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LEARNING STRATEGIES AND ACADEMIC PERFORMANCE IN COMPUTER ENGINEERING STUDENTS FROM THE BENGUELA HIGHER POLYTECHNIC INSTITUTE (ANGOLA)

ESTRATEGIAS DE APRENDIZAJE Y RENDIMIENTO ACADÉMICO EN ESTUDIANTES DE INGENIERÍA INFORMÁTICA DEL INSTITUTO SUPERIOR POLITÉCNICO BENGUELA (ANGOLA)

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ABSTRACT

The purpose of this research study was to analyze the relationship between academic performance and learning strategies, using a descriptive design with a non-experimental and correlational approach. To achieve this, several activities were carried out, based on the fundamental theoretical concepts of learning strategies and academic performance. In addition, non-probabilistic sampling was used and a survey was applied through a questionnaire. The results obtained indicate, with a reliability level of 95%, that it is a fact that, between learning strategies and academic performance, there is a significant relationship for computer engineering students at the Polytechnic Higher Institute of Benguela (ISPB). This research has allowed us to precisely identify how obtaining, perceiving, restoring and supporting the information process are closely linked to the academic performance of students. These findings provide a solid basis for developing effective and personalized pedagogical strategies that promote better academic performance in students, while showing evidence of the importance of implementing appropriate learning techniques, focused on promoting better academic performance of students. providing relevant information that can be used to improve teaching and learning processes.

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Palabras clave:
estrategias, enseñanza, rendimiento académico, aprendizaje, estilos de aprendizaje

RESUMEN

El propósito de este estudio de investigación fue analizar la relación existente entre el rendimiento académico y las estrategias de aprendizaje, mediante un diseño descriptivo con un enfoque no experimental y correlacional. Para ello se realizaron varias actividades, basadas en los conceptos teóricos fundamentales de las estrategias de aprendizaje y el rendimiento académico. Además, se utilizó un muestreo no probabilístico y se aplicó una encuesta mediante un cuestionario. Los resultados obtenidos indican, con un nivel de fiabilidad del 95%, que es un hecho que, entre las estrategias de aprendizaje y el rendimiento académico, existe una relación significativa para los estudiantes de ingeniería informática del Instituto Superior Politécnico de Benguela, de Angola (ISPB). Esta investigación ha permitido identificar de manera precisa cómo la obtención, percepción, restauración y respaldo al proceso de la información están estrechamente vinculados con el desempeño académico de los educandos. Estos hallazgos proporcionan una base sólida para desarrollar estrategias pedagógicas efectivas y personalizadas que promuevan un mejor rendimiento escolar en los estudiantes, a la par que muestra evidencias de la importancia de implementar técnicas de aprendizaje adecuadas, enfocadas en potenciar un mejor rendimiento académico de los estudiantes, brindando información relevante que puede ser utilizada para perfeccionar los procesos de enseñanza y aprendizaje.

Introduction

The education system in Angola has shown great concern for strengthening the effectiveness of education in recent years. In this regard, significant efforts have been made to identify the factors that are associated with such quality. One of these factors is the application of learning strategies in academic performance in the field of computer engineering. It has been observed that most students do not make use of appropriate methods to achieve meaningful learning, which affects their academic performance.

Learning difficulties are another factor influencing the academic performance of students in the Engineering Department of the Instituto Superior Politecnico de Benguela (ISPB). Therefore, this research aims to establish the existing connection between learning strategies and academic performance in students of the Computer Engineering course in the Engineering Department of the ISPB. We seek to understand how the use of different learning strategies can influence students' learning style and, in turn, their likelihood of poor or successful academic performance in the field of computer engineering. These findings will be valuable for making decisions in order to improve teaching results and, therefore, the quality of the graduates of this career.

The relevance of learners developing "learning to learn" skills has been highlighted by Nisbet and Shucksmith (1986) and Beltrán (1996). These authors emphasize the need for students to be self-aware of their learning process and to use strategies that allow them to achieve their educational goals. Monereo (2001) also stresses that the use of strategies implies that students are able to evaluate, guide and adjust their own performance to achieve effective results.

