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Research Article

Relationship between Motivation and Academic Performance in Peruvian Undergraduate Students in the Subject Mathematics

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Existing literature has paid little attention to the role that motivational variables have on the academic performance of mathematics students in Peru. The objective of the study was to determine the relationship between motivation and its dimensions and academic performance in this subject. A cross-sectional and correlational study was carried out in a sample of 251 first-cycle Peruvian undergraduate mathematics students using an electronic questionnaire. The students' academic performance was measured by their records of the Mathematics course. The motivation was assessed using a self-report instrument designed to assess students' intrinsic motivation, extrinsic motivation, and demotivation through 28 items. For statistical processing, Spearman's Rho coefficient and a linear regression analysis were taken into account. It was concluded that there is a weak correlation between academic performance and motivation ($r = 0.222$, $p = 0.001$), in the same way as intrinsic motivation ($r = 0.242$, $p = 0.001$) and extrinsic ($r = 0.117$, $p = 0.003$) and a weak correlation with the demotivation dimension ($r = 0.142$, $p = 0.024$). With regard to linear regression, all dimensions of motivation were predictive of academic performance; intrinsic motivation explains a 27.2% of academic performance ($\beta = 0.732$; $p = 0.011$); extrinsic motivation explains a 16.8% of academic performance ($\beta = 0.556$; $p = 0.001$), and demotivation a 12.4% ($\beta = 0.427$; $p = 0.008$). This research provides a clear contribution with results on the association between motivation and academic performance in mathematics. This study suggests that universities, teachers, and students' families take the necessary measures and provide stimulation to increase their motivation. In the same way, it is suggested that the university, in general, implements strategies to involve the student so that the student is always clear about the reason why they are at university and finish the degree they have started.

1. Introduction

The first year in college can be a time of many new and exciting experiences. Besides, this can be a challenging experience for students due to the obligations that all this entails [1]. Under this context, previous research has shown that students who have better adapted to the academic environment will perform better academically [2, 3]. The research of components related to academic success and student persistence are vitally important issues with regard to higher education [4]. Thereby, student motivation is considered an important issue in higher education due to the importance of educational attainment in their professional life [5]. However, it should be noted that students, in general, have different barriers to having a good level of learning motivation during their studies at university, along with exposure to content or teachers who do not necessarily consider interest in teaching [6]. In the case of mathematics,

many students lack a positive disposition, which is usually associated with multiple factors, such as teaching methods applied by tutors, anxiety, worries about not passing the subject, cultural and social factors, among others. When these factors start to build up or take hold of the student, the results on academic performance in this subject are usually unfavorable, leading in many cases to demotivation and abandonment by the student [7].

In the above context, there are various theories, such as Locke's goal-setting theory [8], Vroom's expectation theory [9], and Eccles's expectancy-value theory [10], which alongside an abundant amount of literature, emphasize the importance of noncognitive factors in improving academic performance, the motivation being one of these key factors that accurately predict academic performance [11–13].

O'Neil and Drillings [14] indicated that it had not been given the necessary importance to academic motivation and its influence on academic performance, taking into consideration intrinsic and extrinsic dimensions, which in the same way, have a fundamental role in educational attainment. It is convenient to state that the rate at which students acquire new skills, resistance to new knowledge, and the various stress conditions vary according to the context where the student is. As mentioned previously, academic motivation in students is a primary factor in achieving a good level of academic performance [11, 12]. However, through a literature review to find out if academic motivation is correlated with academic performance, it was found that opinions on the matter are divided. On the one hand, there are those studies that have obtained a positive association between academic motivation and educational attainment [15–17]. In contrast to [18, 19], who did not obtain a correlation between internal motivation and students' academic performance. Specifically in the subject of mathematics, there were also studies that analyzed the correlation between motivation and academic performance of students that serve as background for this research, to name a few, we have the study of [20], who added family background as an additional variable to analyze intrinsic motivation and academic performance in mathematics; on the other hand, [21] evaluated the association between student motivation and mathematics anxiety; [22] based their study on the self-determination theory, to evaluate student motivation and self-regulated learning; in mathematics students, [23] evaluated the reinforcement of the students' self-efficacy and motivation in learning mathematics using the cooperative learning model with the Team Games Tournament and finally, [24] who analyzed the predictive value of affective-motivational variables and deep and superficial learning approaches in the academic performance in mathematics.

