Influence Of Pedagogical Competencies And Learning Strategies On Mathematical Academic Achievement

Luis Velarde-Vela[1] , Freddy Ochoa-Tataje[2] , Jeidy Panduro-Ramirez[3] , Maria Alza-Salvatierra[4] , Juan Paucar-Elera[5] , Yohnny Huarac Quispe[6] , Lino Andrés Quiñones Valladolid[7]

[1]Universidad Peruana de Ciencias Aplicadas, Lima-Perú
pcmalvel@upc.edu.pe
ORCID: 0000-0003-4436-6736
[2]Universidad César Vallejo, Lima-Perú
fochoa@ucv.edu.pe
ORCID: 0000-0002-1410-1588
[3]Universidad Tecnológica del Perú, Lima-Perú
c21289@utp.edu.pe
ORCID: 0000-0001-9512-4329
[4]Universidad César Vallejo, Lima-Perú
malzasa@ucvvirtual.edu.pe
ORCID: 0000-0001-7639-1886
[5]Universidad Nacional Federico Villarreal, Lima-Perú
jpaucare@unfv.edu.pe
ORCID: 0000-0002-8111-1102
[6]Universidad Nacional de Huancavelica
yohnny.huarac@unh.edu.pe
ORCID: 0000-0002-5558-1979
[7]Universidad Nacional de Huancavelica
lino.valladolid@unh.edu.pe
ORCID: 0000-0002-4434-9189

Abstract

The main objective of this research article is to determine the relationship between pedagogical competencies and learning strategies in mathematical academic performance in students of the III cycle of architecture of the Universidad Peruana de Ciencias Aplicadas (UPC), 2016. It is of descriptive-explanatory or causal approach, correlational design, non-experimental, cross-sectional. The sample consisted of 167 architecture students of the UPC to whom 3 questionnaires were applied. According to the results obtained, there is a positive dependence between the study variables (p=0.000<0.05 and Chi-square=113.49) and according to

Nagelkerke's statistic, pedagogical competences and learning strategies affect mathematical academic performance by 39.2%.

Keywords: Pedagogical competencies, learning strategies, academic achievement, mathematics.

Resumen

El presente artículo de investigación tiene como objetivo principal determinar la relación entre las competencias pedagógicas y las estrategias de aprendizaje en el rendimiento académico matemático en estudiantes del III ciclo de arquitectura de la Universidad Peruana de Ciencias Aplicadas (UPC), 2016. Es de enfoque descriptivo-explicativo o causal, de diseño correlacional, no experimental, de corte transversal. La muestra estuvo conformada por 167 estudiantes de arquitectura de la UPC a los cuales se aplicaron 3 cuestionarios. De acuerdo a los resultados obtenidos, existe una dependencia positiva entre las variables de estudio (p=0.000<0.05 y Chi-cuadrado=113.49) y según el estadístico de Nagelkerke, las competencias pedagógicas y estrategias de aprendizaje afectan en un 39.2% al rendimiento académico matemático.

Palabras clave: Competencias pedagógicas, estrategias de aprendizaje, rendimiento académico, matemáticas.

1. Introduction

The teaching and learning of basic knowledge is fundamental within any growing society; one of the most studied fields and whose mastery helps to solve everyday and occupational problems is mathematics. Feared by many, especially in the school stage, mathematics requires unmatched pedagogical competencies to get most students interested in it (Cantero et al. , 2018: 392). The truth is that, within the educational field, increasingly, the competencies of future education professionals become more relevant, even replacing the curricular meshes of their formative stage within the university, for the development of these competencies (Pérez, 2019: 78).

Higher education is still facing new challenges and one of them is to enhance the pedagogical act that allows the integration of students and teachers so that the inclusion and implementation of teaching and learning strategies, within collaborative environments, is an ideal means for the formation of competent professionals, within the branch in which they choose to develop. In fact, competencies and learning strategies go hand in hand and both propitiate the achievement of good results (Hernández et al., 2021:242).

The negative results related to low academic performance and lack of autonomy to learn, are related to confusion or frustration, due to the speed with which the student is saturated with information, even this has been enhanced by new technologies (Vilanova and Varas, 2020:140).

1.1 Pedagogical competencies

There are multiple definitions of the word competence, the truth is that from different approaches the definition of competence has as a common denominator: the ability to perform a function. According to Pérez (2019), competence can be understood as the way in which humans master language and use it to communicate or express themselves in different areas, and also describes it as the different strategies that human beings develop and support the analysis of specific tasks of a given profession (p. 80). Vilanova and Varas (2020) consider competencies as a mixture of skills, knowledge, aptitudes and abilities, appropriate to the environment in which they operate. In other words, the ability to move cognitive resources in order to improve situations.

