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ORIGINAL

Key Factors in the Success of Virtualization of Teaching in Spanish Universities During the COVID-19 Pandemic

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ABSTRACT

The virtualization of university teaching in Spain caused by the pandemic was a success, but the urgent nature of the transition from face-to-face teaching to online teaching meant that some peculiarities that should have been taken into account were omitted. Thus, in order to find out and analyze the factors causing the success of this virtualization and take measures to address the weak points of this process as teachers may want to maintain the use of online teaching as support for their face-to-face teaching, these factors were located through a literature review and were classified according to their level of importance in this success through a causal study carried out with the methodology of fuzzy cognitive maps. The results achieved indicated the determining factors in students, involving their attitude, aptitude and predisposition, which are factors where the work of the teacher is of main relevance (as it exerts the greatest influence on these factors). For this reason, technological attitude and aptitude, teaching style, and the creation and structuring of content should be reinforced in teachers.

Keywords UNIVERSITIES, E-LEARNING, COVID-19, CAUSAL FACTORS, INFORMATION TECHNOLOGY

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1 INTRODUCTION

The arrival of the COVID-19 pandemic in Spain and, consequently, the confinement of the population, caused Spanish universities to take the step away from traditional training to online training (García-Peñalvo & Corell, 2020). From one day to the next, Spanish universities (and part of the world) were closed, paralyzed and faced with the great challenge of virtualizing all their training so as not to lose an academic year.

This step had to happen without a margin of preparation time, without prior training and, in many cases, with a great lack of knowledge of the technological tools to use and with which to support the entire training process.

The use that the universities already made of the technologies, the optimal knowledge of the technologies by a large part of the teaching staff, the training plans on the possible tools to use (created and offered by the universities), the support of the virtual teaching services

of these universities and the interest and adaptability of the teaching staff made the process of digitizing the subjects possible in record time (García-Peñalvo, 2021; Lucas, Dorotea, & Piedade, 2021). The foundations were set quickly, but it remained to be seen if the training process could be carried out correctly.

The infrastructure for teaching and the technical part of the digitization of the content was created with the help of technology (and was already in place in many of the universities), which made the tools to be used and the guidelines to follow, but in teaching it is the teaching-learning process (training process) that really matters. This is the same in face-to-face teaching as in online teaching (Turpo-Gebera, Hurtado-Mazeyra, Delgado-Sarmiento, & Peréz-Postigo, 2021).

Online teaching is defined as the teaching-learning process that takes place in a digital environment, where teachers and students carry out the training process thanks to information and communication technologies.

This type of teaching is practically the same as face-to-face teaching, although it changes the environment where it is carried out and requires a series of considerations that are not needed or are not taken into account in face-to-face teaching. Among these considerations can be found (Cabero & Gisbert, 2005):

- It requires minimal technological skills in teachers and students.
- It requires teacher knowledge of the technological tools to be used as an aid to explanations (tools that replace the traditional blackboard), so as not to lower the quality of teaching and the clarity of explanations.
- It requires correct and adequate digitization of the content; simple digitization is not enough.
- It requires a greater workload of the teaching staff and, therefore, a greater investment of time by the teachers.
- It requires greater attention to students from teachers.
- Finally, in some cases in which it is decided to provide students with the materials asynchronously and use the synchronous virtual face-to-face sessions as clarification sessions, it requires that the students have skills for autonomous learning.

In this way, this virtualization of university teaching in Spain produced by the COVID-19 pandemic caused uncertainty in universities which was not focused on the creation of the digital environment in which to carry out the training process (the creation of a digitized area where teaching the subjects was not problematic or disruptive, which in many cases already existed), but related rather to the pedagogical aspect (knowing what to do, how to do it and why you want to do it). This was something that had been touched on in studies prior to this pandemic for this type of teaching (Cabero, 2006).

However, it can be said in conclusion that this entire process was a success in Spanish universities; the academic year was able to be completed and the number of complaints from students was minimal (Grande-De-Prado, García-Peñalvo, Almuzara, & Abella-García, 2021; Llorens-Largo, Villagrá-Arnedo, Gallego-Durán, & Molina-Carmona, 2021). Online

teaching continues to be carried out today in many of these universities (due to the continuation of the pandemic), which has allowed many of the factors which should be taken into account, as stated previously, in the transition from classroom teaching to teaching online to be improved (Carpio-Ramos, Carpio-Ramos, García-Peñalvo, Carpio, & Hernández, 2021).

