Learning Styles and Performance in Generic Competencies at the Higher Education Level

Ubaldo Martínez-Palacio[1], Samara Romero-Caballero[2], Ana Guzmán-Valeta[3], Jorge Ruiz-Escorcia[4], Alejandro Valencia-Pérez[5], Marcial Conde-Hernandez[6], Edgardo Sánchez-Montero[7], Gloria Moreno-Gómez[8], Kadry Garcia-Mendoza[9], Claudia Medina-Mosquera[10], Jorge Bolaño-Truyol[11], Aura Ganem-luna[12], Daniela Alcala-Martínez[13]

Abstract

Nowadays, the great diversity of students in universities is a very important factor to consider guaranteeing a high-quality education. According to theories of academic authors, such as the experiential learning theory in the 70s by David A. Kolb, students have different learning preferences.

This study presents conceptions about the role of learning styles as an aspect articulated with generic competencies in higher education. Its objective is to solve questions such as "What are the learning styles that favor the development of generic competencies in higher education students?" and as a subordinate question: What is the relationship between learning styles and the development of generic competencies in higher education students?

In this way, a number of 1885 students from a university in Colombia, who were given Kolb's learning styles instrument and who have also taken a series of tests to measure the development of generic competencies (Written Communication, Quantitative Reasoning, Critical Reading and Citizenship Competencies), are linked with the intention of observing and analyzing these two variables (Learning Styles vs. Generic Competencies) in the present study.

Keywords: *learning styles, generic competencies, intervention.*

1. Introduction

Achieving teaching excellence in higher education is one of the priority areas of university institutions. Specifically, the analysis of teaching-learning processes has emerged as one of the most relevant topics. Evidence suggests that not all individuals learn in the same way (Rodríguez-Cepeda, 2018). Consequently, in order to ensure an education based on the development of competences, we must consider individual differences, as well as develop possible educational interventions for students with

[1] Universidad De la Costa, Barranquilla, Colombia, umartine@cuc.edu.co
[2] Universidad De la Costa, Barranquilla, Colombia, sromero10@cuc.edu.co
[3] Universidad De la Costa, Barranquilla, Colombia, aguzman18@cuc.edu.co
[4] Universidad De la Costa, Barranquilla, Colombia, jruiz4@cuc.edu.co
[5] Universidad De la Costa, Barranquilla, Colombia, avalenci26@cuc.edu.co
[6] Universidad De la Costa, Barranquilla, Colombia, mconde1@cuc.edu.co
[7] Universidad De la Costa, Barranquilla, Colombia, esanchez2@cuc.edu.co
[8] Universidad De la Costa, Barranquilla, Colombia, gmoreno@cuc.edu.co
[9] Universidad De la Costa, Barranquilla, Colombia, kgarcia@cuc.edu.co
[10] Universidad De la Costa, Barranquilla, Colombia, cmedina4@cuc.edu.co
[11] Universidad De la Costa, Barranquilla, Colombia, Jbolano4@cuc.edu.co
[12] Corporación Universitaria del Caribe, Barranquilla, Colombia, aura.ganem@cecar.edu.co
[13] Corporación Universitaria del Caribe, Barranquilla, Colombia, daniela.alcala@cecar.edu.co

learning difficulties. To this end, studies must be designed to understand the learning processes of students, in order to develop student-centred teaching proposals.

The match between the development of generic competencies and the learning style of students can promote meaningful content learning and academic performance. Similarly, to assess generic competencies it is important to include a variety of assessment methods to provide students with the opportunity to demonstrate their achievements through different types of tests. The student, the student's learning style, and the assessment of generic competencies, form an educational triangle in which the adjustment between the dimensions will promote excellence in educational processes.

Learning Styles

The study of different learning styles is not new, there are different investigations that have been carried out; and that, thanks to them, different classifications of styles are expressed:

Learning styles refer to the way in which each person learns. Roque-Herrera et al. (2023) say that learning style refers to the general way people approach a given learning task; emphasizing learning style as a person's characteristic way of learning. The learning style refers to the fact that each person makes use of their own methods and strategies to learn, which may vary according to what they want to learn, but each individual develops over time, certain ways of doing things, which in the end they end up using in most cases (Cisneros-Verdeja, 2004).

Each person's learning process is different, in this process many things must be taken into account such as: the knowledge they have about the subject to be dealt with previously, learning styles, motivation, among others. These individual differences affect the learning process and are the reason why some learners find it easy to learn in a particular course, while others find it difficult (Graf et al., 2010).