Within the pedagogical context, teachers have the commitment to develop the competencies of their students and to develop their own, therefore, training is an extremely important factor, which favors the formation of pedagogical competencies in teachers, providing quality education (Alvarez, 2021). Dmitrieva et al. (2019) consider that the main competencies that a teacher should have are: the ability to identify practical problems and translate them through research questions, be able to continuously improve, evaluate, interpret and reflect on the results.

In the case of mathematics education, the pandemic affected all teaching-learning processes, so the repercussions that may occur due to virtual environments can be mitigated through the redesign of processes and constant training on pedagogical competencies (Fajardo-Santamaría, 2022).

1.2 Learning strategies

According to Hernández et al. (2021) learning is a process through which, by means of perceived experiences, in our daily life or spontaneously, a change is exposed within our previous knowledge, behavior, values and attitudes, this change improves the capabilities and skills to perform activities. In other words, a factor that modifies

cognitive processes is the adaptation to unstable and changing environments that the environment demands.

Within the learning strategies there are those that facilitate student learning, so that they acquire the necessary competencies demanded by the educational and work environment, within a globalized context (Hernández et al., 2021). The teacher must design teaching processes according to the historical, social and economic conditions of the students, as long as the autonomy of thought is respected, in order to maximize the learning obtained from the classes (Sandoval-Obando et al. 2018).

Multiple strategies have been used to develop students' mathematical skills, including the creation of groups in social networks, the development of playful games, e-learning and competitions within the classroom (Tristanti and Nusantara, 2022). In the case of university students, they constantly deal with stress and the feeling that they should give more, this is called "academic burnout", this overload occurs more in the first cycles than in the last ones, since it is where students change the subjects of school or high school to the subjects that will give them the basis for their entire university career, if they do not master this base, they will have problems in their future courses, this can be prevented with an adequate design of the teaching plan, along with appropriate learning strategies such as motivation, accompaniment and cooperation (Comella et al., 2021) and (Muñoz et al. , 2021).

1.3 Academic performance

Academic achievement is the measure in which the student demonstrates an adequate internalization of what has been learned, thanks to the teacher's own action and the teaching-learning processes that both dominate (Villasol, 2021). Academic performance associated with mathematics is a human construct that refers to the ability to obtain, process and retain mathematical information, from a cognitive perspective (Zhao et al., 2022).

It is known that learning and teaching mathematics is not a simple task, especially in countries with problems related to technology, economy, science and democracy; however, teachers try to devise very good designs and teaching strategies for the classroom, but there is still a lack of a teaching process that helps to demonstrate how valuable mathematics is in daily life (Rogora and Tortoriello, 2021). The approaches to calculate the academic performance of higher education students in mathematics have always varied; however, new data

analysis technologies and algorithms, even allow designing particular teaching strategies for each type of student, so that their performance is increased. Therefore, the objective of this article is to determine the influence of pedagogical competences and learning strategies in the academic performance of mathematics in students of the III cycle of architecture of the Universidad Peruana de Ciencias Aplicadas 2016.

2. Methodology

The present research is a non-experimental, descriptive-explanatory, cross-sectional design, and follows a hypothetical-deductive method of basic type, descriptive level with a quantitative approach. The population consisted of 297 students in the third cycle of the architecture course at the Universidad Peruana de Ciencias Aplicadas in 2016. A purposive probability sampling was applied and resulted in 167 students, who attend classes regularly.

The interview technique was used and 3 questionnaires were used as instruments, one for each research variable (pedagogical competencies, learning strategies and mathematical academic performance). Technical sheets were elaborated for an adequate interview and test taking, both individual and group. The reliability of the instruments was validated through expert judgment in order to obtain greater expertise in the measurement. Then, a pilot test will be conducted, where the instruments will be applied to a percentage of the selected sample, this will serve to meet the reliability criteria of the instruments. Afterwards, the instrument will be applied to the entire sample, and then the data processing will be carried out to elaborate the data processing tables that have been used to tabulate and process the results of the surveys.

The SPSS 21 Statistical Program will be used to process the surveys and contrast hypotheses. We will work with basic statistical formulas, as well as inferential statistics. The authorship of the bibliographic information has been respected; therefore, reference is made to the authors with their respective data according to the origin of the source and respecting the APA norms.

3. Results

Once the Likert-type questionnaire of the variables pedagogical competencies and learning strategy in the academic performance of mathematics in students of the III cycle of architecture of the Universidad Peruana de Ciencias Aplicadas 2016 was applied, the descriptive results with the degree of veracity corresponding to a research study are presented in Table 1.