The existing literature has studied the influence of cognitive variables on academic performance in mathematics. However, little attention has been paid to the role that motivational variables have in the performance of this subject [25]. Therefore, there is a clear knowledge gap in the area of mathematics in reference to the relationship between motivation and academic performance. To address this aspect, the present study evaluated the association between academic motivation and academic performance in the subject of mathematics. This course was chosen since the teachers have been able to appreciate a low level of academic performance in this subject compared to others from general studies which were taken on four initial semesters; these are Language, Communication, Philosophy, College Study Strategies, Ethics, Personal Leadership, Business Leadership, National Reality, Global Reality, Scientific Research Methodology, Introduction to the Career, Chemistry 1-2, Basic Mathematics, Mathematics 1-2-3, Physics 1-2, Innovation, Ecology, Aesthetics, Work Safety, Design and Statistics 1-2. Most of these courses have a qualitative evaluation or require some instruments that help with the students' performance, which is why students have high scores. However, this is not the case in Basic Mathematics. This course requires the students' entire dedication because everything depends on their performance, which is measured mostly in a quantitative way through evaluations.

Based on the aforementioned, the research questions are the following: What is the relationship linking motivation and academic performance of first-cycle students of the Basic Mathematics subject in a Peruvian university? What is the relationship linking intrinsic motivation and academic performance? What is the relationship linking extrinsic motivation and academic performance? What is the relationship linking demotivation and academic performance? Based on this, the objective was to determine the relationship linking motivation and academic performance of first-cycle students of the Basic Mathematics subject in a Peruvian university.

2. Framework

As of this century, motivation is considered a very extensive field of research. Thus, authors such as Eccles and Wigfield [26] indicated that the organization of motivational constructs is useful by referring to the two areas of motivational research; the first area refers to the motives, for example, goal orientation and values that allow promoting a student's behavior in a positive way, the second area refers to the student's perceptions of the ability to learn a topic in relation to the complexity of the task and the resources of the context. An example of the aforementioned adapted to the present study would be the mathematics course taught in the first cycle of the university that students do not fully understand due to a lack of advice from the teacher, which is why students feel unmotivated. So, for this, various strategies are managed, such as planning time, adopting metacognitive tools, etc.; for this reason, they face a demanding task successfully. Other definitions cited in [27] explain that motivation is the starting point and behavior behind a force; in addition, motivation is associated with physical, emotional, and logical aspects and is an internal condition that awakens, directs, and maintains behavior [27].

According to [28], motivation refers to the process of initiation, intensity, and persistence of the behavior; along these lines, the reasons cause certain effects, including inaction. So, the source of an individual's motivation can be intrinsic; that is, it is derived from internal processes, or

it can also be extrinsic, which is the result of external forces.

As has been seen, there is no single definition of motivation in education. For this reason, the authors of the present study have chosen to propose the following concept according to the previous definitions: motivation is considered the force that drives students to specific behaviors to achieve their academic goals.

The study was based on the theory of the authors Ryan and Deci [29] for the academic motivation variable, where it is proposed that individuals are motivated by the innate necessity to feel competent and autonomous; thus, when the learning environment supports the satisfaction of these needs, students are more intrinsically motivated and self-determined [28]. Likewise, it is mentioned that a person who does not feel the inspiration to carry out their activities is perceived as a demotivated person; on the other hand, someone who feels energetic or has a positive attitude towards an end is considered a motivated person [30].

Authors Deci and Ryan distinguished 3 forms of motivation based on the degree to which they can be considered self-determined, the same as detailed below [29, 31]:

(a) Intrinsic motivation: it is based on autonomy and competence; it describes a situation in which one participates out of inherent interest and the satisfaction it generates. For instance, a student enjoys learning mathematics because of the satisfaction when mastering new concepts or because of the inherent interest and joy associated with the learning. Given this, it is important to mention that the activities of playing and exploration allow to exemplify intrinsically motivated behaviors since they do not depend on incentives or external pressures but rather provide their own satisfaction and joys.

(b) Extrinsic motivation: in this case, the individuals are committed to achieving some objective that is separate from the activity itself. In effect, it refers to behaviors performed for reasons other than their inherent satisfaction; for example, a person who wants to learn mathematics because he considers it useful for his professional life or to continue with the course that follows him in the curriculum.