In the Computer Engineering course of the ISPB, a worrisome decrease in the academic results of the students has been detected. According to the data obtained in the 2021-2022 diagnostic test, only 16% of students achieved a satisfactory level, while an alarming 64.1% are at initial levels or in the process of development. In addition, in the tests applied, the results show 15.8% of students at a satisfactory level and 65.3% at initial levels or in process. The ISPB is facing an educational challenge due to the combination of the Traditional and Behaviorist pedagogical models. In the traditional model, teachers play a central role in the educational process, being the ones who predominantly transmit knowledge. This is aggravated by the lack of contextualization of the curricula. The contents are presented in isolation, without establishing connections with reality or practical application. For example, in the Computer Engineering course at ISPB, students may learn the theoretical principles and concepts of programming, but have difficulty understanding how to apply them in everyday situations or real problems. This was confirmed by observations made in the programming classrooms, which showed that students learn the basics of a programming language, but may have problems in using this knowledge to solve practical situations or develop real applications.

It is important to note that programming in Computer Engineering is a discipline that requires a practical and applied approach. Students should be able to apply theoretical concepts in solving concrete problems and developing technological solutions.

In this context, the need arises to design learning and academic performance strategies for ISPB Computer Engineering students that address this problem. It is essential to implement pedagogical strategies that foster greater awareness of the students' own learning process. In addition, the lack of motivation and the inadequate use of study techniques and strategies make it difficult for students to consolidate what they have learned. To this end, it is imperative that teachers design innovative pedagogical strategies that motivate students to improve their academic performance.

Learning Strategies

Several researchers have defined the concept of learning strategies in different ways, but all agree on their fundamental importance for the learning process. According to Beltrán (1996), learning strategies are tools that facilitate the acquisition and development of processes that promote learning. These strategies are directly related to the quality of students' learning, as they allow them to identify and diagnose the causes of their academic performance, whether high or low. Strategies are rules and operations that enable learners to make appropriate decisions at the right time to facilitate their learning. They also promote autonomous and independent learning, transferring the learning management from teachers to students.

Sosa (2022) points out that learning strategies are cognitive tools used by students to facilitate knowledge management processes. These strategies involve organizing information, making connections and associations, planning and monitoring study, practice and repetition, and seeking additional help and resources. By using these strategies effectively, students can improve their understanding, retention and application of knowledge.

Betancourt, Soler and Colunga (2020), state that, when it comes to learning strategies, the affective aspect, motivation and self-esteem of students are closely related. The emotional state of students can have a significant impact on their motivation and how they engage in the learning process. From the affective point of view, learning strategies should aim to generate positive emotions and a supportive and trusting environment. This is achieved by creating a safe and welcoming learning environment where students feel valued and respected. As for motivational strategies, it is important to awaken the interest and curiosity of the students towards the topic or content being addressed. This can be achieved by creating interactive, challenging and relevant activities that capture their attention.

Likewise Oseda, Mendivel and Angoma (2020) are of the opinion that learning strategies are behaviors and thoughts used by learners to influence their information encoding process. These strategies can be simple, such as underlining or memorizing, or more complex, such as associating prior knowledge for better comprehension. Its objective is to improve the retention and application of knowledge. It is important to note that learning strategies are not innate, but can be developed and refined with practice. Students should identify the most effective strategies for them and practice them consistently to optimize their learning process.

The authors García, Alfredo and Ponte (2021), in their research "Learning Strategies", analyze the national educational reality and reveal that the level of understanding of information management and the use of learning strategies are fundamental for students. Learning strategies are used when students demonstrate a continuous ability to adapt to changes and variations that occur during the activity, with the ultimate goal of achieving the objectives efficiently. In this way, students minimize the number of errors before finding the solution to the problem, ensuring that their answer is correct after a minimum number of attempts. In addition, autonomous learning is a process that allows students to regulate what they learn and to be aware of their cognitive and socio-affective processes. It focuses on forming individuals capable of solving specific aspects of their own learning, encouraging them to question, review, plan, control and evaluate their own learning to learn action. We seek to imprint significant learning by using appropriate and motivating strategies in the learning process.