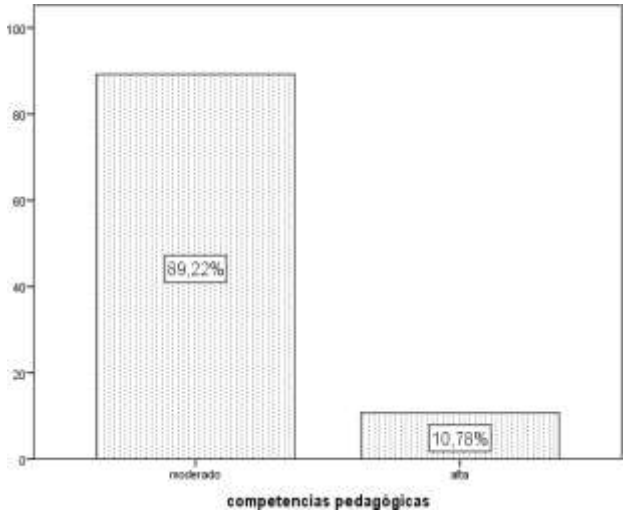
Table 1: Levels of pedagogical competencies in students of the III cycle of architecture at the Universidad Peruana de Ciencias Aplicadas.

Pedagogical competencies

Levels	Frequency	Percentage	Valid percentage	Cumulative percentage
Moderate		89,2	89,2	89,2
High		10,8	10,8	100,0
Total		100,0	100,0	

Source: Own elaboration

Frequency levels of pedagogical competencies in students of the III cycle of architecture at the Universidad Peruana de Ciencias Aplicadas.



As for the results shown by levels of pedagogical competencies in students of the III cycle of architecture at the Peruvian University of Applied Sciences, it can be seen that 89.22% of the respondents state that the level of pedagogical competencies is moderate and 10.78% state that the level is high in the students' pedagogical competencies (Figure 1).

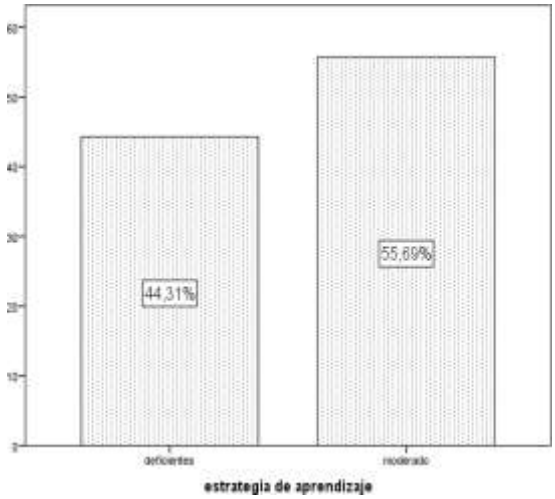
Table 2: Levels of the learning strategy in students of the III cycle of architecture at the Universidad Peruana de Ciencias Aplicadas.

Learning strategy

Levels	Frequency	Percentage	Valid percentage	Cumulative percentage
Deficient		44,3	44,3	44,3
Moderate		55,7	55,7	100,0
Total		100,0	100,0	

Source: Own elaboration

Percentage distribution of the learning strategy in students of the III cycle of architecture at the Universidad Peruana de Ciencias Aplicadas.



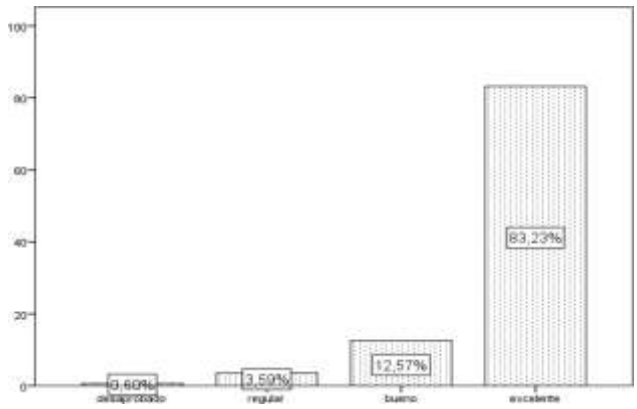
Likewise, as for the result of (table 2) are shown by levels of the learning strategy in students of the III cycle of architecture of the Peruvian University of Applied Sciences, there is the perception that 44.31% of the respondents perceive that the learning strategy in students is deficient, while 55.69% perceive that the level is moderate in learning strategies (figure 2).

