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Analysis Of The Factors That Influence The Success Of Teamwork In The Virtual Modality, In The University Context

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Abstract:

In this research, factors that impact the success of teamwork in the online modality were identified and classified. The research was classified as mixed with a sequential exploratory design. As for the data collection and analysis, a systematic review of research on the factors that impact teamwork in the educational context was implemented, emphasizing virtual education. Subsequently, the MICMAC technique was implemented, where there was assistance from experts who, as a group reflection, made it possible to contemplate the interactions between factors to carry out a structural analysis. The results showed four factors that were directly

classified as key. The indirect classification showed a displacement of the factors in the plane, compared to the direct classification. This displacement is relevant given that factors classified in one category were classified in a new category and this result is observed only with the indirect relationships that the MICMAC method makes it possible to find.

Keywords: education, virtualization, Micmac, academic performance, skills.

Introduction

In March 2020, the WHO declared the state of pandemic due to SARS-CoV-2 after the negative impact generated in more than 125 countries and with more than 130,000 cases identified on the planet (Burgos, et al., 2020). This situation forced the recognition of an unknown reality, represented by uncertainty, complexity, and new forms of communication (Vivas, et al., 2020). Therefore, a great capacity for flexibility and adaptation was required in all contexts, including the university where new teaching strategies had to be deployed in virtual environments abruptly (Cavallo, et al., 2021). Both private and public universities began coupling their organizational structure to teleworking (Sánchez, 2012). The above highlighted the shortcomings of the educational system in adapting to virtuality, and the different mechanisms used to face this obstacle (Ochoa & Torres, 2021).

One of the great challenges of this modality is to ensure that the student develops skills for self-learning, that he takes responsibility for his educational process, and that he acquires the necessary skills for his work performance (García, 2014). Based on what has been stated, cooperative work is a highly demanded skill that also contemplates a series of values for its application and solidification, such as honesty, solidarity, respect, tolerance, effort, and responsibility, among others (Pacios & Bueno, 2013). Teamwork focuses on cooperative work by students, in order to learn social skills that promote equitable effort (Brufee, 1995). In this sense, various studies have been carried out regarding teamwork in education due to its relevance in the organizational environment.

In (Da Silva, Marini, & Márquez, 2013) the authors investigated academic performance and cooperative work, in their findings, they found that there is a significant connection between these two variables based on the implementation of the Chi Square statistical test. For their part, Delgado, et al. (2016), also investigated academic performance and cooperative work and showed that the students showed high scores on the scale of this competence in general, however, in (Lerís, et al., 2016) it was not proven that the creation of groups based on heterogeneous learning modes increases performance when learning subjects. Based on the above, given that cooperative work, in addition to being an individual competence, has been transformed into an organizational competence that strengthens personal skills through the strength of the association, this research aims to analyze the factors that influence the success of the teamwork in virtual mode, in the university context.

The above is because, when it comes to working in a virtual team, additional competencies than those generally classified as key factors for cooperative work may be required, and promote certain disciplines and capabilities identified and acquired so that the performance, results, and work environment of the virtual team are satisfactory (More, 2015). To achieve the purpose of this study, it was decided to use the MICMAC technique, which has wide applications in determining key variables (KV) and factors in different areas including education.

The versatility of this technique in determining factors and KV in different areas is confirmed with the arizing of various investigations where it is applied, for example, in (Martelo, et al., 2017) the key factors for school dropout were identified, in (Martelo, et al., 2018) the authors used this technique to find KVs in a program proposal for higher education institutions, and in (Martelo, et al., 2020) the researchers successfully determined the factors that influence in the quality of online education.

Methodology

The development of this research involved a systematic review of cooperative work in virtual environments. The research was mixed with a sequential exploratory design

since first qualitative data and then quantitative data were acquired and examined (Hernández, et al., 2014). In this case, the factors that directly and indirectly impact the success of collaborative work in the virtual modality in the university context were analyzed, which will allow expanding the results in the literature on the topic of study. The data was collected through documentary review and for its analysis the MICMAC method was applied, which allows identifying the variables in this case, motor and dependent factors (key factors), applying matrix multiplication to a structural matrix, to examine the diffusion of the impacts produced by factor (Sarría, et al., 2009).