For this reason, in order to find out and analyze the factors that have led to the success of this virtualization of teaching in Spanish universities and to undertake measures to address the weak points of this process since teaching staff may like to keep part of what has been achieved in this virtualization as support for their face-to-face teaching, as can already be seen in other studies (Benites, Villalba-Condori, Arias-Chávez, Berrios-Espezua, & Cano, 2021; A. Infante-Moro, Infante-Moro, Gallardo-Pérez, & Luque, 2021; Lázaro-Carrascosa, Hernán-Losada, Palacios-Alonso, & Ángel Velázquez-Iturbide, 2021; León-Gómez, Gil-Fernández, & Calderón-Garrido, 2021), this study focused on locating the determining factors in the success of the virtualization of teaching in Spanish universities during the COVID-19 pandemic.

Thus, for this research, a literature review was carried out that allowed the creation of a list of factors that influence the adoption and use of online teaching (that is, when it comes to achieving success in teaching virtualization). Subsequently, they were used to develop a causal map of the system, in which technology and education experts analyzed these influences, and their impacts on each other, to detect the most influential factors in achieving this success in Spanish universities following the emergence of the coronavirus.

The latter was due to the fact that, if you really want to know the most determining factors in a system, you must take into account the influences that occur between the factors of that system (a fact that can change their relevance). This is something that is not observed in existing research on this problem, since most studies try to ascertain these factors by assessing the degree of influence of each of them on achievement and not considering the influences that occur between the factors themselves.

In this research, the following section details the uses of technologies in training processes, their situation in traditional face-to-face teaching in Spanish universities, and the factors that influence the adoption and use of online teaching. The methodology used in this study and the analysis of the results follows, and the conclusion points out the determining factors in the success of virtualization of teaching in Spanish universities during the COVID-19 pandemic.

2 LITERATURE REVIEW

Since their appearance, technologies have been incorporated into many sectors of society (Abad-Segura, Infante-Moro, González-Zamar, & López-Meneses, 2021; Domingo-Carrillo, González-Rodríguez, & Chávez-Miranda, 2020; Haurech & Red-Martinez, 2020; A. Infante-Moro, Infante-Moro, & Gallardo-Pérez, 2021c, 2021d; A. Infante-Moro, Martínez-López, Infante-Moro, García-Ordaz, & Gallardo-Pérez, 2020; Ortiz-Cortés & Pacheco-Cortés, 2020), completely changing the image of these sectors and providing a series of advantages that were unattainable without the appearance of these tools. The

same has obviously happened in the educational sector and in training processes (Eliche-Quesada, Rubia, & Martínez-Cartas, 2021; García-Holgado, Vázquez-Ingelmo, García-Peñalvo, & Conde, 2021; A. Infante-Moro, Infante-Moro, & Gallardo-Pérez, 2021e; Melo, Neto, & Silva, 2021).

For training processes, the incorporation of technology allowed the possibility of studying at a distance, the creation of digital educational platforms, the digitization of their content (even changing the way in which they were taught) and the way of providing their services (Morales-Salas, Infante-Moro, & Gallardo-Pérez, 2019, 2020; Ponce & Alfaro, 2020; Rosales-Almendra & Becerra, 2020). Digital platforms such as Moodle, Canvas or Sakai appeared, which made it possible to dispense with face-to-face infrastructure to carry out the training process; tools based on word processing appeared (Carvalho & Yeoman, 2021; Faria-Ferreira, Ferreira, & Marques, 2021), multimedia techniques (Borrero-Ojuelos & Bermejo-Berros, 2021; Cebrián-De-La-Serna, Gallego-Arrufat, & Cebrián-Robles, 2021), along with serious games (Juan-Lázaro & Area-Moreira, 2021) , augmented reality (Álvarez Marín, Velázquez-Iturbide, & Campos-Villarroel, 2021; Pérez, Robles, & Osuna, 2021), robotics (Carro, Sancristobal, & Plaza, 2021; González-González, Holz, Moro, García, & Franco, 2021) and digital boards, among others, which offered a new way of presenting content (Lorente-Ruiz, Despujol, & Castañeda, 2021; Pacheco-Cortés & Infante-Moro, 2020; Ruiz, Cebrián, & Cebrián, 2021); tools for video calls and virtual meetings appeared that provided a new way of imparting training beyond face-to-face (Martínez-López, Infante-Moro, García-Ordaz, Infante-Moro, & Gallardo-Pérez, 2021; Rojo, Alatorre, & P, 2020); and all of this thanks to the evolution of technologies and the appearance of the Internet, which has allowed us to achieve online and distance teaching-training.