The Learning Styles Manual (Cisneros-Verdeja, 2004) shows a diagram with the classification of the different learning models and styles, and the classification of each of them. Each learning style has its own characteristics, Table 1 below shows some models with their characteristics (Fontalvo et al., 2007; García-Cué, et al., 2010; Pantoja-Ospina et al., 2013).

Table 1. Characterization of Learning Styles

Models		Style	Feature
Model "Onion"	Curry	Their preferences are made regarding the mode of instruction and the different environmental elements	It takes into account the student's preference of the environment during learning
		Information processing is important	It takes into account the way the student appropriates the data.
		It takes into account the elements of personality	Evaluates how the individual's personality influences the relationship between the acquisition and integration of information
Models based on information processing	Kolb's Model	Divergent	They are based on concrete experiences and reflective observation
		Converging	They are deductive and interested in the practical application of ideas

	Assimilators	It makes use of abstract conceptualization and reflective observation of situations
	Ushers	They base their learning on concrete experiences and participation in experimentation
Model Honey and Mumfod	Assets	They are open-minded, you do new activities with enthusiasm and they take on new tasks
	Reflective	Consider the individual's experience to be of great value and see it from different angles
	Theoretical	They integrate facts into coherent theories. They like to analyze and synthesize facts.
	Pragmatic	The ideas he has he puts into practice, and he doesn't just stop at the idea.
The Neuro-Linguistic Programming Model	Visual Representation System	They learn best if they can observe or read the information in some way
	Auditory Representation System	They learn best if explanations are received orally, as well as if they can convey the information to others
	Kinesthetic Representation System	It takes into account the movements and sensations of the body as a means of obtaining information
Based on information perception channels	Felder and Silverman Model — Active/Reflective	Learn: doing activities/thinking, meditating
	Sensitive/Intuitive	Learn: Facts, Problems/Discovering Possibilities or Relationships
	Visual/Verbal	They learn: What they see: shapes, drawings, etc./ written or oral explanations
	Sequential/Global	Learn: Linear steps / make big leaps
	Gardner's Multiple Intelligences — linguistics	Typical of writers, poets, composers.
	mathematics	Typical of scientists, used in the solution of problems of logic and mathematics

Bodily-Kinetic	uses the body to carry out activities or to be able to solve problems
spatial	It is the process of visualizing bodies in space and being able to orient oneself from their position.
musical.	It is the ability to perceive and reproduce music
interpersonal	It has to do with the relationship we have with the people around us
intrapersonal	It has to do with the knowledge you have of yourself, it is related to the control of emotions, self-esteem and confidence
naturalist	Look at the relationship we have with nature and the beings that make it up

Each model has its own measuring instrument, usually tests, tests or questionnaires, in order to identify the style to which a person belongs (García-Cué et al., 2009).

Learning Styles of the Kolb Model

Kolb's model of learning styles is a framework that explains how people prefer to learn and acquire knowledge and skills. It describes four stages of the learning process:

- Concrete Experience

- Reflective Observation

- Abstract Conceptualization

- Active Experimentation

Each associated with a unique learning style. Kolb's model defines four learning styles, including concrete experience, reflective observation, abstract conceptualization, and active experimentation. By recognizing their preferred learning styles, individuals can personalize their learning experiences to optimize learning outcomes and improve overall performance. In addition, Kolb's model highlights the importance of incorporating the four learning styles into the learning process and indicates that everyone can develop competencies in all four styles (Lozano-Rodríguez, 2006).

Figure 1: Graphical representation of Kolb's Model (Lozano-Rodríguez, 2006)

Generic competencies

In the competency training approach, knowledge ceases to be the focus of learning and becomes instruments to demonstrate what is learned, that is, knowledge that is used in context. In a reality such as the current one, which is increasingly unstable, flexible and characterized by uncertainty, educational institutions seek to prepare students to face the vicissitudes of daily life, especially in higher education, which thus acquires a new function, that of preparing students in the competencies for the uncertain and to be good professionals. or in other words, to "learn how to learn". This is the reason why, today, learning is privileged and educational authorities are increasingly interested in understanding it (CUC, 2020).

The above situation is based on the fact that future professionals learn permanently and each training space is necessary for the next (Ausubel, 2002), therefore, achieving this training sequence is not easy, and one of the ways through which it can be done is by inquiring what are the strategies that allow students to learn better. in addition to analysing the set of characteristics or traits of the student with which they face a learning situation.

Different authors consider that learning styles are the conceptual and explanatory link that allows learning strategies to be associated with the generic competencies that are going to be developed in higher education (Gómez-Malagón & López-Pérez, 2012). Therefore, learning strategies and styles are the central elements of the competence of learning to learn.

