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RELATIONSHIP BETWEEN THE ACADEMIC LEVEL OF UNIVERSITY TEACHERS AND THE EDUCATIONAL METHODOLOGIES IN THE CLASSROOM THROUGH ICT

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Abstract
This study focuses on the relationship between the academic level of teachers at the University of Sucre and the use of pedagogical methods through ICT in the classroom. Cluster analysis was used to analyze a sample of 354 teachers and determine whether there was a relationship between the level of academic training and the knowledge and use of pedagogical methods through ICT. The methodology involved the application of a survey to teachers to evaluate their knowledge and skills related to 31 variables that constitute pedagogical methods through ICTs. These variables range from access to educational resources and the use of Web 2.0, and tools to the evaluation of competencies through the use of ICTs. The results showed that most teachers performed well on the evaluated variables, regardless of their academic level. Even those with less advanced academic training demonstrated excellence in their knowledge and application of pedagogical methods through ICT.

Keywords: Cluster Analysis, Educational Methodologies, ICT in the classroom.

1 Introduction
The pandemic caused by the SARS virus COV - 2 (COVID-19), forced us to change the routines that eventually became citizens we brought, touching all social and institutional spheres, being one of higher education. This was evidenced by the change of classes from face-to-face to remote, which implied a great challenge for teachers, since it was necessary to use technological, virtual, and communicative tools for the development of teaching-learning processes that were being executed in a face-to-face manner.

It is evident that the competencies in the management and use of ICT in the pedagogical and didactic work of university teachers is a topic that has aroused the interest of academics in recent years, the above, coupled with the recent fact of the pandemic COVID-19, where in Colombia the Minister of Health and Social Protection, through resolution 385 of March 12, 2020, declared the sanitary emergency, throughout Colombian territory, until May 30, 2020, and established sanitary measures to prevent the spread of the virus (DECREE 637 OF 2020, 2020). Consistent with the above, the Ministry of National Education (MEN) issued ministerial directive No. 04 on March 22, 2020, in which it established that, in order to give continuity to the academic programs with qualified registration in face-to-face mode during the period of sanitary emergency, the Higher Education

Institutions (HEI) could develop academic activities assisted by the tools offered by ICT, guaranteeing the quality conditions recognized in the qualified registration.

Around the digital competencies of university teachers, an academic and scientific discourse has been weaving an academic and scientific discourse based on the premise that teachers should have, in addition to disciplinary and pedagogical competencies and digital competencies, which they should put at the service of the teaching and learning processes, but the COVID-19 pandemic has exacerbated the need for teachers to have these competencies.

In the midst of this new experience, it was necessary for teachers to have the minimum or basic knowledge about the use of new technological and information tools, as well as teaching through virtual environments, to be able to competently carry out their academic work in the midst of the new scenario that was being experienced.

Therefore, the University of Sucre in 2020 applied a survey to a total of 354 teachers who provided their services in this educational institution in order to investigate their knowledge, skills, and/or abilities in four dimensions that cover various aspects of virtual educational tools. The dimensions were as follows:

Dimension 1: Use and Technological Literacy, with 45 variables.
Dimension 2: Educational Methodologies through ICT in the Classroom, with 31 variables.
Dimension 3: Training of University Teachers in ICT, with 25 variables.
Dimension 4: Attitudes toward ICT in higher education, with 16 variables.

The teachers' knowledge, skills and/or abilities in the variables comprising these 4 dimensions were evaluated on a scale with the following ratings: "None"; "Low"; "High"; "Very High" for the first 3 dimensions and "Strongly disagree"; "Disagree"; "Agree"; "Agree"; "Strongly agree" for dimension 4.

In this work, dimension 2 "Educational Methodologies through ICT in the Classroom" was used to determine how the academic level achieved by teachers working at the University of Sucre is related to the 31 variables that make up this dimension.

The main objective of this study was to determine the relationship between educational methodologies through ICT in the classroom and the academic level of teachers who develop their academic activities at the University of Sucre through a cluster analysis.