(c) Demotivation: It refers to when the individual feels neither intrinsically nor extrinsically motivated to carry out an activity. It is pertinent to mention that in this case, it is impersonal and represents a lack of perceived competence and relevance. The aforementioned can negatively influence the student's attitudes and behaviors and not give the corresponding importance to group dynamics, which causes generalized and long-term negative learning results [32].

On the side of the academic performance variable, [33] indicates that it refers to performance results on the extent to which a student has been able to achieve different specific goals according to activities in educational settings, depending on the faculty and university. Furthermore, according to [34], the academic performance is the student's ability to reproduce knowledge and tasks; like so, in higher education, it allows measuring the performance of students using grades on standardized university entrance exams, university grades, and credit hours obtained in consecutive terms, which allow representing the progress of the student. Therefore, academic achievement is characterized by tests associated with course work and student performance on other types of tests.

Regarding the theory that supports academic performance, Herbert Walberg includes academic performance within the theory of educational productivity, which is simplified since learning is affected by the characteristics of the school and locality, as well as by various economic, sociological [35], and political factors at the university, community, and state levels. Nonetheless, characteristics such as sex, ethnicity, and socioeconomic status of the student, together with the size and levels of expenses of the universities, and political and sociological organizations are less flexible in a democratic system and pluralistic society, associating in less consistent learning [36].

In this theory, it is postulated that it is the individual psychological characteristics of students and their immediate psychological conditions that impact the educational results (cognitive, behavioral, and attitudinal) [37, 38], including the student's ability, motivation, age, quality of instruction, academic climate, home environment, and peer group.

3. Materials and Methods

3.1. Design. This is quantitative research carried out at a correlational and transversal level. The place of study was at the Peruvian University de Lima.

3.2. Participants. For the sample calculation, the population registered in the periods 2019-1 and 2019-2 was considered, which corresponded to a total of 724 students of the Basic Mathematics subject. A probability sampling was carried out with a confidence level of 95% and an error level of 5%, using the following equation:

$$n = \frac{NxZ^2xpxq}{d^2x(N-1) + Z^2xpxq}, \quad (1)$$

where N: Population Z = 1.96 at 95% of reliability p = 0.5 q = 0.5 d = 5% of error.

Therefore, from (1), a total of 251 students were obtained. There were 79% male and 21% female students, with an average age of 20 years. The following criteria were taken into account for its selection: ages between 17 and 25 years old, to have grades above 10 points in the subject, and those who are taking the course for the first time.

3.3. Ethics Statement. This research was approved by the Institutional Review Board of the Dean of the Faculty of Industrial and Systems Engineering of the Federico Villareal National University, and the project identification code was

assigned: 0017-FIIS-UNFV. In the same way, the need for consent was waived by the Institutional Review Board.

3.4. Data Collection Instrument. The survey was used as a technique of information collection for the motivation variable. An adaptation of the instrument was realized. This instrument was validated by [39], which originally consisted of 7 dimensions. For the present study, only 3 dimensions were considered: intrinsic motivation, extrinsic motivation, and demotivation. This selection is due to the fact that these are the dimensions that are most closely related to the variables of our research.

Finally, the questionnaire was conformed for 28 items in total, distributed as follows: 12 for the intrinsic Motivation dimension, 12 for the extrinsic Motivation dimension, and 4 for the Demotivation dimension. These items measure student motivation using a Likert-type scale, from 1 = never, 2 = almost never, 3 = sometimes, 4 = usually, and 5 = always.

While for the academic performance variable, the records of the Mathematics course in the periods 2019-1 and 2019-2 were used.

After the questionnaire was adapted according to the objective of this research, the instrument was validated by 3 experts from educational institutions. For the validation, criteria of writing, relevance, coherence, adequacy, and understanding were taken into consideration. From this process, an Aiken V value higher than .9 was obtained. Indeed, high content validity is assumed in accordance with [40].

For the calculation of the coefficient V of Aiken; In the first place, the classification of each element of the questionnaire was obtained by each expert considering the values of −1, 0, and 1, to later make a summation of them for each item; second, the coefficient was calculated using the corresponding formula, where a value close to 1 indicates high content validity [41]. Table 1 shows the results of the instrument's validation.

The reliability of the instrument was evaluated using the internal consistency procedure by calculating Cronbach's Alpha, obtaining values of 0.743, 0.733, and 0.700 for the dimensions: intrinsic motivation, extrinsic motivation, and demotivation, respectively, which refers to acceptable reliability according to [42]; therefore the measurement instrument is reliable.