2. Methodology

The present study was carried out under a quantitative approach, with a correlational design, since its main purpose was to know the relationship between learning styles and the development of generic competencies, as well as, from the approach it was sought to identify the learning styles that favor the development of generic competencies in higher education students; According to the postulates of Hernández-Sampieri et al. (2010), correlational studies validate the relationship between two or more categories, concepts or variables.

Participants

The study was conducted with university students who had a recognition of their learning style between the periods 2018 to 2022 at the Universidad de la Costa, Colombia. A total of 1885 students from different academic programs and semesters were selected to participate in the research using non-probability purposive sampling. The sampling included information related to sociodemographic dimensions, such as sex and age, and educational dimensions, such as the semester studied and the subject in which the instrument was applied.

Instrument

The instrument was used to use learning styles proposed by Kolb and Kolb (2005) and adapted from Freedman and Stumof (1980). This instrument consists of 9 items with four alternative answers. Respondents should rank their answers (from 1 to 4) for each statement. Each response choice corresponds to a different learning preference: active experimentation (EA), reflective observation (OR), abstract conceptualization (AC), and concrete experience (CE). The combination of these learning dimensions gives rise to four learning styles and their corresponding percentage distribution according to the predominance of the style in the population sample: Accommodating (37.1%), divergent (24.6%), convergent (11.1%) and assimilating (27.1%).

Regarding the evaluation of generic competencies, the overall results of the evaluation of the students' generic competencies were taken with respect to: Quantitative Reasoning (CR), Critical Reading (LC), Citizenship Competencies (CC) and Written Communication (CE).

Procedure

The procedure for data collection consists of evaluating the learning styles of all students who took the generic competency exam in the previously mentioned periods. In addition, to systematize the process, the teachers were in charge of socializing the learning styles instrument in all their groups of students. Prior to the start of the study, the students were informed of the objectives of the study on learning styles and the development of generic competencies. The total duration of the assessments was about 180 min for the application of the generic competency exam and 10 min for the application of the learning styles instrument.

Data analysis

Prior to the statistical analysis, the data were prepared in terms of homogenization and cleanliness of variables. Regarding the analysis and visualization of the results, the technique used was relationship analysis. For bivariate analyses, Pearson's correlation coefficient was calculated and then one-way analysis of variance (ANOVA) was performed. Multivariate analyses were also performed to obtain a better understanding of the variables studied. The k-means clustering analysis method was used to group observations based on the similarity between them in terms of their characteristics. Finally, the correlation relationship was used as a nonlinear association coefficient to assess the degree of extension of the non-linearity of the relationship.

3. Results

A bivariate analysis was performed to determine how KOLB learning styles relate to student performance on generic competency tests. This will make it possible to identify if there is a correlation between the way students learn and their ability to apply skills and knowledge in different situations.

After transforming the Learning Styles variable into numerical values, Pearson's correlation coefficient was applied. This coefficient measures the strength and direction of the linear relationship between two numerical variables.

Table 2. Pearson's correlation coefficient

KOLB_0	1.000000	KOLB_1	1.000000	KOLB_2	1.000000	KOLB_3	1.000000
GPA_CE	0.017381	GPA_LC	0.023831	GPA_CC	0.037253	GPA_RC	0.004029
GPA_RC	-0.006188	GPA_CC	0.007307	GPA_LC	0.016368	GPA_LC	-0.003413
GPA_CC	-0.021094	GPA_RC	0.004765	GPA_RC	-0.002745	GPA_CC	-0.011089
GPA_LC	-0.029541	GPA_CE	0.001095	GPA_CE	-0.008273	GPA_CE	-0.014583

The results obtained suggest that there is no significant linear relationship between KOLB's learning styles and the results obtained in the generic competency tests. In other words, the correlation between these two variables is low or non-existent. It is important to note that, although a linear correlation has not been found, it is still possible that there is a non-linear relationship between these variables, which can be explored using other methods of analysis.

A second one-way variance analysis (Anova) was performed to assess whether there are significant differences between learning style groups in terms of their results in generic competency tests. The analysis focused on examining whether the means of numerical variables (representative of generic competency test scores) were significantly different between KOLB learning style groups. This was done to better understand the possible relationship between learning styles and generic competency test scores.

Table 3. One-way variance (Anova)

Numerical Variable	GPA_CE
F-statistic	0.2583839243582566
p-value	0.8553896651392281
Numerical Variable	GPA_LC
F-statistic	0.7592342095876217
p-value	0.5169549860569189
Numerical Variable	GPA_RC
F-statistic	0.0373465029900728
p-value	0.9903511569258846
Numerical Variable	GPA_CC
F-statistic	1.032827901490796
p-value	0.3769463729122284

The results of the analysis show that the p-values for all numerical variables are greater than 0.05, suggesting that there are no significant differences in group means for these variables. In other words, there is insufficient evidence to state that KOLB learning styles have a significant effect on student performance on generic competency tests (represented by numerical variables).