The author Betancourt-Pereira (2020), in his study "Learning Strategies and Academic Performance in Executive Secretarial Students, Machala - Ecuador", aimed to investigate the relationship between learning strategies and academic performance of Executive Secretarial students. This was a descriptive research with a correlational design, in which the population and sample consisted of 25 students. To measure the correlation between both variables, Pearson's relationship coefficient was used, which yielded a correlation value of 0.846, thus demonstrating a significant relationship between learning strategies and academic performance. This study provides evidence of the importance of learning strategies in the academic performance of Executive Secretarial students, suggesting the relevance of promoting and developing these strategies to improve academic outcomes.

On the other hand, Olmedo (2020), in his article "Learning styles and school academic performance from the cognitive, procedural and attitudinal dimensions", presents an educational research whose main objective is to evaluate the correlation between learning styles and academic performance in the cognitive, procedural and attitudinal dimensions in the subjects of mathematics, natural sciences, humanities and technology and computer science of tenth grade students in three educational institutions in Bogota. The study proposes educational strategies that contribute to the teaching-learning process. The results of the quantitative analysis revealed 63 significant relationships and implications, to varying degrees, of the 84 possible variable crossovers. These relationships were established by considering learning styles and academic performance in the subjects investigated. These findings provide inputs for the design and development of didactic strategies that take into account learning styles for the benefit of academic performance. The design of lines of action for the development of the proposed strategies according to the learning style is also suggested.

The author Fernando, A (2020), in his research The academic performance of the cadets of the Academy of the National Air Force of the Republic of Angola (AFAN), focuses on analyzing the educational reality and the training of the AFAN cadets, in order to improve their competent professional performance, in accordance with the needs of the Angolan Armed Forces and society in general. The result of this research is important because it evidences the need to implement changes in military disciplines and the relevance of a didactic strategy oriented towards developmental learning with a professional approach. This will contribute to improving the academic performance of AFAN cadets.

Quality of learning in the special school in Angola from teacher preparation, by Carlos, Carrera and Perdomo (2020), is a research whose results allowed to diagnose the needs and potentialities of teachers and to propose a pedagogical strategy. These results are evident in the preparation of teachers to provide quality education to all students with special educational needs. The relevance of this strategy and the satisfaction of the commitments demanded by Angolan society to the school as an educational institution are evident.

The research of Oseda, Mendivel and Angoma (2020) shows that learning strategies also promote metacognition Oseda, Mendivel, and Angoma (2020) evidences that learning strategies also promote metacognition, i.e., students' ability to reflect on and monitor their own learning process. By using strategies such as planning, review, and self-reflection, students can assess their progress, identify areas for improvement, and adjust their study approaches accordingly. It is important to note that learning strategies are not universal, and what works for one student may not work for another. Therefore, it is

essential that educators provide guidance and support for students to develop and use effective learning strategies that are adapted to their own needs and learning styles.

Learning strategies are cognitive and behavioral tools that students use to facilitate their knowledge acquisition process. These strategies are related to academic performance, as they can influence the way students approach study and the assimilation of the topics to be covered. However, it should be taken into consideration that academic performance can also be affected by other factors, such as motivation, educational environment and individual skills. Therefore, it is advisable to continue to deepen this study in order to better understand the relationship between learning strategies and academic performance, and thus develop effective pedagogical interventions.

Academic Performance

Academic performance is a key factor in university research. The relationship between student learning strategies and academic performance has been studied. To better understand this concept, it is important to refer to several definitions of academic performance.