For the validity of the instrument calculation, a Confirmatory Factor Analysis was carried out, using the calculation of compound reliability. Next, Table 2 is presented with the values obtained.

Subsequently, the Composite Reliability (CR) values were calculated using the following equation:

$$\mathrm{CR} = \frac{(\Sigma i \lambda i)^2}{(\Sigma i \lambda i)^2 + (\Sigma i V(\delta i))}. \quad (2)$$

The values of 0.799 were obtained; 0.857 and 0.720 for the first, second, and third dimensions, respectively. The data on the reliability of the composite material allowed us to observe internal coherence, presenting a number greater than 0.7 [43]. Through confirmatory factor analysis, it was found that the three dimensions are reliable; therefore, the instrument is reliable.

Table 1: Validation and reliability.

Scale	N° of elements	Alpha	V de Aiken
Motivation	28	0.705	0.9

3.5. Study Hypothesis. The research questions and their respective hypotheses posed for this study were the following:

(1) What is the relationship that links intrinsic motivation and educational achievement in first-cycle students of Basic Mathematics in a Peruvian university?

Statistical hypothesis

H0: $\rho = 0$ (There is no linear correlation between intrinsic motivation and educational achievement)
H1: $\rho \neq 0$ (There is a linear correlation between intrinsic motivation and educational achievement)

(2) What is the relationship that links extrinsic motivation and educational achievement in first-cycle students of Basic Mathematics in a Peruvian university?

Statistical hypothesis

H0: $\rho = 0$ (There is no linear correlation between extrinsic motivation and educational achievement)
H1: $\rho \neq 0$ (There is a linear correlation between extrinsic motivation and educational achievement)

(3) What is the relationship that links demotivation and educational achievement in first-cycle students of Basic Mathematics in a Peruvian university?

Statistical hypothesis

H0: $\rho = 0$ (There is no linear correlation between demotivation and educational achievement)
H1: $\rho \neq 0$ (There is a linear correlation between demotivation and educational achievement)

(4) What is the relationship that links motivation and educational achievement in first-cycle students of Basic Mathematics in a Peruvian university?

Statistical hypothesis

H0: $\rho = 0$ (There is no linear correlation between motivation and educational achievement)
H1: $\rho \neq 0$ (There is a linear correlation between motivation and educational achievement)

3.6. Analysis of Data. In this way, the Statistical Package SPSS was used to verify the relationship between motivation

Table 2: Estimates of autovalues, correlations, and variance.

	Estimate	Std. err	z-value	$P(>\|z\|)$	Std. lv	Std. all
Latent variables						
Mo_I = ~						
P1	0.352	0.079	4.464	0	0.352	0.301
P2	0.553	0.087	6.381	0	0.553	0.42
P3	0.638	0.087	7.361	0	0.638	0.478
P4	0.551	0.089	6.16	0	0.551	0.407
P5	0.622	0.091	6.835	0	0.622	0.447
P6	0.752	0.088	8.574	0	0.752	0.545
P7	0.695	0.082	8.434	0	0.695	0.538
P8	0.629	0.083	7.553	0	0.629	0.489
P9	0.554	0.085	6.526	0	0.554	0.429
P10	0.761	0.087	8.75	0	0.761	0.555
P11	0.995	0.082	12.094	0	0.995	0.718
P12	0.762	0.074	10.294	0	0.762	0.634
Mo_E = ~						
P13	0.835	0.072	11.575	0	0.835	0.679
P14	0.986	0.067	14.626	0	0.986	0.804
P15	0.778	0.073	10.605	0	0.778	0.634
P16	0.622	0.08	7.782	0	0.622	0.49
P17	0.549	0.083	6.632	0	0.549	0.425
P18	0.676	0.082	8.286	0	0.676	0.517
P19	0.849	0.072	11.851	0	0.849	0.691
P20	0.751	0.071	10.605	0	0.751	0.634
P21	0.686	0.078	8.757	0	0.686	0.542
P22	0.512	0.083	6.151	0	0.512	0.397
P23	0.683	0.076	8.977	0	0.683	0.554
P24	0.209	0.074	2.808	0.005	0.209	0.188
A_mo = ~						
P25	0.711	0.083	8.576	0	0.711	0.55
P26	0.991	0.086	11.554	0	0.991	0.704
P27	1.185	0.086	13.723	0	1.185	0.81
P28	1.019	0.087	11.774	0	1.019	0.715
Covariances						
Mo_I~~						
Mo_E	−0.37	0.066	−5.607	0	−0.37	−0.37
A_mo	0.409	0.067	6.111	0	0.409	0.409
Mo_E~~						
A_mo	−0.031	0.075	−0.415	0.678	−0.031	−0.031
Variances						
P1	1.241	0.113	10.976	0	1.241	0.909
P2	1.425	0.133	10.715	0	1.425	0.823
P3	1.375	0.131	10.529	0	1.375	0.772
P4	1.525	0.142	10.751	0	1.525	0.834
P5	1.544	0.145	10.634	0	1.544	0.8
P6	1.335	0.13	10.238	0	1.335	0.703
P7	1.188	0.116	10.276	0	1.188	0.711
P8	1.261	0.12	10.488	0	1.261	0.761
P9	1.36	0.127	10.69	0	1.36	0.816
P10	1.304	0.128	10.189	0	1.304	0.692
P11	0.928	0.106	8.762	0	0.928	0.484
P12	0.865	0.089	9.667	0	0.865	0.598
P13	0.815	0.083	9.831	0	0.815	0.539
P14	0.533	0.064	8.272	0	0.533	0.354
P15	0.899	0.089	10.125	0	0.899	0.598
P16	1.223	0.114	10.699	0	1.223	0.76
P17	1.364	0.126	10.852	0	1.364	0.819
P18	1.251	0.118	10.62	0	1.251	0.732
P19	0.788	0.081	9.734	0	0.788	0.522
P20	0.838	0.083	10.125	0	0.838	0.598
P21	1.129	0.107	10.538	0	1.129	0.706
P22	1.401	0.128	10.905	0	1.401	0.842
P23	1.055	0.101	10.497	0	1.055	0.693