Box and mustache graphs are generated to visualize how the averages are distributed according to the learning style, which allows to identify which styles predominate in each competency and thus determine if the performances in each competency can be associated according to the learning style.
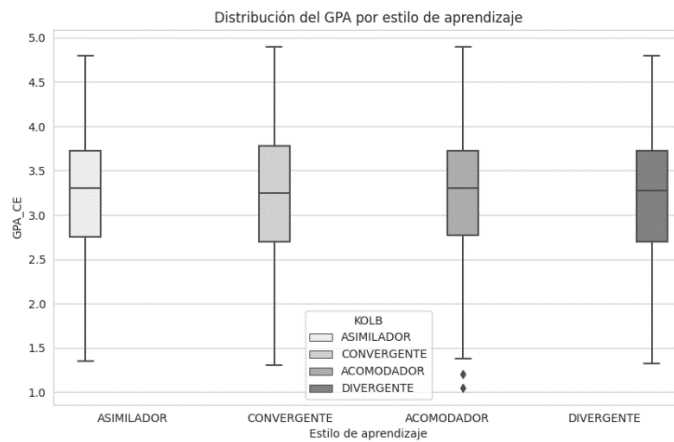

Figure 1: Distribution of Written Communication (CE) GPA by Learning Style
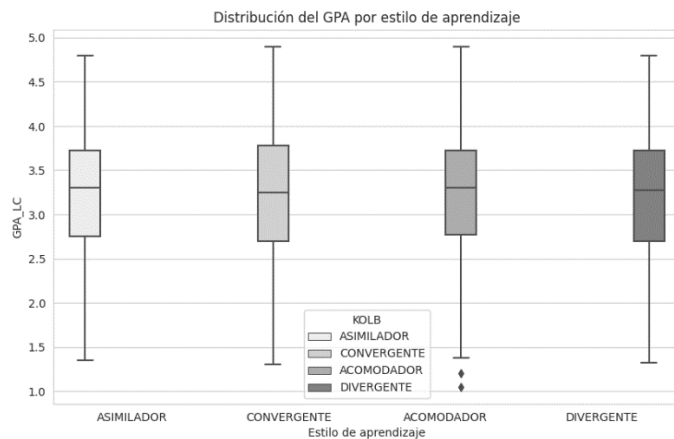

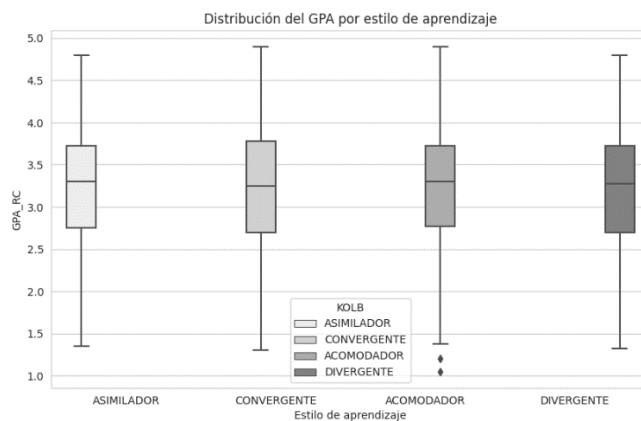Figure 2: Distribution of Critical Reading (LC) GPA by Learning Style
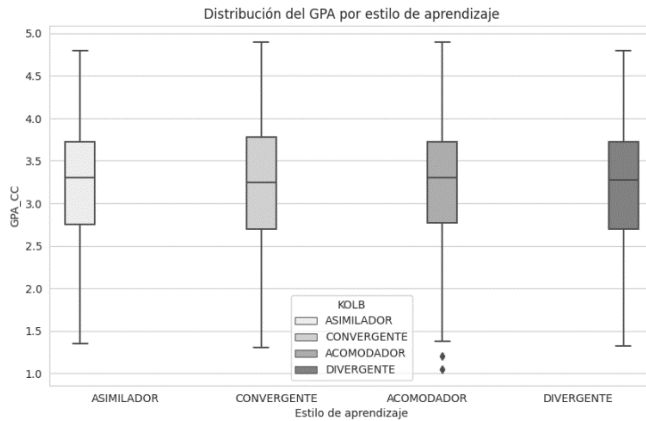