Levels of academic performance in mathematics in students of the III cycle of architecture at the Universidad Peruana de Ciencias Aplicadas.

Academic performance

Levels	Frequency	Percentage	Valid percentage	Cumulative percentage
Disapproved	1	,6	,6	,6
Regular		3,6	3,6	4,2
Good		12,6	12,6	16,8
Excellent		83,2	83,2	100,0
Total		100,0	100,0	

Percentage distribution of academic performance in mathematics in students of the III cycle of architecture at the Universidad Peruana de Ciencias Aplicadas.



Likewise, as for the results shown below by levels of academic performance in mathematics in students of the III cycle of architecture at the Peruvian University of Applied Sciences (Table 3), 0.6% of the respondents perceive that the academic performance of mathematics in students is not satisfactory, 3.59% are at a regular level, while 12.57% are at a good level and 83.23% are at an excellent level (Figure 3).

Hypothesis testing

Table 4: Pseudo coefficient of determination of the variables.

Pseudo R-squared

	Cox and Snell	Nagelkerke	McFadden.
result	,301	,392	,246

Link function: Logit.

In reference to the pseudo R-squared (see Table 4), what is presented is the percentage dependence of the pedagogical competencies and the learning strategy in the academic performance of mathematics in students of the III cycle of architecture of the Peruvian University of Applied Sciences. From Nagalkerke's results, it can be seen that the variability of academic performance in mathematics is due in 39.2% to the pedagogical competencies and the mathematics learning strategy in students of the III cycle of architecture of the Peruvian University of Applied Sciences.

According to the specific results of the coefficients of the regression expression in relation to the pedagogical competences and the learning strategy in the academic performance of mathematics, the students who perceive that the strategies are deficient, being this protective, have the probability that the academic performance in the dimension of application of definite integrals is at an excellent level. The students

who perceive that the strategies are deficient, being this protector, have the probability that the academic performance in the dimension of application of definite integrals is at an excellent level, as confirmed by the $p < 0.05$ and the Wad value equal to 0.698; while, the competences at a moderate level, being this protector, present the probability that the student's academic performance in the dimension of application of indefinite integrals is excellent at a level $p < 0.05$ and the Wald value equal to 165.32.

4. Discussion

After analyzing the results, it is concluded that there is a relationship between pedagogical competencies and learning strategies with the mathematical academic performance of students. In agreement with what was found in the present analysis, Cantero et al. (2018), in their study "Predictive elements of mathematical performance in students of compulsory secondary education", argue that teachers who do not develop the capacity or ability to find the factors or attitudes that affect the academic performance of students and combat their root causes, present a situation that results in a lack of pedagogical competencies, this results in low grades, lack of motivation and frustration in the mathematics course (p. 408).

(2021), show in the results of their research that the academic training experience allows concluding that pedagogical learning strategies related to collaborative environments provide research and data analysis skills that influence academic performance. Dmitrieva et al. (2019) agrees and indicates that the constant pedagogical training related to competencies, in support of the educational process was beneficial for the outcome or academic performance of future teachers.

Tristanti and Nusantara, (2022) argue that low performance in the area of mathematics is related to the lack of competencies on the part of students to understand, on their own terms, basic and relevant concepts; overinformation has made students memorize; however, simple analysis performed under one's own understanding works better at the time of learning. The teaching-learning process should be focused on the development of the "base" so that students can continue to develop their mathematical skills, continuously and without gaps that lead to discouragement and low performance in this subject (Ribeiro, Oliveira and Oliveira, 2021). For his part, Villasol, (2021) argues that learning strategies to achieve higher academic performance in the area of mathematics, should be focused on a strong theoretical foundation according to the learning pace of each student, as well as addressing the expected behavior and conduct of the same.

5. Conclusions

According to the statistics used, it is concluded that there is a relationship between pedagogical competencies and learning strategies with mathematical academic performance in students of the III cycle of architecture at the Peruvian University of Applied Sciences (UPC). According to the results obtained, there is a positive dependence between the study variables ($p=0.000<0.05$ and Chi-square=113.49) and according to the Nagelkerke statistic, pedagogical competencies and learning strategies affect mathematical academic performance by 39.2%.

Therefore, it is recommended that university authorities and managers develop training and updating courses on innovative didactic capacities, so that teachers become more aware of their importance in the task of teaching applied to university mathematics. Likewise, workshops should be developed for students where topics related to the need to manage learning strategies should be developed in order to improve their academic performance and the application of mathematics in everyday life. Finally, we must make both teachers and students aware of the search for and continuous improvement of their competencies, which will help them to face the new globalizing context, full of technological and educational advances at any level of education.

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