It is important to emphasize that academic performance is not only based on obtaining grades, but also on the ability to use the acquired knowledge in a meaningful way and apply it in different situations. In this way, academic performance goes beyond simple memorization and focuses on comprehension, critical reasoning and problem-solving skills. Talani and Branco (2021), point out that the study of academic performance involves the analysis of various factors that can influence it, such as the educational environment, the quality of teaching, student motivation, the learning strategies used and family support. These factors can interact in complex ways and affect academic performance positively or negatively.

On the other hand, Niemba and Almeida (2023), in the study "Student Adaptation in Higher Education (QAES): Validation of Assessment Instrument in Angola, validated the Questionnaire for use in research on the transition and academic adaptation of students entering Higher Education in Angola. Good coping skills can help students set clear goals, integrate into the academic environment, effectively manage study demands, maintain emotional balance, and establish positive social relationships. These factors, in turn, can contribute to better academic performance and prevent early dropout.

Terán and Schulmeyer (2022), in their study entitled Relationship between High School Academic Performance and College Academic Performance, found a moderate correlation between the grades obtained by students in college and the grades they had obtained in high school. This means that there is a relationship, although not a very strong one, between prior academic performance and university academic performance. However, it is important to note that this correlation was not significantly different between genders or between different types of schools. Despite these findings, it was concluded that school performance alone has limited predictive ability when considered as the sole predictor variable. This implies that university academic performance is influenced by factors other than school performance, such as motivation, dedication, study skills and adaptability to the university environment.

Quispe and Noriega (2022), in their article "Academic self-efficacy and school performance in adolescents", show that self-efficacy is positively related to the academic performance of adolescent students. Promoting and developing self-efficacy in students can be an effective strategy to improve their learning and academic performance.

Pretel (2022), in "Familias disfuncionales y su relación en el rendimiento académico de estudiantes del 2° grado de una institución educativa-Huancayo", states

that he found a significant relationship between family dysfunction and academic performance of second grade students. These results suggest that family dysfunction may have a negative impact on students' academic performance. It is important to take these findings into account in order to implement strategies to help improve the academic performance of students who come from dysfunctional families.

Suarez Pisacome, (2022), in his work "Significant learning and its impact on academic performance in 4th year GBS students at UE Emigdio Esparza Moreno, Babahoyo", highlights the importance of significant learning in the academic performance of students. The implementation of innovative pedagogical strategies and the creation of a climate conducive to learning are key to improving students' academic performance. In addition, the need for greater commitment and support from teachers and parents to achieve meaningful learning and better academic performance is highlighted.

Pincay-Ponce, De Giusti, Reyes-Cárdenas, Franco-Pico, Macías-Espinales and Quiroz-Palma, (2022), in their research "Data analytics of socioeconomic factors affecting school performance", highlight the importance of considering factors such as family economy, gender and students' social skills to improve academic performance. The support provided by parents in schoolwork, the learning environment at home, schooling, culture and authoritarianism also have a significant influence on academic performance. These findings highlight the importance of involving the family in the educational process and implementing strategies that promote a favorable environment for learning.

In the article "Factors influencing the academic performance of Acting students", by Pizarro Valenzuela, (2022), it is shown that highlight the importance of factors such as previous educational experience, the pedagogical skills of the teaching staff, the socioeconomic factor and psychoemotional well-being in the academic performance of students. The assessment of school performance, whether quantitative or qualitative, is related to a variety of factors that influence academic achievement. These factors may include socioeconomic status, family support, quality of teaching and pedagogical strategies used. A thorough understanding of these factors can help improve assessment and, ultimately, student academic performance.

Páez and Ramírez, (2022), in "Predictive models of academic performance based on characteristics of engineering students", show that data analysis is a fundamental tool to identify patterns and trends in academic performance. This allows us to identify relationships between academic performance and different factors that influence it. These data provide us with valuable information to improve the quality of education and make informed educational decisions. By examining large data sets, we can detect patterns of student behavior, enrollment trends, evaluate the effectiveness of academic programs and other key variables. Knowing these relationships, we can design more effective and personalized strategies to promote students' academic success.