Structural analysis with MICMAC

Structural analysis (SA) allows the structuring of a group reflection that facilitates, through the creation of a matrix of direct influences/dependencies (MDI), the relationship of the elements that constitute a system (Godet, 2000). The SA is made up of three stages, the first in which the variables are listed, the second in which the interactions between them are detailed, and finally the identification of the KVs. In the first phase, the definition and description of the variables that make up the analyzed system and its context (external and internal) are required, where the homogeneity, comprehensiveness, and exhaustiveness with which this list is prepared stand out as important aspects. The establishment of the relationships between the variables listed in the first phase requires the experts to process an MDI, which allows them to respond, in a qualitative way, to the question of the existence or not of relationships of direct influence between two variables. In the KV (or relevant variables to the evolution of the system) identification phase, the indirect classification (produced by raising the power of the matrix with the MICMAC technique) and the direct classification (from the matrix generated in the previous stage) are complemented.

Procedure

Systematic review: a systematic review was carried out on topics related to virtual education, collaborative learning, factors that affect virtual education, virtual tools, collaborative work, and other related topics, where

several authors stand out, such as Guitert, et al. (2007), Hernández & Muñoz (2012), and Silva, et al. (2020).

Selection of factors: Once the documentary review was completed, the factors associated with the success of collaborative work in the virtual modality were selected according to the literature, resulting in a list that covered 10 factors that served as a basis for the use of the MICMAC technique.

Implementation of the MICMAC technique: The MICMAC technique was applied to study the diffusion of the impact produced by each factor. This technique details a system through a matrix that associates its constituent elements, and identifies dependent and influential factors, thus highlighting the key factors of a system (Arango & Cuevas, 2015). For its use, the Softprosp platform was implemented, whereby the MDI was completed with the list of factors found in the documentary review. The completion of the matrix involved five experts chosen for their knowledge in virtual education in the practical and theoretical sphere, who had to score from 0 to 3, with the possibility of indicating the potential influences, the direct relationships between the factors: 0: No influence 1: Weak 2: Medium 3: Strong P: Potential.

Results

The SA carried out on the “collaborative work in the virtual modality, in the university context” system is part of the studies that are considered to be promoted in various systems of interest to improve virtual education. On the other hand, the selection of experts made it possible to take advantage of their knowledge and experiences to identify the structure of the interrelationships and the set of interactions existing between the factors that characterize the object of study. The results acquired in this research are presented below.

Identified factors

In Table 1, the factors acquired with the bibliographic review of authors such as Morales & Vargas (2010) and Ruíz, et al. (2015) are displayed. For example, factor number 1 is identified with the code "HGC"; the name

"Have group conscience"; and the description "it refers to the total of the consciousnesses of the subjects, who merge their opinions to reach a final agreement ".

Table 1. Identified factors

#	Code	Name	Description
1	HGC	Have group conscience.	It refers to the total of the consciousnesses of the subjects, who merge their opinions to reach a final agreement.
2	SCOA	Spontaneously collaborate and offer mutual assistance.	It refers to cooperation, reciprocity in the exchange of services, skills, resources, and collaborative work, which translates into a mutual advantage for the cooperating subjects.
3	CMGIR	Coordinate and maintain good interpersonal relationships.	It refers to the adequate provision of social bonds between the members of the group.
4	HCO	Have common objectives.	It refers to the objectives that unite the members of the group; they must share them, believe in them, and feel part of the process to achieve them.
5	HRTA	Have roles and tasks that are accepted.	It refers to the fact that each member must have a role in the team, which entails tasks or responsibilities that they must accept with said role.
6	ECS	Establish a collaboration system.	Se relaciona con el establecimiento de reglas, donde se recompense lo correcto y se indique lo incorrecto.
7	MAIG	Maintain affinity and identification with the group.	Hace referencia a que cada integrante del grupo debe estar en consonancia e identificarse con el resto de integrantes.
8	MCFC	Maintain clear and fluid communication.	It refers to the ability to maintain fluid communication and create a dialogue where all team members can feel an important part of it.
9	HCDR	Have clearly defined rules.	It refers to the stipulation of rules that are clear and concise.
10	HCDO	Have a clearly defined organization.	It refers to the definition of what is going to be done (goals), who is going to do it (functions), how it is going to be done (procedures).

Source: Authors, based on bibliographic review.

Below, Figure 1 shows the MDI completed by the experts. As can be seen, the HGC (Having group conscience) factor maintains a strong direct relationship (3) with almost all

the factors, except for the ECS (Establish a collaboration system.) factor, with which it maintains a medium direct relationship. In the case of the SCOA factor (Spontaneously collaborate and offer mutual assistance), it maintains a strong direct influence relationship with three factors (HGC, CMGIR, ECS), it maintains a medium relationship with two factors (HCO, MAIG) and it maintains a weak relationship with four of the factors (HRTA, MCFC, HCDR, HCDO).