2. Conceptual Framework

To determine the relationship between the levels of two qualitative variables, cluster analysis is applied with the KNN or K-nearest neighbors methods, using the Metric Distance or Euclidean Distance as a similarity measure, whose equation, according to Johnson (1998), is:

$$\boldsymbol{d_{rs}} = \left[(\boldsymbol{X_r} - \boldsymbol{X_s})'(\boldsymbol{X_r} - \boldsymbol{X_s})\right]^{\frac{1}{2}} \qquad \text{Ec. 1}$$

Where: d_{rs}, is the distance between points r and s; X_r, is the r point; X_s, is the s point

The nearest neighbor method according to (Johnson, D. 1998), is performed as follows:

We start with N clusters, where each cluster contains exactly one given point.

The two nearest points are linked according to one of the three selected distance measures: Metric Distance, Standardized Metric Distance and Mahalanobis Distance.

The distance between this new cluster and any other point was defined as the minimum distance between the two points of the cluster and this point.

We continue to combine the clusters that are closest to each other such that at each stage, the number of clusters is reduced by one, and the distance between any two of these is always defined as the distance between the closest members.

Thus, the nearest-neighbor method starts with N clusters, each containing one observation, and continues by combining the points and clusters until all observations are in a single cluster.

3. Methodology
A survey was administered to a sample of 354 teachers in the city of Sincelejo to inquire about their knowledge and/or skills regarding educational methodologies through ICT in the classroom.
The dimension "Educational Methodologies through ICT in the Classroom" has 31 variables, as mentioned above.
The teachers surveyed had different levels of academic training, including professional, specialist, master's, doctor, and PhD.
According to their knowledge and/or ability in the management of each of the variables that make up this dimension, a score is assigned ranging from 1 to 4, with the following interpretation:
1= Null
2= Low
3= High
4= Very High

To determine the relationship between the levels of teacher training and the scores obtained in each of the 31 variables that make up the dimension "Educational Methodologies through ICT in the Classroom," a cluster analysis was applied with the KNN or K-nearest neighbors methods, using the Metric Distance or Euclidean Distance as a measure of dissimilarity, using SPSS Version 21 software.

4. Results
Table 1 shows the distribution of teachers in each cluster, according to the highest academic level achieved.

Table 1. Distribution of Teachers in Clusters by Academic Profile

Cuenta de Conglomerado	Etiquetas de columna					
Etiquetas de fila	1	2	3	4	5	Total general
Doctorado	10	8	16	1	9	44
Especialización	13	27	17	8	14	79
Maestría	44	43	49	13	40	189
Posdoctorado	1	4	1		1	7
Profesional	6	15	1	4	9	35
Total general	**74**	**97**	**84**	**26**	**73**	**354**

As can be seen, in cluster 1, there are 10 teachers with doctoral training, 13 with specialization, 44 with a master's degree, 1 with postdoctoral training, and 6 professionals.
In cluster 2, there were eight teachers with doctoral training, 27 with specialization, 43 with a master's degree, 4 with postdoctoral training, and 15 professionals.
In cluster 3, there were 16 teachers with doctoral training, 17 with specialization, 49 with a master's degree, 1 with postdoctoral training, and 1 professional.
In Cluster 4, there was one teacher with doctoral training, eight with specialization, 13 with a master's degree, and four professionals.
In Cluster 5, there were 9 teachers with doctoral training, 14 with specialization, 40 with master's degree, 1 with post-doctorate, and 9 professionals.
The following graphs show the percentage of scores achieved in each cluster and the percentage of each teacher with doctoral, specialization, master's, postdoctoral, and professional training.
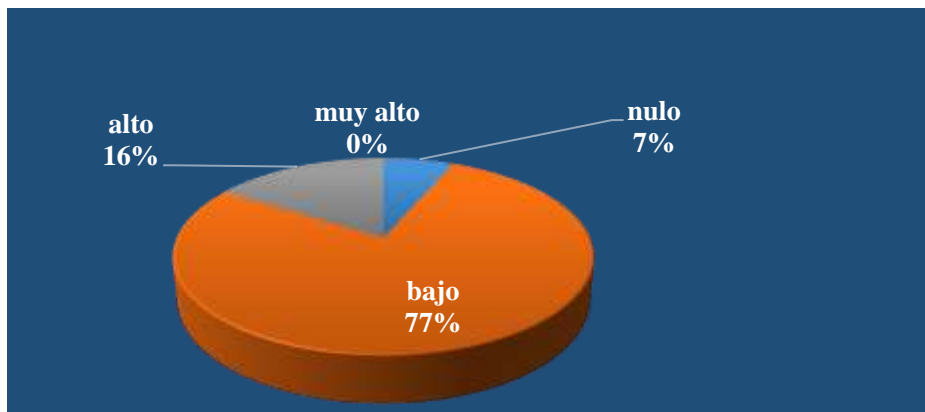
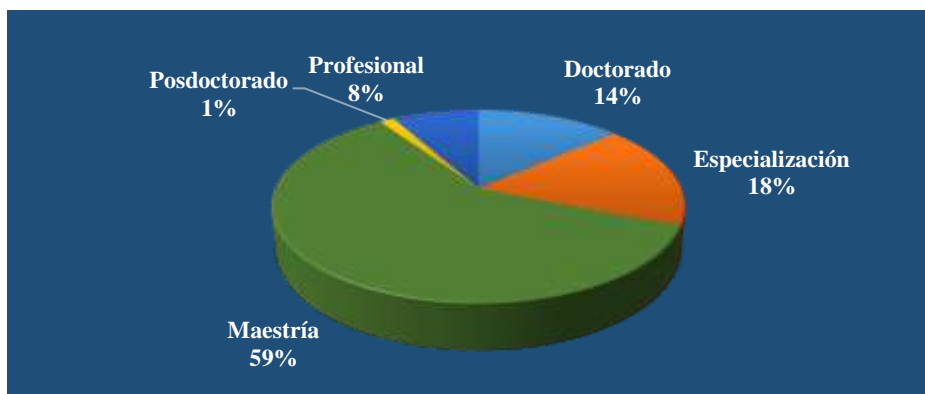**Figure 1.** Percentages of scores achieved in cluster 1.