Simaro, Tonelli and Varela, (2018) show in their study "Indicadores y fichas metodológicas para la medición del rendimiento académico mediato universitario mediato", that both performance indicators are related to each other. academic performance indicators, both GPA and career advancement, are related to and affected mainly by students' previous performance. Students with good academic performance tend to have higher GPAs and higher career advancement, while those with lower performance may have lower scores on both indicators.

These authors explore how optimism can influence academic performance and overcoming obstacles. They offer practical strategies to cultivate optimism and help students achieve their full potential.

All of these researchers have made important contributions to the field of motivation and personal development in the last five years. His works offer valuable insights and practical strategies for fostering motivation and self-regulated learning.

Methodology

Following the methodology proposed by Sampieri, Fernández and Baptista (2010), this study is framed within a quantitative approach. This criterion is distinguished by its focus on the collection and analysis of numerical data for the purpose of examining the properties and phenomena of a specific variable. In addition, it emphasizes the precise and independent measurement of the concepts or variables under investigation, relying on the systematic collection of information and its subsequent analysis to answer the research questions posed. It is also based on numerical measurement, counting and the use of statistical techniques to accurately establish patterns of behavior in a given population.

Likewise, the present research work is framed within the non-experimental-correlational design, characterized by the absence of manipulation of the study variables and by its objective of seeking the relationship between two events in a specific time (Hernández, Fernández and Baptista, 2014, p.93). In this sense, no manipulation of the study variables was performed and, in accordance with the stated objectives, we seek to determine the relationship between learning strategies and academic performance.

The assessment of the variable of learning strategies was carried out using the Questionnaire for the Evaluation of Learning Strategies of University Students (CEVEAPEU), an instrument that allows the collection of data for the purpose of using them in research and obtaining relevant information on the subject. investigated. This questionnaire consists of 88 items, organized into two scales, six subscales and twenty-five strategies. The items are designed using a Likert-type scale format, with five response options: strongly disagree, disagree, undecided, agree and strongly agree.

In the validation of the questionnaire, we worked with a sample of 242 undergraduate students of the computer engineering course at the ISPB Engineering Department. The results showed a chi-square value indicating that the correlation matrix is not an identity matrix, which confirms that the data matrix obtained is suitable for factor analysis. In addition, the KMO (Kaiser-Meyer-Olkin) index was calculated, which yielded a value of 0.572, admissible for this index, as it is greater than 0.5 for sample adequacy.

Cronbach's coefficient was used to establish the reliability of the questionnaire. The reliability results of the two scales were excellent, yielding a value of 0.75, while those of the subscales were good. Likewise, the reliability of the strategies was more than acceptable in the context of the research, considering the number of items of the factors/strategies.

The overall reliability of the questionnaire, composed of 88 items, was = 0.895, the validation results show that the questionnaire used is reliable, with adequate reliability indices in all scales and subscales. These findings support the use of this instrument to assess learning strategies in the research context.

One of the most important aspects of research in this field is to determine to what extent the use of the questionnaire can be predictive of academic performance. If learning strategies are considered to be the tools used to acquire knowledge, it is reasonable to assume that these strategies may have some effect on academic performance. In order to

evaluate the predictive validity of the questionnaire, two tests were carried out: correlations and multiple regression analysis. In these tests, the relationships between the learning strategies identified in the questionnaire and academic performance were explored, allowing us to obtain a clearer picture of the questionnaire's ability to predict academic success.

As for the results of the correlations, Pearson product-moment correlations were performed to analyze the linear association between the mean evaluations of the items of the scales and subscales of the questionnaire, and the mean evaluations of the grades obtained in five core/compulsory subjects. Positive correlations were found in all cases, being outstanding in most cases, excluding the Information Search and Selection subscale.