Figure 1. MDI

	HGC	SCOA	CMGIR	HCO	HRTA	ECS	MAIG	MCFC	HCDR	HCDO
HGC	0	3	3	3	3	2	3	3	3	3
SCOA	3	0	3	2	1	3	2	1	1	1
CMGIR	2	3	0	1	2	3	2	3	1	0
HCO	2	0	1	0	2	3	1	2	3	3
HRTA	3	2	0	1	0	2	3	2	3	2
ECS	0	2	1	3	0	0	0	3	3	3
MAIG	2	3	3	2	2	2	0	3	2	2
MCFC	3	2	3	1	3	3	3	0	2	2
HCDR	1	2	3	3	3	3	1	2	0	3
HCDO	0	0	0	3	2	3	0	2	3	0

Source: Authors

On the other hand, Figure 2 shows the rate of indirect influence, which is obtained by raising the MDI to power.

Figure 2. The matrix representing the rate of indirect influence

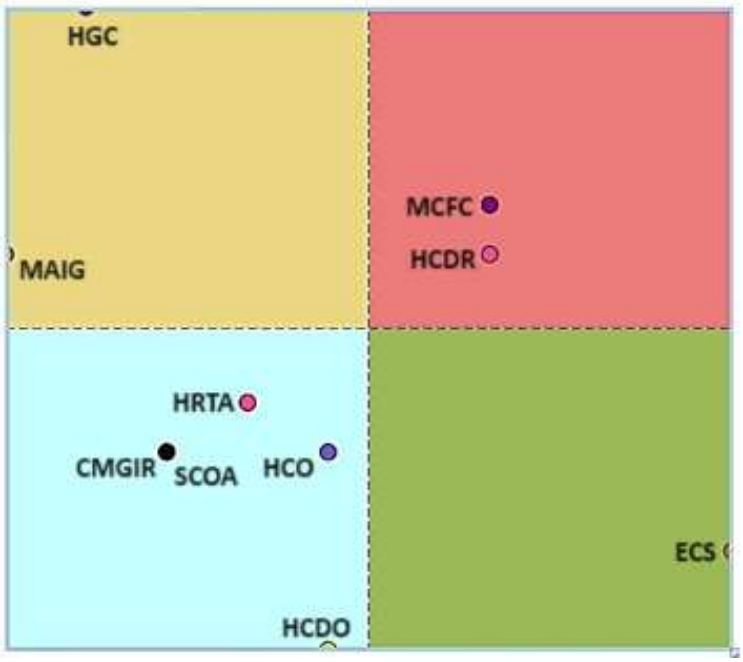
	HGC	SCOA	CMGIR	HCO	HRTA	ECS	MAIG	MCFC	HCDR	HCDO
CDG	703	801	789	919	824	1077	690	985	1002	934
SCOA	535	511	558	613	581	788	481	633	664	619
CMGIR	502	555	546	640	604	795	474	699	684	617
HCO	517	491	521	586	559	767	456	634	662	613
HRTA	574	572	540	648	615	855	523	732	748	659
ECS	391	480	407	528	443	594	386	598	601	543
MAIG	593	667	655	756	679	894	556	823	827	770
MCFC	665	656	712	772	743	989	607	813	850	799
HCDR	548	618	657	730	668	851	525	750	760	750
HCDO	348	384	386	479	434	573	333	496	508	445

Source: Authors

Results of the implementation of the MICMAC method

The MICMAC method allows the classification of variables or factors according to their direct and indirect relationships, which determines that the most relevant variables or factors of the system studied are the motor ones, that is, the less dependent and more influential factors, and the linking ones, which means, very influential and dependent factors, these being highly unstable. Below, Graph 1 shows the plane of dependencies and influences of the direct classification (PIDC), provided by the experts.