Table 2: Continued.

	Estimate	Std. err	z-value	$P(>\|z\|)$	Std. lv	Std. all
P24	1.193	0.107	11.145	0	1.193	0.965
P25	1.164	0.115	10.099	0	1.164	0.697
P26	1	0.116	8.595	0	1	0.504
P27	0.735	0.118	6.211	0	0.735	0.344
P28	0.993	0.118	8.412	0	0.993	0.489
Mo_I	1				1	1
Mo_E	1				1	1
A_mo	1				1	1

*Mo_I = intrinsic Motivation; Mo_E = extrinsic Motivation; A_mo = Demotivation; Std. Err = standard error; z-value = value of z; $P(>|z|)$ = value of p; Std. lv = unstandardized estimation; Std. all = standardized estimation.

and its respective dimensions and academic performance, taking into consideration Spearman's Rho correlation coefficient. The analysis included linear regression analysis.

It is important to mention that within the ethical considerations, the informed consent of the students was taken into account to fill out the survey, as well as the approval of the ethics committee of the university to carry out the research. Also, the principles of confidentiality and anonymity were borne in mind.

4. Results

Table 3 shows the student gender distribution of students who took this course in 2019 in both semesters.

The gender of the students corresponded to 55% male and 45% female of the total 251 students.

Table 4 shows the academic performance in mathematics distribution of students who took this course in 2019 in both semesters.

The academic performance of the surveyed students was classified as in start (11–14), in process (15–17), and satisfactory (18–20). Therefore, of the total, 83 students (33.1%) were found to be in start stage; 85 (33.9%) in process, and 83 students (33.1%) presented a satisfactory academic level.

In terms of motivation, the studies of [44, 45] were taken into consideration for the distribution of its levels. Figure 1 shows a descriptive study developed by the data extracted from the questionnaire, similar to the study developed by [44], where the inferential results were collected in the Relative Weight Analyses. On the other hand, [45] carried out a descriptive study similar to that shown in this figure, where they have two dimensions of motivation (Low Motivation and High Motivation). In this case, the next scale is used (Table 5) for the three motivational dimensions of the instrument.

Figure 1 shows the motivation levels of the students, where a high percentage, represented by 132 students (52.6%) presenting a medium level of motivation, as well as 32 students (12.7%) presenting a high level of motivation and 87 students (34.7%) presenting a low level of motivation.

For a more detailed analysis of the study variables, the information was crossed according to the previously defined levels; this was in order to identify the number of students that intersect at each level of the variables and obtain a profile of them.

Table 3: Student gender.