Figure 3: Distribution of Quantitative Reasoning (CR) GPA by Learning Style

Figure 4: Distribution of Citizenship Competence (CC) GPA by Learning Style

Since univariate analysis of means was not sufficient to establish clear patterns of relationship between KOLB learning styles and results in generic competency tests, a multivariate analysis was performed. In this analysis, the k-means clustering model was used to group students into groups according to their learning styles and test performance. In this way, we sought to identify groups of students who shared similar characteristics in terms of their learning style and their performance in generic competencies. Variable conversion and scaling were performed to perform cluster analysis.
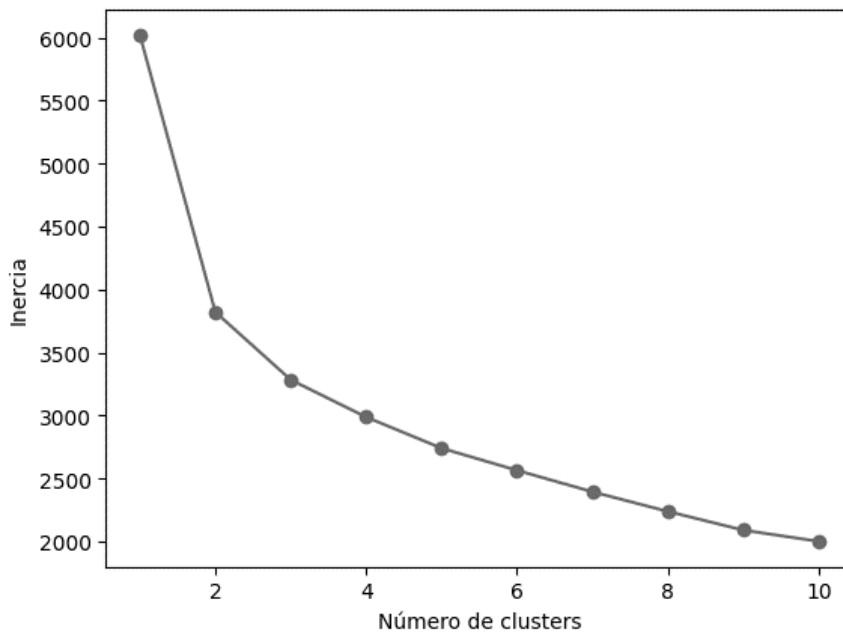

Figure 5: Analysis of results on the elbow curve selected k = 4

Figure 5 indicates that 4 groups/clusters should be used for cluster analysis using the k-means model. The model was then run to generate the corresponding groups/clusters. The labels of each group/cluster were then added to the dataframe of the original data, in order to calculate the means of each variable in each group/clusters (see Table 4 / Figure 6).

Table 4. Means of each variable for each of the 4 groups/clusters

Cluster	GPA_CE	GPA_LC	GPA_RC	GPA_CC	GPA_T	KOLB_O	KOL8_1	KOLB_2	KOLB_3
0	-0.668018	-0.879640	-0.640898	-1.003837	-1.016904	0.362613	0.261261	0.101351	0.274775
1	-	-	-	-	-	0.000000	0.446309	0.187919	0.365772