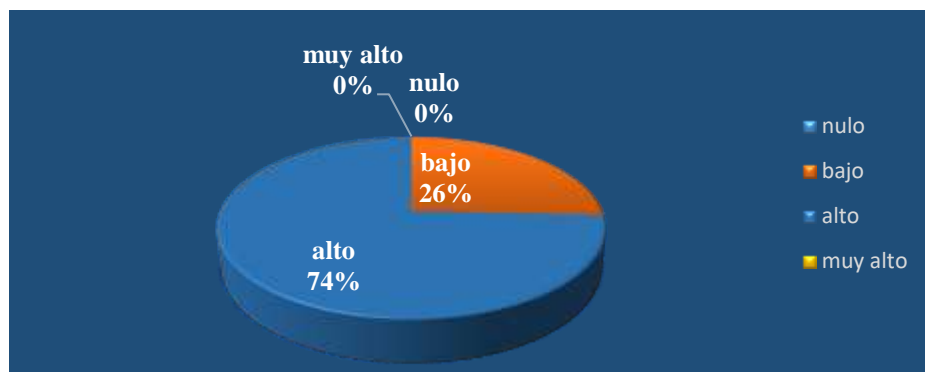**Figure 2.** Percentages of the level of education of teachers in cluster 1.

Figure 3. Percentages of scores achieved in cluster 2

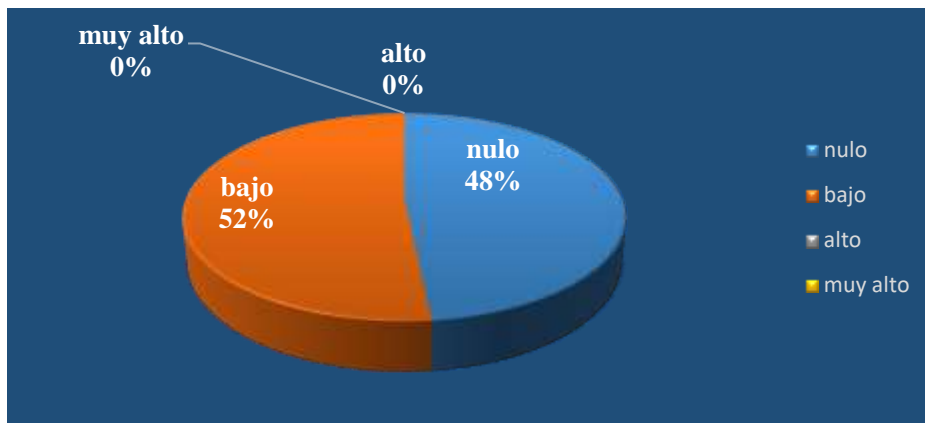**Figure 4.** Percentages of teachers' level of education in cluster 2