In relation to the multiple regression analysis, a multiple rating R coefficient of 0.403 was obtained, indicating a moderate magnitude between the dependent variable (academic performance) and the five predictors considered in the study. The coefficient of determination (R2) was 0.163, which means that the five predictors explain 15.3% of the variance in the ratings. The F value obtained in the ANOVA was 16.324, with a significance level of 0.001, indicating a good level of prediction of academic performance.

Results

Table 1

Relationship between the dimensions of Academic performance and metacognitive skills of students in the Computer Engineering course at the ISPB Department of Engineering

Metacognitive skills	Subtotal skills	
Technical dimension	Correlation Coef	-,230**
	Sig. (bilateral)	,001
	N	219
Spearman's Rho Spearman's Rho Methodical dimension	Correlation Coef	-,145*
	Sig. (bilateral)	,003
	N	220
Personal social dimension	Correlation Coef	,020
	Sig. (bilateral)	,770
	N	220

According to the established significance levels, it was found that the dimensions of academic performance that showed a significant relationship with Metacognitive Skills were the "technical dimension" and the "methodical dimension", as shown in Table 1. These findings led to the generation of Spearman's Rho coefficients. These coefficients indicate a low but significant indirect relationship between metacognitive skills and the aforementioned dimensions of academic performance. This result highlights the importance of metacognitive skills in the academic context and suggests that they can have a positive impact on improving the technical and methodical dimension of academic performance.

Table 2
Levels of learning strategies of students in the computer engineering course in the ISPB Engineering Department

Level strategies for learning	No.	%	% cumulative
Under	41	19,0	19,0
Medium	112	50,1	70,0
High	65	29,8	100,0
Total	220	100,0	

Table 2 shows the levels of learning strategies, considering the classification into three established levels. It is notable that the level with the highest percentage was the Medium level of learning strategies. This result highlights the importance and prevalence of learning strategies in this study group, suggesting an adequate level of engagement and focus in the knowledge acquisition process. These findings are relevant to understanding how students are approaching their learning and can provide valuable information for the design of effective pedagogical interventions.

Table 3
Academic Performance of the students of the Computer Engineering course in the Engineering Department of ISPB

RA Level	No.	%	% cumulative
Deficient	10	5,0	5,0
Acceptable	163	73,1	79,1
Good	45	20,7	100,0
Total	220	100,0	

Table 3 shows the academic performance reflected in the established levels, revealing that Acceptable academic performance obtained the highest percentage, reaching 73.1%. This finding highlights the importance of strong and satisfactory academic performance in the educational context. In addition, it suggests that students are achieving a level of performance that meets established standards and demonstrates a commitment to their learning. These results are significant for understanding the effectiveness of teaching strategies and can serve as a basis for the design of pedagogical interventions that promote even more outstanding academic performance.

Discussion

Based on the results obtained and with respect to the general objective of the research, which sought to determine the relationship between learning strategies and academic performance, it is concluded that the general hypothesis should be rejected. The results obtained do not evidence a significant relationship between learning strategies and academic performance in the students of the Computer Engineering course of the

ISPB Engineering Department. This is because the coefficient of profitability obtained through the Spearman's Rho non-parametric test is close to zero (0) and is not statistically significant ($p>0.05$).

Therefore, the scores of the study variables are not linked, indicating independence between them. This finding suggests that students with higher grades do not necessarily employ better learning strategies compared to those with lower academic performance. This represents an inconsistency with respect to the established theory and a more detailed explanation will be discussed.

Importantly, these results do not rule out the importance of learning strategies in the academic context, but suggest that there are other factors that may influence the academic performance of ISPB computer engineering students. These findings provide a basis for future research and can serve as a starting point for the design of pedagogical interventions aimed at improving students' academic performance in this specific area.

At the level of specific objectives, when seeking to demonstrate the relationship between learning strategies and the dimensions of academic performance (technical, methodical and personal-social), a significant absence of assessment between these variables was found. Likewise, when cross-referencing the dimensions of learning strategies and academic performance, no relationship was found between them either. It is significant to point out that learning strategies are conscious and intentional decision-making processes, in which students choose and coordinate the knowledge necessary to meet a specific demand or objective (Monereo, 2000). These strategies are also considered conscious or metacognitive, since they allow understanding.

