in students, favor the learning of mathematical knowledge and reduce the stress associated with them (Ilyas *et al.*, 2019). In relation to this, in Barraza and González (2016) it was determined that the performance of students exposed to a mathematics teaching model, based on the self-perception of their multiple intelligences, increased considerably compared to the performance of groups that They received an

education based on the knowledge transmission paradigm. These findings show the importance of considering as valuable, within the educational processes, other intelligences besides the intellectual one.

There are also other studies that have taken as a research topic the correlation between the variables of emotional intelligence and mathematical performance. According to Salcedo & Pérez (2020), several studies indicate that aspects of emotional intelligence such as adaptability, empathy, understanding of emotions, and self-control can act as predictors of academic success (including mathematical performance). For his part, Akben-Selcuk (2017) talks about internal factors that are associated with mathematical performance in students; These include personality and motivation, which in their study explained academic achievement. Likewise, it is pointed out that the student's attitude towards learning mathematics is determined by their emotions, so that mathematical success is due to emotional factors such as the level of anxiety and motivation.

Other investigations such as that of Torres & Pérez (2019) found a significant improvement in the mathematical achievement of a group of students after an emotional intelligence training program, compared to a control group that did not receive the training. These results highlight the importance of emotional education within the academic context. On the other hand, in non-experimental research in a pre-university population such as that of Salcedo & Pérez (2020), it was found that emotional intelligence has a slight but significant influence on mathematical skills.

In the Colombian context there are few investigations on the relationship between emotional intelligence and mathematical skills, one of them and the only one developed in a university population, is that of Casabianca (2015), who in his doctoral

thesis develops a correlational study of the Influence of emotional intelligence on mathematical abilities in a group of first-semester university students from "Sergio Arboleda" University. As a result of this work, the author notes that no correlation was found between the two variables evaluated.

The present study responds to the lack of literature on the relationship between emotional intelligence and mathematical performance observed in the Colombian university population, and aims to determine if there is a correlation between the emotional intelligence quotient and the numerical-operative mathematical performance of first-semester students. from the National University of Colombia. It was a correlational study and data collection was carried out through the application of emotional intelligence questionnaires and numerical-operative mathematical performance.

MATERIALS AND METHODS

This was a correlational study, which was carried out virtually during the first semester of 2021, with a sample of 73 first-semester students from the National University of Colombia (H = 27, M = 46) out of 19 different undergraduates, whose ages ranged from 16 to 31 years (m = 18), and who were taking the level course in basic mathematics. The method of selection of the participants was a convenience sampling.

As an inclusion criterion, it was determined that the participants should be: first-semester students of the National University of Colombia, Bogotá Campus, who were taking the leveling course in basic mathematics during the first semester of 2021, and who wished to participate voluntarily in the study giving their informed consent. Table 1 presents a detailed description of the study participants.

Table 1- Study participants organized by the undergraduate to which they belonged

undergraduate	Number of participants		
	Total	Men	Women
Economy	3	1	2
Accountancy public	18	5	13
Nursing	2	0	2
speech therapy	4	0	4
Nutrition and Dietetics	1	0	1
Medicine Vet	3	0	3
Math	2	1	1
Physical	1	1	0
Therapy occupational	4	0	4
chemical engineering	6	3	3
biology	1	1	0
Chemistry	6	2	4
electrical engineering	6	5	1
civil Engineering	2	1	1
agricultural engineering	1	0	1
Statistics	1	1	0
Engineering in systems	2	2	0
Psychology	2	0	2
business administration _	4	1	3
not reported	4	1	3

Study participants were provided, verbally and in writing, with all necessary information about the methodology and purpose of the research. Likewise, they were asked to fill out an informed consent and were invited to answer the two questionnaires that would serve as data collection instruments.

To measure the emotional intelligence of the participants in this study, the emotional intelligence test designed by Mercado and Ramos (2001) was used. This questionnaire was designed taking into account the Colombian context and was validated with a population of more than 300 people. This test aims to measure emotional intelligence, assessed in seven domains: self-awareness, self-control, self-motivation, empathy,

interpersonal relationship domain, self-esteem, and communication. It consists of 120 statements that must be answered as appropriate with the options "Always", "Almost always", "Almost never" and: "Never", and lasts approximately 30 minutes.