Gender	2019-I	2019-II	Total	Percentage (%)
Male	79	58	137	55
Female	62	52	114	45
Total	141	110	251	100

Table 4: Academic performance in mathematics.

Performance	Frequency	Percentage	Accumulated percentage
In start	83	33.1	33.1
In process	85	33.9	66.9
Satisfactory	83	33.1	100.0
Total	251	100.0	

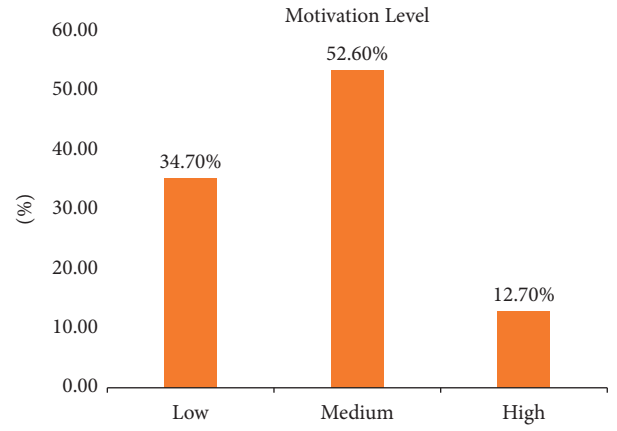

Figure 1: Motivation levels of the students.

Table 6 shows that of those students who present low motivation, 66 students (26.3%) present an academic performance at the start level, and 19 (7.6%) academic performance in process. In addition, of the students who showed medium motivation level, 62 (24.7%) had an academic performance in process, 55 (21.9%) an academic performance satisfactory, and 15 (6%) an academic

Table 5: Scale for the motivational dimensions.

Dimension	Scale
Intrinsic and extrinsic motivation	High motivation
Intrinsic or extrinsic motivation	Medium motivation
Demotivation	Low motivation

performance in the start level. Finally, of the students with high motivation, 26 (10.4%) have a Satisfactory academic performance, 4 (1.6%) an academic performance in process, and 2 (0.8%) an academic performance in the start level.

Based on the results shown in Table 7, the hypotheses raised in this study can be answered: it can be seen that there exists a link between motivation and academic performance weak, positive, and significant ($r = 0.222$, $p = 0.001$). The link between intrinsic motivation and academic performance is significant, positive, and weak ($r = 0.242$, $p = 0.001$) and similarly with extrinsic motivation ($r = 0.117$, $p = 0.003$). Similarly, there exists a link between demotivation and academic performance weak, positive, and significant ($r = .142$, $p = 0.024$); the scale considered was according to [46, 47].

Regarding the relationship between academic performance and each of the items that make up each dimension of the instrument used, Table 8 is presented below, which shows the items that presented the highest correlation in order to highlight the factors with the greatest impact on academic performance:

Item 4: Because my studies allow me to continue learning a lot of things that interest me (intrinsic motivation).

Item 22: Because it may allow me to enter the labor market in the field that I like (extrinsic motivation).

Item 26: At the time, I had good reasons to go to university, but now I wonder if I should be there (demotivation).

Table 9 shows an $r^2 = 0.55$ and a value $F = 53.43$, which refers that there is an incidence of 55% of the model into the academic performance; these results confirm what was obtained with Spearman's Rho coefficient, since the model is significant with a p-value ≤ 0.001. As can be seen in the previous table, all the p values are less than 0.05, which indicates that the variables are significant; that is, they provide information to the model. When comparing academic performance with intrinsic motivation, it was obtained that this explains a 27.2% of academic performance in a significant way ($\beta = 0.732$, $p = 0.011$); with extrinsic motivation, it was obtained that this explains a 16.8% of academic performance in a significant way ($\beta = 0.556$, $p = 0.001$), with demotivation, it was obtained that this explains a 12.4% of academic performance a significant way ($\beta = 0.427$, $p = 0.008$).

5. Discussion

This study evaluated the relationship between academic performance in mathematics and motivation and looked at intrinsic motivation, extrinsic motivation, and demotivation. It was found that motivation and its various dimensions influence the academic performance of first-cycle mathematics students in different measures. The link between academic performance and intrinsic motivation was significant, positive, and weak (0.242), highlighting that the fact that their studies allow them to continue learning many things that interest them is the factor with the greatest impact, with a correlation of 0.236 to academic performance. These results match those obtained by [20, 48, 49], who confirm that intrinsic motivation has a stronger relationship to academic performance. For example, [20], highlighted in their study that a poor family environment generates in students the need to excel, thus creating an internal motivation that drives them to learn and understand the importance of mathematics education, which leads to better academic performance. However, others did not find any relationship [50–52], cited in Clark et al. [19].