Despite its uses and the endless benefits of all this, many of these advances remained unused and have not been properly exploited in traditional classroom teaching in Spanish universities. However, a large part of the content was digitized (in most cases) and digital platforms were installed, although the latter were used more as a repository of subject content than as a training platform (Martínez, Padilla, Rosa, & Eguizábal-Román, 2021). Even so, this was the main reason why the virtualization of teaching in Spanish universities was possible in record time after the appearance of COVID-19. The foundations of the environment where the training process had to be carried out were already in place in most universities, but it remained to install this process on the established foundations (which was successfully achieved).

In this way, as stated previously, in order to determine and analyze the factors behind the success of the virtualization of teaching in Spanish universities and take measures to address those weak points of this process to support its potential ongoing use as a support for face-to-face teaching, this study focused on locating these determining factors.

To do this, first a literature review was carried out through the main scientific databases (Web of Science, Scopus and Google Scholar) that allowed the extraction of a list of the factors that influence the adoption and use of online teaching, from a previous study carried out by Selim (2007), who ascertained these factors through structural equation modeling (SEM) techniques applied to a series of factors (and indicators) reached in a previous liter-

ature review and based on experimentation with its application in a university.

This list consisted of the following factors:

- Instructor's attitude towards and control of the technology. This factor includes whether the instructor pays adequate attention to the students, encourages the participation and interaction of the students, participates actively in the teaching of the course subjects through e-learning, and encourages the use of e-learning and e-learning-based units. This factor is part of the characteristics of the instructor and was adopted from the studies of Volery and Lord (2000) and Soong, Chan, Chua, and Loh (2001).
- Instructor's teaching style. This factor includes whether the instructor manages the e-learning units effectively, explains how to use the e-learning components, is enthusiastic about the teaching process, and whether the learning style interests students. This factor is also part of the characteristics of the instructor and was adopted from the study by Volery and Lord (2000).
- Student motivation and technical competency. This factor includes whether the student seeks more facts with e-learning than with the traditional method, is encouraged to participate more with e-learning than with the traditional method, uses computers to work and play, feels comfortable using computers, has previous experience in using computers, is not intimidated by computer use, and prefers constructed to absorbed knowledge. This factor is part of the student's characteristics and was adopted from the study by Soong et al. (2001).
- Student interactive collaboration. This factor includes whether the student reads and participates in the discussion group and initiates discussions, or whether it is the instructor who initiates these discussions and actively participates instead. This factor is also part of the student's characteristics and was adopted from the study by Soong et al. (2001).
- e-Learning course content and structure. This factor includes whether the student considers that the instructions on the use of the e-learning components are clear, the design of the e-learning components is good, understanding the structure of the e-learning components presents no difficulty, navigation through the course blackboard/web is easy, e-learning components are available long enough, course content is sufficient and topic-related, and course materials are posted online in a timely manner. This factor is part of the student's characteristics and was adopted from the study by Selim (2007).
- Ease of on-campus internet access. This factor includes whether there is easy access to the Internet, whether problems are experienced while browsing, whether the browsing speed is satisfactory, whether the website is easy to use, whether the information is well structured/presented, and whether the layout of the screen is attractive. This factor is part of the technology and was adopted from the study by Volery and Lord (2000).

- Effectiveness of information technology infrastructure. This factor includes whether you can use any computer, register for online courses, interact with peers through the web, easily contact the instructor, use computer labs to practice, and trust the computer network, all with a technology infrastructure. efficient information. This factor is part of the technology and was adopted from the studies by Volery and Lord (2000) and Selim (2007).
- University support of e-learning activities. This factor includes whether technical assistance can be obtained from technicians and e-learning support is good, whether assignments and materials can be printed easily, and whether other university services that support the training process, such as a library, can be accessed. This factor is part of the university support and was adopted from the study by Selim (2007).

Once this list of factors (necessary to achieve success in teaching virtualization) had been obtained, we proceeded to develop a causal map of the system with them to locate the determining factors in the success of teaching virtualization in Spanish universities during the COVID-19 pandemic.