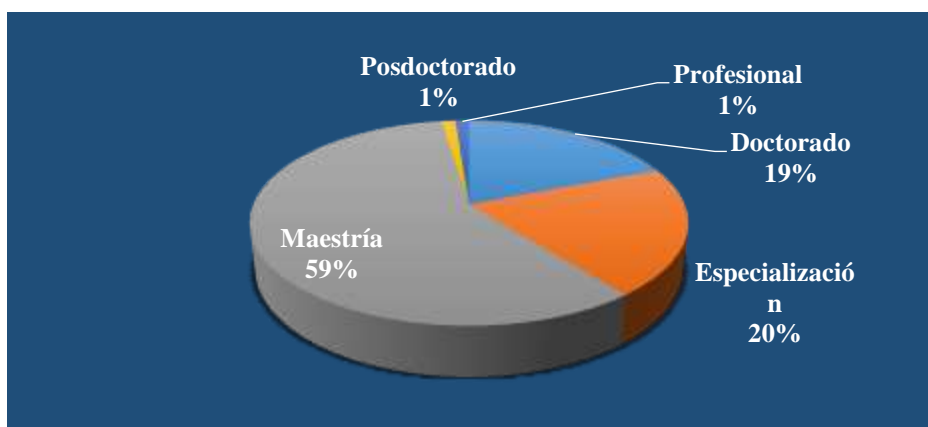**Figure 5.** Percentage of scores achieved in cluster 3

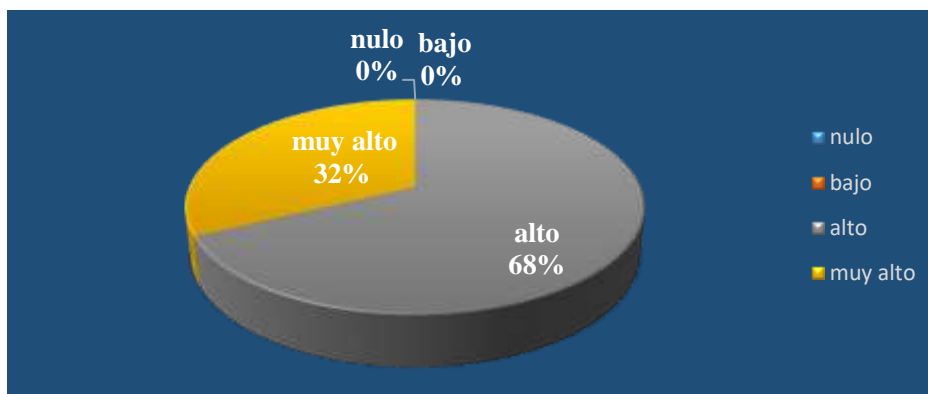**Figure 6.** Percentages of teachers' level of education in cluster 3

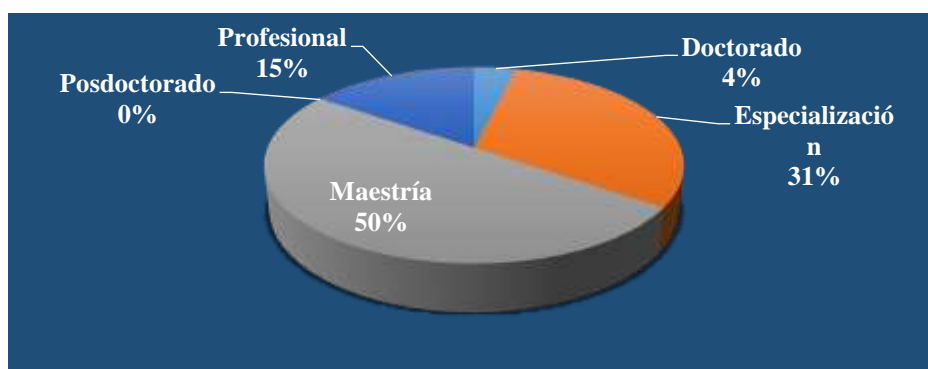**Figure 7.** Percentages of scores achieved in cluster 4