Meanwhile, extrinsic motivation presented a slightly weaker relationship to academic performance in mathematics compared to intrinsic motivation, with a positive correlation of 0.117. When analyzing the items of this dimension, it was found that item 22 stood out, showing a correlation with academic performance of 0.153, through which students maintain that they feel motivated since this may allow them to enter the labor market within the field of their preference. In this sense, our results match those obtained by [44, 45, 53], who found a significant and positive correlation between both types of motivation (intrinsic and extrinsic) and academic achievement. In the case of [53], these authors highlight that intrinsically motivated students persist longer, demonstrate achievements with their academic efforts, and achieve more challenges when compared to extrinsically motivated students, who focus on achieving higher grades, peer recognition, and obtaining rewards. On the other hand, demotivation also presented a weak significant correlation with academic performance (0.142), yet it still stood out as the factor with the greatest impact (0.147), the fact that students feel that, at the time they started university, they had good reasons to attend, but now they wonder if they should continue there. This result differs from those obtained by [54], whose results indicated that demotivation was not related to performance in mathematics. However, it is important to note that according to our results, it is possible that demotivation is positively correlated with academic performance, and although this may seem to be a somewhat incongruent result, it is nonetheless valid. At this point, these results can be supported by those obtained by [25], who affirm that motivational variables do not play an important role in the academic performance of mathematics. There are cases of students who lack the motivation to study their career and still manage to obtain a remarkable or positive academic performance, as evidenced in the results obtained by [55]. These authors found a positive correlation of 0.208 between disinterest and rejection of work with academic performance.

There is also the case of Subinas and Berciano [17], who, after implementing a ludic activity in the classroom to take advantage of the benefits of gamification in the subject of mathematics, point out that, although there are activities that increase the intrinsic motivation of students to learn this

Table 6: Crossing between academic performance in mathematics and motivation.

			Academic performance level			
			In start	In process	Satisfactory	Total
Motivation level	Low	Recount	66	19	2	87
		% of total (%)	26.3	7.6	0.8	34.7
	Medium	Recount	15	62	55	132
		% of total (%)	6.0	24.7	21.9	52.6
	High	Recount	2	4	26	32
		% of total (%)	0.8	1.6	10.4	12.7
Total		Recount	83	85	83	251
		% of total (%)	33.07	33.86	33.07	100

Table 7: Relationship between motivation, its dimensions, and academic performance.

			Academic performance
Spearman rho	Academic performance	Correlation coefficient	1.000
		Significance	
		N	251
	Motivation	Correlation coefficient	0.222*
		Significance	0.000
		N	251
	Intrinsic motivation	Correlation coefficient	0.242*
		Significance	0.000
		N	251
	Extrinsic motivation	Correlation coefficient	0.117*
		Significance	0.003
		N	251
	Demotivation	Correlation coefficient	0.142*
		Significance	0.024
		N	251

*The significance between 0.000 and 0.05 indicates a significant correlation.

Table 8: Relationship between the instrument items and academic performance.

			Academic performance
Spearman rho	Academic performance	Correlation coefficient	1.000
		Significance	
		N	251
	Item 4	Correlation coefficient	0.236
		Significance	0.000
		N	251
	Item 22	Correlation coefficient	0.153
		Significance	0.016
		N	251
	Item 26	Correlation coefficient	0.147
		Significance	0.045
		N	251

subject, this does not imply a significant change in academic performance. Therefore, it is important to keep in mind that there are other factors that can influence academic performance, as outlined by [56] when stating that academic performance can be explained by the attitude that students have towards mathematics. Motivation is only one of the factors that influence academic performance since there are also economic, sociological, and political factors, the student's sex, age, and the quality of the received instruction, among other factors that influence academic performance [35, 36], however, as Walberg and Ethington [36] indicates, it is the student's individual psychological characteristics and conditions that have the main impact on the student's academic performance.

Just as there may be a positive correlation between demotivation and academic performance, it is possible that there is no relation between intrinsic or extrinsic motivation and academic performance, as found by Areepattamannil [54]. In these cases, it is necessary to turn to other aspects to better analyze this situation. A factor that we consider important to highlight regarding the results obtained by [54] is that this author, after

Table 9: Linear regression analysis.