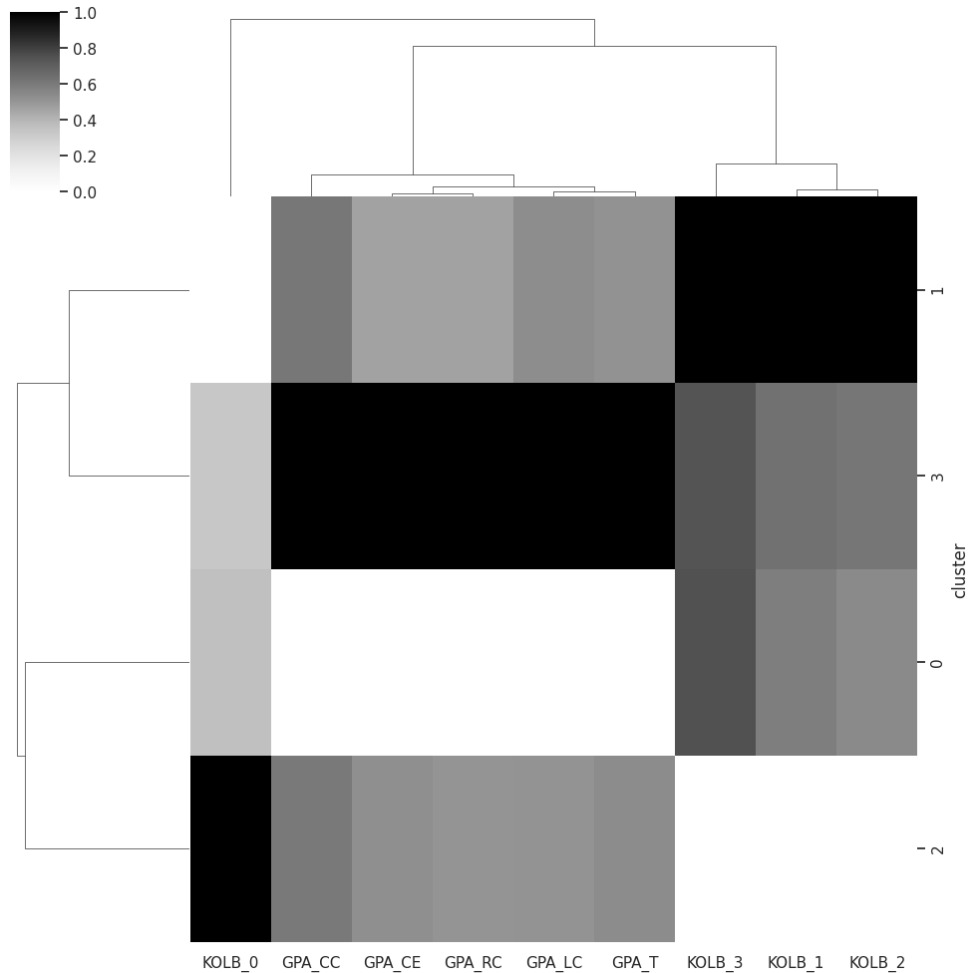|									
	0.091275	0.020537	0.036419	0.022620	0.052773				
2	-0.015657	-0.054227	0.023651	-0.035987	-0.012100	1.000000	0.000000	0.000000	0.000000
3	0.577571	0.733742	0.670485	0.597455	0.856570	0.330416	0.282276	0.115974	0.271335

Figure 6: Heat map with the means of the variables per cluster

The heat map represents the means of the variables in a graph that allows you to visualize the associations between them using colors. In addition, a dendrogram is presented that shows the relationship between the clusters, i.e., how the means of learning styles and performance in generic competencies are grouped according to their similarity. Therefore, associations between learning styles and performance in generic competencies can be identified, and how these variables are grouped according to their similarity.

Since previous analyses did not allow us to measure a linear relationship between learning styles and academic performance in generic competencies, an analysis was carried out to validate this hypothesis and determine its degree of relationship. To do this, the correlation relationship was used as a nonlinear association coefficient, whose value is higher in nonlinear relationships. The difference between the correlation ratio and the correlation coefficient makes it possible to assess the extent of the non-linearity of the relationship.

In this case, correlation ratio coefficients were calculated for each combination of generic competencies and learning styles, which allowed us to determine the level of association between these variables. A higher value in the correlation ratio coefficient indicates a

greater association between the two variables, which may be useful to understand how learning styles influence performance in generic competencies.

Table 5. Correlation Ratio Coefficients by Combination of Generic Competencies and Learning Styles

GENERIC COMPETENCE vs LEARNING STYLE	CORRELATION COEFFICIENTS
GPA_CE and KOLB_ACOMODADOR	0.2567593498493488
GPA_CE and KOLB_ASIMILADOR	0.22570812369430124
GPA_CE and KOLB_CONVERGENTE	0.294376540160091
GPA_CE and KOLB_DIVERGENTE	0.26481655652546776
GPA_LC and KOLB_ACOMODADOR	0.26467357600717323
GPA_LC and KOLB_ASIMILADOR	0.2439147539957848
GPA_LC and KOLB_CONVERGENTE	0.20221426541287094
GPA_LC and KOLB_DIVERGENTE	0.24993350809134146
GPA_RC and KOLB_ACOMODADOR	0.23918695536915638
GPA_RC and KOLB_ASIMILADOR	0.25373793859804716
GPA_RC and KOLB_CONVERGENTE	0.2431549286955745
GPA_RC and KOLB_DIVERGENTE	0.24042796461305846
GPA_CC and KOLB_ACOMODADOR	0.22237156403336156
GPA_CC and KOLB_ASIMILADOR	0.24048266522303588
GPA_CC and KOLB_CONVERGENTE	0.2348440448969391
GPA_CC and KOLB_DIVERGENTE	0.26117535319220375