For the evaluation of mathematical skills, the numerical-operative mathematical skills test was used, designed by Casabianca (2015) and validated for Colombia with a university population. This test assesses numerical-operational math skills and is made up of 20 multiple-choice questions with a single answer. Finally, for the analysis of the data obtained, the statistical software RStudio was used.

RESULTS

The interpretation of the score obtained by the study participants in the emotional intelligence test was carried out, according to the indications of the authors, as follows: High Score: 361 to 480 points, Medium Score: 241 to 360 points, Low score: 120 to 240 points (Mercado and Ramos, 2001). Similarly, the scores obtained in the numerical-operative mathematical performance test were classified into three levels, according to the criteria proposed by the author; These were: High Score: more than 16 correct answers, Medium Score: 12 to 16 correct answers, Low Score: less than 12 correct answers (Casabianca, 2015).

Figures 1 and 2 show the distribution of the participants according to the score obtained in the respective tests; The relationship between the results obtained in both tests is presented in Table 2.

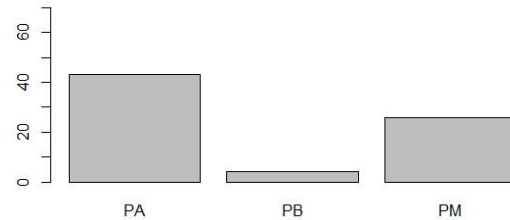


Fig. 1- Scores obtained in the numerical-operative mathematical skills test
 Note: The initials PA, PB and PM denote "High Score", "Low Score" and "Medium Score", respectively
 Source: generated by RStudio

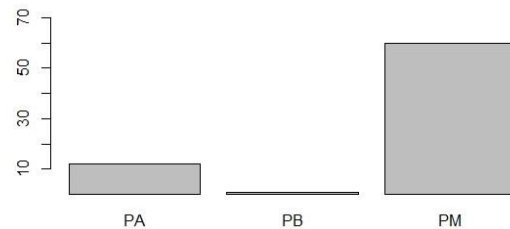


Fig. 2- Scores obtained in the Emotional Intelligence test
 Note: The initials PA, PB and PM denote "High Score", "Low Score" and "Medium Score", respectively.
 Source: generated by RStudio

Table 2- Percentage of students who obtained "High Score" (PA), "Medium Score" (PM) and "Low Score" (PB) in the emotional intelligence and numerical-operative mathematical performance tests

Performance Test	intelligence test Emotional					
	PA		P.M		bp	
Mathematical	#	%	#	%	#	%
PA	8	10.95	3	46.57	1	1.36
P.M	4	5.47	2	30.1	0	0
bp	0	0	4	5.47	0	0

On the other hand, for the analysis of the statistical correlation of the scores obtained in the questionnaires, the application of the Pearson correlation coefficient was ruled out, since according to the values obtained in the Shapiro-Wilk test ($w = 0.93994$ and $p = 0.001726$), the data obtained did not come from a normal distribution and did not meet the assumptions required to perform this measurement. It was decided to apply the Kendall correlation coefficient, since this is a non-parametric measurement, which is recommended in cases where the data do not necessarily come from a bivariate normal distribution (Kendall, 1938), so it adjusted to the characteristics of the data obtained.

After the analysis, it was found that the Kendall correlation coefficient for the emotional intelligence and mathematical performance variables is close to zero ($\tau = 0.0149919$). This indicates that there is no correlation between the variables studied. Table 3 shows the values of the Kendall correlation coefficient (τ) obtained after analyzing the test scores in the RStudio statistical software.

Table 3- Kendall's correlation coefficient (τ) between the scores obtained in each domain and the general score of the emotional intelligence test and the numerical-operative mathematical performance test

Domain	Kendall's correlation coefficient (τ)
Communication	0.03199409
Empathy	-0.05554701
self knowledge	0.03488355
self control	0.1206829
Self motivation	0.08140065
Self-esteem	-0.04062389
Relations interpersonal	-0.1157393
Overall Score	0.0149919

Finally, for the hypothesis test, the following hypotheses were determined: H_0 . There is no correlation between the emotional intelligence quotient and the mathematical abilities of a sample of students from the National University of Colombia, who were

studying the Basic Mathematics level course during the first academic semester of 2021. H_1 . There is a positive correlation between the emotional intelligence coefficient and the mathematical abilities of a sample of students from the National University of Colombia who were studying the Basic Mathematics level course during the first academic semester of 2021.