Variable	Beta coefficient	Standard error	t value	Significance
Intrinsic motivation	0.732	0.354	2.65	0.011
Extrinsic motivation	0.556	0.259	5.025	0.000
Demotivation	0.427	0.194	2.11	0.008
R^2	0.55			
F statistics	53.43			
Sig.	0.000			

analyzing the relation of these variables (intrinsic motivation, extrinsic motivation, demotivation, and academic performance) in Indian students in India and Indian students in Canada, he found that in the case of Indian immigrant students in Canada, there was a significant relation between intrinsic and extrinsic motivation and academic performance, while in the case of Indian students in India there was no relation between the variables. He also noted that intrinsic motivation was a statistically significant positive predictor, while extrinsic motivation was a statistically significant negative predictor.

In general, our results showed that there is a significant, positive, and weak correlation of 0.222 between motivation and academic performance in undergraduate students of mathematics. These results coincide with various studies as those developed by [16, 53], as well as the studies carried out by [15, 18, 19], who demonstrated a statistically significant relationship between motivation and academic performance in subjects other than mathematics.

In conclusion, it is important to highlight the implication of the unexpected positive correlation between demotivation and academic performance. We can understand that despite the fact that a student is demotivated, there may be other factors that drive him/her to have a good academic performance, as explained above. This leaves an open invitation for future research to analyze the relation between demotivation and academic performance in order to know which factors positively influence academic performance even when the student is demotivated. It is also important to carry out activities with the objective of increasing motivation in students to learn mathematics.

6. Conclusions

The development of this research allowed us to identify the theory that supports the study of motivation and academic performance, as well as the type of association it presents. Also, it provides valuable information for the universities, teachers, and students of the mathematics subject regarding motivation and its dimensions, which can serve as a reference for future research.

A predominance of the medium level of motivation was evidenced, representing 52.6% of the total number of students, while there are 24.7% of students with academic performance in process. This indicates that both the academic performance and the motivation of the students should improve to be located at a satisfactory level, for which some type of academic motivation program could be implemented.

A significant and positive correlation was found between motivation and its dimensions with academic performance. Similarly, it was found that both intrinsic motivation and extrinsic motivation have a moderate correlation with academic performance in mathematics. Therefore, this research suggests that universities, teachers, and students' families take the necessary measures and provide stimulation to increase student motivation. Teachers, for example, should implement strategies to involve students in academic activities that improve their motivation and, consequently, their grades in mathematics. Equally an important aspect to consider as a suggestion both for relatives of the circle close to the student and for the university is that students expressed as a cause of demotivation, the fact that at the time, students had good reasons for going to university, but now they wonder if they should continue there. For this reason, the study suggests that universities implement motivational programs, with the main aim being university-student-family rapprochement. Although it is true that university students choose a career by their own choice or motivation, given that these are first-cycle students, many of whom are under the tutelage of their parents, it is important to help the student to connect with their purpose of being at university, so that they feel motivated by what they are doing.

Finally, this study opens the door to future research that intends to analyze the variables studied and, in turn, considers the immediate family of the analyzed sample. Given that as a limitation of this research, no data was taken with respect to students' family members, who represent one of the main extrinsic factors that influence student motivation.

7. Limitations

This study certainly confirms the positive influence of motivation and its variables on student performance supported by the methodological basis developed in the framework, and this coincides with the findings of other authors. However, in this study, it was not possible to dig deeper into the relation obtained between these variables; we obtained weak relationships for both motivated and demotivated students, which, in spite of being supported by the scientific literature, may be necessary and interesting to corroborate with other studies.

In turn, a limitation of this study is that no specific indicators of the types of motivations were detailed in order to offer a more "detailed" discussion, but to limit ourselves to talk about "intrinsic motivation," "extrinsic motivation" and "demotivation."

On the other hand, regarding the use of spearman's rho, its selection was based on the fact that we worked with a qualitative variable (motivation), which was measured by means of a Likert scale, and a quantitative variable (academic performance), which is why spearman's rho was used. Meanwhile, other studies employ the *T*-student statistic to determine the relation between students' performance and motivation, such as [45]. Meanwhile, Steinmayr et al.[44] employ crosstab statistics to perform inferential analysis.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest of legal, financial, or commercial nature.

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