The correlation coefficients obtained are statistically significant and provide information on the non-linear relationship between learning styles and academic performance in generic competencies, for a better understanding the results are shown in the following graphs:
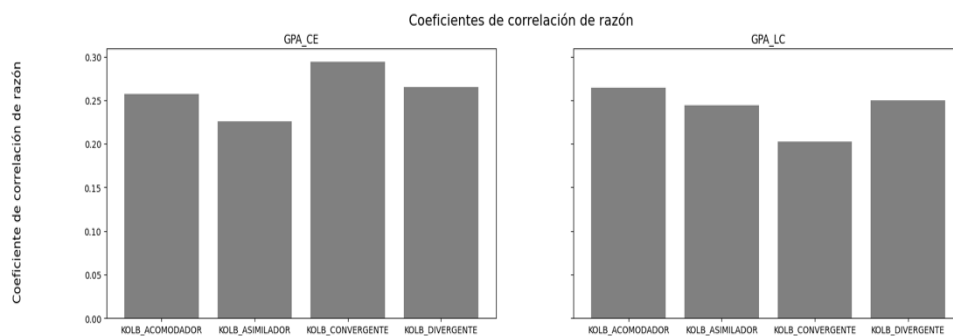

Figure 7: Correlation ratio coefficients by combination of generic competencies (CE and LC) and learning styles
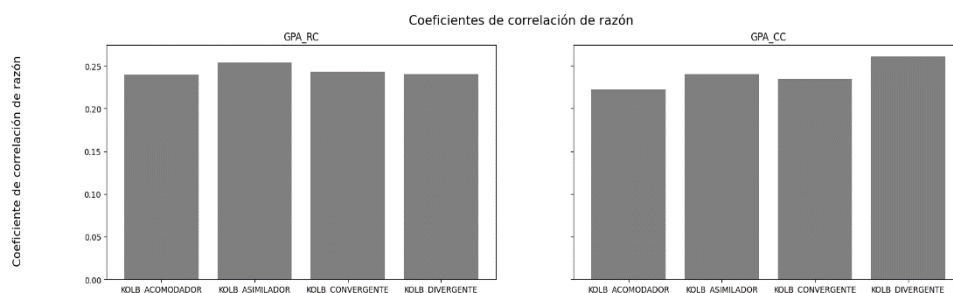
Figure 8: Correlation ratio coefficients by combination of generic competencies (CR and CC) and learning styles

The graphs show that a greater relationship between learning styles and generic competencies can help characterize students, and there is also a slight predominance between one learning style for each generic competency.

4. Discussions

Studies regarding learning styles and academic performance have established a consensus that there is no influence of learning styles on student performance outcomes (Altamirano-Droguett et al., 2019). This consensus does not differ from our findings; mainly, because the results showed that there is no linear relationship between KOLB's learning styles and the results in the generic competency tests. This is consistent with what Garbanzo (2007) pointed out, who stated that performance does not depend on students' preferences for a learning style, but rather on cognitive factors, which contemplate learning strategies that students carry out and that are related to the selection, organization and elaboration of the various learnings. In the same vein, Altamirano-Droguett et al. (2019) point out that it is possible to establish a statistically significant relationship between certain learning styles and academic performance; However, this link would be determined more by the closeness between the individual characteristics of the students and the competencies to be developed, than by a certain learning style. In fact, several studies that have been carried out in recent years on the subject corroborate these findings by indicating that learning styles are closely related to how students learn, how teachers teach, and how both interact (Adán, 2004).

Therefore, and taking as a reference the approaches of Caulley et al. (2012), although the learning style may not predetermine a result in the academic performance of a student, the recognition of learning styles contributes to structuring the didactic strategies that, depending on the modality and discipline of study, will favor the training process. Some studies have concluded that the implementation of didactic strategies, particularly based on students' learning styles, are useful to help them improve their skills, mainly in communicative competence (Carranza-Marchena, 2019). This is supported by the results obtained by the present study, which shows that for each competency there is a level of predominance of a learning style, so this recognition contributes to the design of didactic strategies focused on the predominant styles to strengthen the development of each competency.

Finally, the results obtained from the analysis of correlation ratio coefficients show that the characterization of the learning styles of students at Universidad de la Costa based on how they learn (Maya et al., 2021), has avoided reducing their particularities to a general characteristic, a common phenomenon that occurs in other universities (Newton and Miah, 2017; Maya et al., 2021) and will contribute to the understanding of how learning styles influence performance in generic competencies.

5. Conclusions

In general, it can be concluded that the findings of the study allowed us to identify the linear and non-linear relationships that exist between students' learning styles and their performance in generic competencies. In the same way, it allowed to characterize the students according to the learning styles that have the greatest predominance in each competency.

However, regarding the learning styles that favor the development of generic competencies in higher education students, it was found that, although there is no linear relationship between learning styles and the development of generic competencies, there are predominances between a learning style and the generic competencies studied.

In the same sense, it was found that there is no linear relationship between learning styles and the development of generic competencies in higher education students, however, the findings of this study allow us to show that the characterization of students based on their learning styles and the development of competencies is an ideal complement to understand how learning styles influence performance in generic competencies.