Figure 8. Percentages of teachers' level of education in cluster 4

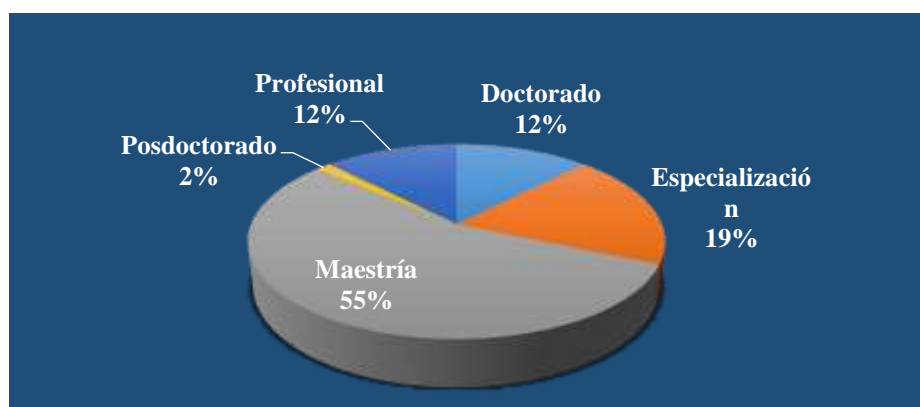**Figure 9.** Percentages of scores achieved in cluster 5

Figure 10. Percentages of teachers' level of education in cluster 5

5. Conclusions

After conducting a cluster analysis of the variables, considering the level of training of the teachers, it was possible to determine the following:

In cluster number one, 77% of the 31 variables were evaluated, and the average score was 2 points, indicating a low score in general. Similarly, 16% of this conglomerate achieved a score of 3, corresponding to a high score. However, 7% of the individuals obtained a score of 1 point, reflecting a null score for these variables. It is relevant to mention that this conglomerate is composed of six professionals: 13 with specializations, 44 with master's degrees, 10 with doctorates, and 1 with a post-doctorate.

In cluster number two, a total of 31 variables were evaluated, and 74% of them obtained an average score of 3 points, indicating a high score. In addition, 26% of the variables obtained a score of two points, indicating a low score. It is important to note that in cluster number two there are 15 professionals, 27 people with specialization, 43 with master's degrees, eight with doctorates, and four with postdoctoral degrees.

After analyzing cluster number three, some interesting findings were highlighted. This conglomerate is composed of only one professional, 17 people with specializations, 49 with master's degrees, 16 with doctorates, and one with a postdoctoral degree. When examining the variables evaluated, 52% of them obtained a score of 2 points, indicating low performance. In addition, 48% of the variables obtained a score of one point, suggesting zero performance. It is important to highlight that this cluster is characterized by the highest number of teachers with master's and doctoral degrees, while the number of professionals and people with specialization is lower compared to the other clusters. These results indicate that advanced academic training affects the performance of the evaluated variables.

An interesting feature stands out. This group had the lowest number of teachers with master's degrees and doctorates, with only one doctorate member and 13 with a master's degree. No teacher with a postdoctoral degree was found, but four professionals and eight specializations were identified. When analyzing the variables evaluated by the teachers, it is evident that 68% of them obtained a score of 3

points, which indicates high performance. In addition, 32% of the variables obtained very high performance with no null or low scores. It is relevant to note that this conglomerate is characterized by a lower presence of teachers with advanced training, such as master's degrees and doctorates. However, despite this particularity, outstanding performance was observed in the evaluated variables, with a significant percentage of high and very high performance.

In Cluster 5, an interesting distribution was observed in terms of teachers' performance. Forty-five percent obtained a score of three points, indicating good performance. On the other hand, 36% obtained a score of two points, which is equivalent to low performance. Finally, 19% obtained a score of one point, indicating no performance. It is important to note that this conglomerate is composed of 9 teachers with doctorates, 40 with master's degrees, 14 with specialization, and 9 professionals.

6. Recommendations

- Conduct an additional study to understand why some teachers with higher levels of education obtain lower scores in the use of ICTs in order to identify possible barriers or challenges that may affect their performance.
- Establish training and refresher programs in the use of ICTs for all teachers, regardless of their level of education, to ensure a comprehensive mastery of these tools.
- Continuously monitor teachers' performance in the use of ICTs in the classroom to identify specific areas that require additional support or training.
- Develop specific support and training strategies for teachers with higher levels of education who present difficulties in the use of ICTs, with the purpose of improving their performance and promoting equitable mastery of these tools.
- To adjust training and support strategies and to establish a periodic evaluation of the impact of academic training on teacher performance in the use of ICTs.

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