According to the statistic used, which was the Kendall correlation test, there is not enough evidence to accept the alternative hypothesis ($\alpha = 0.05$ and $p = 0.4294$), therefore the null hypothesis is not rejected and the existence of a correlation between mathematical performance and the emotional intelligence quotient for the population studied.

DISCUSSION

According to the results obtained from the evaluation instruments and their corresponding statistical correlation analysis, it is obtained that there is no correspondence between the numerical-operative mathematical performance and the emotional intelligence coefficient of the studied population ($\tau = 0.0149$). These results are consistent with those obtained in other research and university theses (Casabianca, 2015).

The relationship between academic performance and emotional intelligence has been addressed in recent years, finding positive results regarding the relationship between these two variables. However, the influence of emotional intelligence on academic performance in specific subjects such as language or mathematics has been little explored. Some studies that address this issue suggest that the perceived effects of emotional intelligence may vary according to factors such as educational level, age, and subject (Cantero et al., 2020). Faced with this, in their work, Cantero *et al.* (2020)

found that when age and nonverbal intelligence remain constant, the significant relationship between emotional intelligence and mathematical performance is reduced, which could explain the results obtained in the present investigation.

Although significant correlations between mathematical performance and emotional intelligence quotient have been reported in the literature, it is worth mentioning that most of these investigations were carried out with a population that was studying primary and/or secondary school at the initial levels (Salcedo & Pérez, 2020) or were carried out after the application of emotional intelligence training programs (Torres & Pérez, 2019). Likewise, none of these studies was developed in Colombia. These contextual and population differences are valuable if the particularities of emotional intelligence development are taken into account, including the high influence of the social and cultural environment, age, the role of parents, the way of upbringing and the contextual influences to which a person is exposed during his life (Maryani *et al.*, 2019). All these characteristics are highly variable from one population to another, as well as from one level of academic training to another.

Regarding research carried out in contextual conditions similar to those given for the present study, Casabianca (2015) developed research with very similar population and instrumental conditions. In this, the author correlated the numerical-operative mathematical performance with the emotional intelligence coefficient of first-semester students of the Sergio Arboleda University in the city of Bogotá, who were studying the subject "differential calculus". The results obtained by Casabianca are congruent with those referred to in this research, while no general correlation was found between the two variables studied or between mathematical performance and the result obtained in the seven domains contemplated by the Mercado and Emotional

Intelligence test. Ramos (2001). Regarding this research, it is possible to establish similarities with respect to the results obtained by the participants, noting that in both studies average scores in the emotional intelligence test and high scores in the mathematical performance test predominate. This speaks, in a way, of the general conditions expected for students who start their university life in terms of emotional state and mathematical performance.

On the other hand, no correlations have been reported in the literature between emotional intelligence and other areas of mathematical thinking other than numerical-operational ones, which were the object of this study. According to what was reported by Cantero *et al.* (2020), emotional intelligence does not seem to have a significant influence on mathematical or scientific performance in general, but it does on linguistic performance. Although these results are not favorable, it is important to consider that mathematical performance is not influenced exclusively by emotional factors, but also requires the use of high-level metacognitive, attentional, and operational strategies (Ilyas *et al.*, 2019). Faced with this, the literature reports research that finds significant correlations between mathematical performance and metacognitive abilities (Maryani *et al.*, 2019; Ilyas *et al.*, 2019), which would indicate that these are skills that determine mathematical achievement to a greater extent than emotional intelligence.

It is worth highlighting the need to continue investigating the role and importance of emotional intelligence in the academic and training processes of children and young people, since the evidence shows that, at a general level, it favors academic performance and achievement, health, well-being and quality of life.

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Conflict of interests:

The authors declare not to have any interest conflicts.

Contribution of the authors:

The authors participated in the design and writing of the work, and analysis of the documents.

Quote as

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