According to these premises, it could be expected that university students who use more complex learning strategies have a more significant academic performance, and in turn, present better levels of self-esteem in the academic and family environments (García, Fonseca, & Concha, 2015). In other words, those who are more proficient in the use of learning strategies are also successful in their studies. However, our results indicate that strategies do not emerge on their own deliberately, if within the training process there is no encouragement in an intentional way to foster and extend the set of strategies in students.

Furthermore, if the evaluation processes continue to support the memorization or reproduction of content, as could be happening in our study sample, there is a lack of relationship between the variables analyzed.

It is important to note that mastering learning strategies does not influence or is not directly related to academic performance in students at the higher technological level. Therefore, academic performance would be linked to other aspects of the educational process that are not related to the learning strategies measured in the instrument used. This should be elucidated in future research with a methodological design appropriate to the intention of analyzing the hypotheses raised.

However, when continuing with the data analysis, it has been observed that when examining the subdimensions of learning strategies more specifically, "metacognitive skills" (affective, supportive and control) and "information management skills" (cognitive) present a weak but significant assessment with academic performance. This suggests that some aspects of learning strategies do relate to academic performance when analyzed at a more detailed level.

On the other hand, the findings of this study indicate that, even though a relevant connection between learning strategies in general and academic performance has not been identified, certain specific aspects of these strategies do have a tenuous but appreciable variation with academic performance. This implies that it is necessary to

deepen the analysis of the subdimensions of learning strategies to better understand their influence on student performance.

According to Villalobos (2012), learning strategies go beyond simple study habits. They have a specific purpose, such as solving academic or other related problems. These strategies include specific techniques, operations or activities. In order to achieve a better understanding of the problem identified, it is suggested to follow up and monitor the forms of evaluation used by teachers. In this way, valuable information can be obtained to help address the problem more directly. Creativity and imagination are powerful tools that allow us to find innovative and surprising solutions in the field of education.

Since there is no relationship between learning strategies and academic performance, then what factors are at work here? There are numerous studies aimed at identifying the elements that hinder students' academic performance. These factors can be grouped into two main categories: those related to social aspects and those linked to the educational center. One of the aspects that hinders the efforts of Higher Education Institutions (HEIs) to improve the academic performance of students is the diversity of needs among the different actors involved in the educational processes, as well as the context in which these processes take place. For example, Bronfenbrener's (1987) ecosystemic theory of human development points out that students are affected by changes in their immediate environments, and the link to their broader contexts.

Based on this idea, it has been concluded that the ecosystems defined by Bronfenbrener (1987) are decisive factors in students' academic performance. These ecosystems include factors such as the role of teachers, study programs, environmental factors in the classroom (microsystem); the seriation of subjects, the profession or trade of the parents, the family environment (mesosystem); the cost of the career, the place of study, health problems, the work situation (exosystem); and urban mobility, as well as the socioeconomic and political environment of the student (macrosystem).

Within these environmental factors, culture, technology and instructional practices have been found to have a significant influence on students' academic performance. According to Alexander (2006), there are several factors that affect academic performance, highlighting that motivation, family environment, quality of teaching and time dedicated to study are key factors that influence academic performance. These results support the initial statement and highlight the importance of taking these factors into account to improve student performance. This focus on environmental factors to improve educational processes is not exclusive to HEIs, but is also addressed by other institutions, which emphasize the social, economic and political dimensions.

In relation to the aspects of the environment that are linked to educational institutions, the literature mentions organizational management, educational policies, teaching strategies and loads, the number of students per group and evaluation criteria, among others. An important assumption in these studies is that student expectations toward the institution play a crucial role in their academic performance. According to Méndez (2011) and Paredes & Paredes (2009), several factors influence academic performance, such as organizational management, educational policies, teaching strategies and loads, students per group and evaluation criteria. These authors will provide results that support this claim.