Finally, when reviewing how learning styles favor the development of generic competencies, the results of the research and the findings of other research confirm that learning styles do not directly favor the development of competencies, but, on the contrary, are inputs to establish didactic strategies related to the styles that do contribute to the development of competencies.

References

Adam, M. (2004). Learning styles and academic performance. Article presented at the I International Congress of Learning Styles, UNED, as part of the Doctoral Thesis work. Spain: UNED.

Altamirano-Droguett JE, Araya-Crisóstomo SP, Contreras MP. (2019) Learning styles and academic performance of obstetrics students. Rev Cienc Salud; 17(2): 276-92. Doi: http://dx.doi.org/10.12804/revistas.urosario.edu.co/revsalud/a.7937

Ausubel, D.P. (2002). Acquisition and retention of knowledge. A cognitive perspective. Barcelona: Ed. Paidós

Carranza-Marchena, P. (2019) Teaching Strategies Based on Learning Styles: Promoting Communicative Competence in Speaking Skills. Educational Innovations, Year XXI · Number 31.

Cisneros-Verdeja, A. (2004). Learning Styles Manual. Retrieved from: http://biblioteca.ucv.cl/site/colecciones/manuales_u/Manual_Estilos_de_Aprendizaje_2004.pdf

CUC (2020) Agreement No. 1626. By means of which the learning evaluation model of the University of the Coast Corporation (CUC) is approved. Board of Directors. Corporación Universidad de la Costa.

Fontalvo, H., Iriarte, F., Domínguez, E., Ricardo, C., Ballesteros, B., Muñoz, V., & Campo, J. D. (2007). Design of virtual teaching-learning environments and adaptive hypermedia systems based on learning style models. Nearby Zone, (8), 42-61.

Garbanzo G. Factors associated with academic performance in university students, a reflection from the quality of public higher education. Education Magazine. 2007; 31(1): 43-63. Doi: https://doi.org/10.15517/revedu.v31i1.1252

García-Cué, J. L., Santizo-Rincón, J. A., & Alonso-García, C. M. (2009). Use of ICT according to the learning styles of teachers and students. Ibero-American Journal of Education, 48(2), 1-14. Https://doi.org/10.35362/rie4822233

Caulley L, Wadey V, Freeman R. (2012) Learning styles of first-year orthopedic surgical residents at 1 accredited institution. J Surg Educ. Mar-Apr; 69(2): 196-200. DOI: 10.1016/j.jsurg.2011.09.002. Epub 2011 Oct 22. PMID: 22365865.

Graf, S., Liu, T., & Kinshuk (2010). Analysis of learners' navigational behaviour and their learning styles in an online course. Journal of Computer Assisted Learning, 26, 116–131.

Gómez-Malagón, MG., & López-Pérez, L. (2012) Competencies and learning styles. Learning styles. Research and experiences: V World Congress on Learning Styles. ISBN 978-84-695-3454-0.

Hernández-Sampieri, R., Fernández-Collado, C., & Baptista-Lucio, P. (2014). Research Methodology (6th ed.). Mexico City: McGraw-Hill.

Kolb, A., & Kolb, D. (2005). Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education. Academy of Management Learning & Education, 4(2), 193-212.

Lozano-Rodríguez, A. (2006). Learning and Teaching Styles: An Overview of Educational Stylistics (2nd reprint, January 2006. ed.). Mexico: Trillas.

Maya, J.; Luesia, J.F.; Pérez-Padilla, J. (2021) The Relationship between Learning Styles and Academic Performance: Consistency among Multiple Assessment Methods in Psychology and Education Students. Sustainability, 13, 3341. https://doi.org/10.3390/su13063341

Newton, P.M., and Miah, M. (2017) Evidence-based higher education—Is the learning styles «myth» important? Front. Psychol, 8, 444.

Pantoja, M. A., Duque, L. I. and Correa, J. S. (2013). Learning Style Models: An Update for Review and Analysis. Revista Colombiana de Educación, (64), 79-105. https://doi.org/10.17227/01203916.64rce79.105

Rodríguez-Cepeda, R. (2018). Kolb, Honey, and Mumford's Learning Models: Implications for Science Education. Sophia, 14(1), 51-64. https://doi.org/10.18634/sophiaj.14v.1i.698

Roque-Herrera, Y., Tenelanda-López, D., Basantes-Moscoso, D., & Erazo-Parra, J. (2023). Theories and models about learning styles from a holistic perspective. EDUMECENTRO, 15(1), e2362. https://revedumecentro.sld.cu/index.php/edumc/article/view/e2362