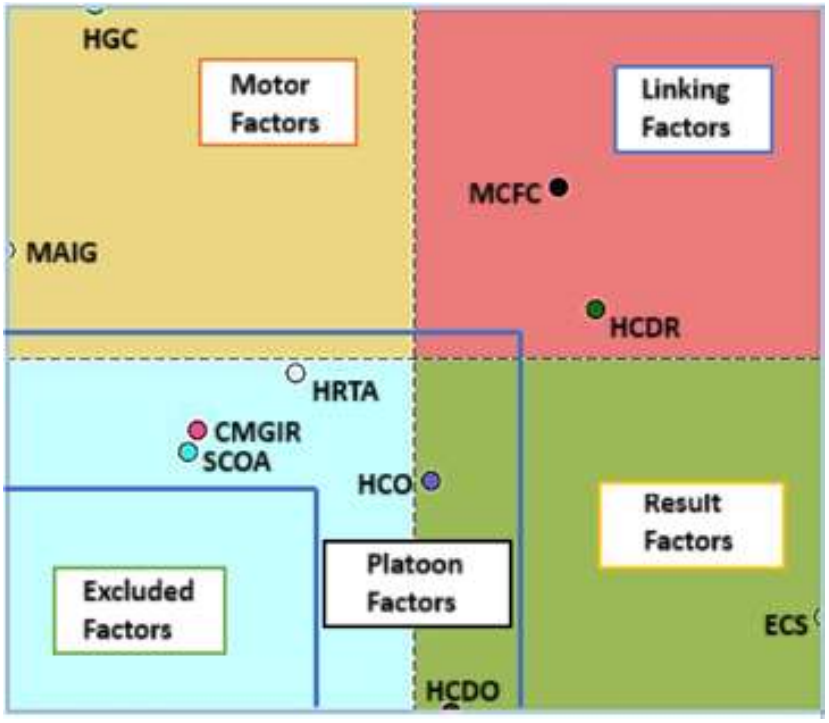
Graph 1. PIDC



Source: Authors

On the other hand, on the same plane but in this case, showing the results based on the indirect classification, the key factors obtained in the process are observed. As shown in Graph 2, in the SA carried out there are no significant deviations from the direct and indirect classification (processed on the Softprosp platform) concerning the motor and linking factors, that is, the factors located in the two upper quadrants.

Graph 2. Plane of indirect influences/dependencies



Source: Authors

Key factors

The key factors were located as follows:

Motor factors: HGC and MAIG.

Linking factors: MCFC and HCDR.

Rest of factors

The remaining factors were located as follows:

Result factors (highly dependent): ECS.

Platoon factors (with medium levels of dependence and influence): SCOA, CMGIR, HCO, HRTA and HCDO.

Excluded factors (autonomous in the system): No factor was classified as excluded.

According to the indirect classification, it is confirmed that the factors determined as key in the study are those to which, due to their indirect relationships, greater attention should be paid to the evolution of the "collaborative work in the virtual modality, in the

university context" system. In this way, it is observed that the most relevant variables in the analysis of the system are HGC, MAIG, MCFC, and HCDR.

In the case of the HGC factor, it is key since this factor is developed to increase the work efficiency of the group and at the same time allows to orient activities in collaborative learning in the virtual modality (Chávez & Romero, 2011). For its part, the MAIG factor is key, because it is important that each member identifies themselves and feels confident. This factor is the main one to take into account when forming groups (Flores, 2000).

On the other hand, one of the factors identified as a linking was MCFC, this is a factor of great importance that makes the group function as a team, reduces efforts, and increases achievements, but also, when it is defective, it produces misunderstandings and unwanted emotional reactions (Aguilar & Vargas, 2010), therefore, this factor should be taken as a norm. The other factor classified as linking was HCDR. This factor is especially important, because by having rules that guide the teamwork process, not only the team's objectives can be achieved, but each member can also obtain the skills to follow established guidelines (Aguilar & Vargas, 2010).

Regarding the rest of the factors, it is relevant to highlight that these results should not be considered textually, but rather their purpose is only to facilitate a reflection regarding the future of the system examined, and that, on the other hand, there is not only one interpretation of the MICMAC results, but it is the group that implements the study that must develop its own interpretation. Therefore, it is essential that, although the key factors were classified and identified in this study, the rest of the factors should not be left aside, because each one plays an important role within the system and therefore must also be taken into consideration when establishing strategies to achieve teamwork success.

Conclusions

Through this research, it is possible to confirm, first of all, that the hierarchization of the factors in the different classifications is enriching in terms of teachings, allows to determine the relevance of certain factors, and also provides the visualization of factors that, with their

indirect actions, they significantly impact others, an aspect that is not evident in the direct classification. Furthermore, the input data (list of variables and matrix) have a high level of subjectivity, considering that this technique is not a truth, but rather a resource that facilitates its visualization.

Secondly, education in times of pandemic is due to the implementation of virtual learning environments, therefore, it is important to note that virtual education requires certain conditions to make learning successful. Within this context, very important factors intervene on the part of the student, such as autonomy, responsibility, and motivation to develop their learning, factors that are also necessary in face-to-face education. In the same way, the factors that influence cooperative work in the virtual modality are the same as those required in person, but they require a greater commitment on the part of the student. The factors here classified as the most important are the bases for achieving teamwork success.

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