Regarding organizational management, Méndez (2011) found that efficient and effective management in educational institutions can have a favorable effect on students' academic performance. This includes adequate resource planning, equitable teacher

deployment, and the implementation of policies that foster an environment conducive to learning.

In relation to educational policies, Paredes & Paredes (2009) highlighted that government policies and decisions at the institutional level can influence academic performance. For example, the implementation of educational support programs, the allocation of adequate resources and the promotion of equity in access to education can have a positive impact on academic results.

The use of effective pedagogical strategies is essential to promote meaningful learning. Teaching methods and assigned workload can affect students' academic performance. (Terán and Schulmeyer, 2022). An unbalanced workload can lead to stress and lack of concentration, while an insufficient workload can cause lack of challenge and motivation. It is the responsibility of teachers to find an appropriate balance in teaching strategies and loads to promote optimal academic performance.

The size of student groups is an important factor that can influence their academic performance; smaller groups favor learning and improve students' academic performance by allowing individualized attention, close interaction between teachers and students, encouraging active participation and collaboration among students. (Pincay-Ponce, De Giusti, Reyes-Cárdenas, Franco-Pico, Macías-Espinales and Quiroz-Palma, 2022). It is important to consider group size when designing educational strategies, as it can have a significant impact on the learning process and academic outcomes of students.

Finally, regarding evaluation criteria, Méndez (2011) highlighted that the way students are evaluated can have an impact on their academic performance. Clarity in assessment criteria, constructive feedback and formative evaluation can promote more effective and motivating learning, which in turn is reflected in better academic results.

Studies by Méndez (2011) and Paredes & Paredes (2009) support the assertion that organizational management, educational policies, teaching strategies and loads, number of students per group and evaluation criteria are factors that will affect academic performance. These results underscore the importance of considering these aspects to improve student performance.

All these studies show that the study of academic achievement and the factors that determine it is a complex field, since there are numerous aspects that do not depend directly on the student, but that must be considered when establishing educational strategies to promote the progress of all students.

On the other hand, the influence of personal factors on academic performance has also been investigated. Some researchers claim that the learner is solely responsible for his or her learning process and that his or her success depends on him or her. In this regard, several personal factors, both cognitive and non-cognitive, have been identified as influencing academic performance. Non-cognitive factors include motivation, interests, expectations and self-regulation, while cognitive factors include specific knowledge, study habits and academic background. Studies have identified motivation, emotions, learning styles, study habits and the importance that the student attaches to academic tasks as determinants of academic performance.

Conclusions

According to the results obtained, it was not possible to establish a relationship between learning strategies and the academic performance of the students of the computer engineering course in the Engineering Department of the ISPB, both at the

general level and in its specific dimensions. This suggests that these variables are not linked and are independent of each other. However, a relevant relationship, although weak and inverse, was detected between the subdimension of "metacognitive skills" and academic performance, especially in the technical and methodical dimensions.

Learning strategies are widely used by students in general, predominantly at a medium level (51.1%) followed by a high level (29.9%). This indicates that learning strategies are a strength in the teaching process being delivered.

In terms of academic performance, in general, students show good academic performance, with more than 90% of the sample obtaining acceptable or good levels. However, it is necessary to reinforce the learning strategies that obtained a low level, so that students can use them effectively in the courses and in their daily activities. This could be achieved through experimental research.

It is important to carry out correlational research that relates the variables under study to other educational indicators. This would provide both theoretical and statistical material that would allow alternative solutions to be proposed in case problematic indicators are found.

The results suggest that there is no direct relationship between learning strategies and academic performance in the context studied. However, specific areas were identified in which learning strategies could have a significant impact on academic performance, so further research is recommended to improve students' learning and academic performance, taking into account a wide range of factors, both environmental and personal. Understanding and addressing these factors is critical to improving the quality of education and promoting student academic success.

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