3 METHODS

The methodology used to develop the causal map was the fuzzy cognitive maps methodology, which is used in the scientific field to identify/validate the factors of a system and analyze the cause-effect relationships that exist between them (Codara, 1998; Papageorgiou & Salmerón, 2013).

The factors of this system were already identified in the literature review, so this methodology was used to validate, add or eliminate factors from that list, and to find out the causal relationships between them, in order to locate the determining factors in the success of virtualization.

This methodology is based on the judgment of experts, so the data collection (for the construction of the causal map) was carried out through interviews with experts, making a causal map of the system for each of the interviewees and subsequently a global causal map with the average assessment of the experts (Curia & Lavalle, 2011).

In each interview, as observed in other studies that use this same methodology (Gutierrez, Sanz, González, & Lastra, 2015), the interviewee received a table with the factors identified in the literature review and the definition of these. The interviewee then had to confirm if all those factors were those involved in this system, if any factor had to be eliminated from the table, or if another had to be added.

Once all the factors that could influence the success of virtualization of teaching in Spanish universities during the COVID-19 pandemic had been identified, the interviewee had to analyze the existing causal relationships or influences between them and assess the degree of these relationships (since the degrees of these causal relationships or influences are those that are used to obtain the level of importance of each one of the factors in the system).

The evaluations of the influences of a factor on another factor should be between the values of the interval [-1,1]: with -1 being strong negative influences, 0 being the non-existence

of influences, and 1 being strong positive influences (Banini & Bearman, 1998; Mouratiadou & Moran, 2007).

With this information, a causal map was constructed per interviewee, then transformed into an adjacency matrix (as can be seen in table 1). This conversion was necessary to be able to perform the data analysis with the FCMappers Software (Bachhofer & Wildenberg, 2010), which was in charge of classifying the factors according to their level of importance.

This adjacency matrix is interpreted as follows: each row contains the assessments provided by the interviewees regarding the influences of each of the factors found in the rows on each of the factors found in the columns. Thus, based on what can be seen later in Table 1, the first row contains the assessments provided regarding the influences exerted by the factor "instructor's attitude towards and control of the technology" on the factors instructor's attitude towards and control of the technology, instructor's teaching style, student motivation and technical competency, student interactive collaboration, e-learning course content and structure, ease of on-campus internet access, effectiveness of information technology infrastructure, and university support of e-learning activities. The same process then had to be followed with the other factors that appear in the other rows.

Once a causal map (or adjacency matrix) was obtained per interviewee, a global causal map (or global adjacency matrix) was created with the average assessment of the experts. These data were the ones that were finally entered into the FCMappers software, the tool that made it possible to identify the factors that exerted the most influence on the other factors, the factors that received the most influence from the other factors, and the most determining factors of this system.

The number of interviewees in this type of study is considered optimal when new factors no longer appear as interviews are carried out (Özesmi & Özesmi, 2004). This means that there are studies (that use fuzzy cognitive maps as methodologies) with 45 (Carley & Palmquist, 1992), 41 (J. C. Infante-Moro, 2017), 40 (A. Infante-Moro, Infante-Moro, Gallardo-Pérez, & Martínez-López, 2021), 29 (Carley & Palmquist, 1992), 8 (González-González, Infante-Moro, & Infante-Moro, 2020; A. Infante-Moro, Infante-Moro, & Gallardo-Pérez, 2021d, 2021e; A. Infante-Moro, Infante-Moro, Gallardo-Pérez, & Ferreira, 2020), 7 (Gutierrez et al., 2015) and up to 4 interviewees (Abreu, Tenezaca, & Mariño, 2020).

In this study, the number of interviewees was set at 40. None of the interviewees added new factors (Figure 1), but interviews were continued up to this number to achieve more significant results.

Since this is a methodology based on the judgment of experts, the results achieved would lack significance if the appropriate experts were not chosen (A. Infante-Moro, Infante-Moro, & Gallardo-Pérez, 2021e), so this study chose to look for a profile of expert appropriate to the problem studied: university professors who have taught classes in Spanish universities face-to-face and / or virtually for more than 10 years (80% of these experts teach classes on the application of technologies in the area of Education), with training in ICT (Information and Communication Technologies) and researchers in the application of technologies in education and teaching. These experts are the ones who responded to the invitation to

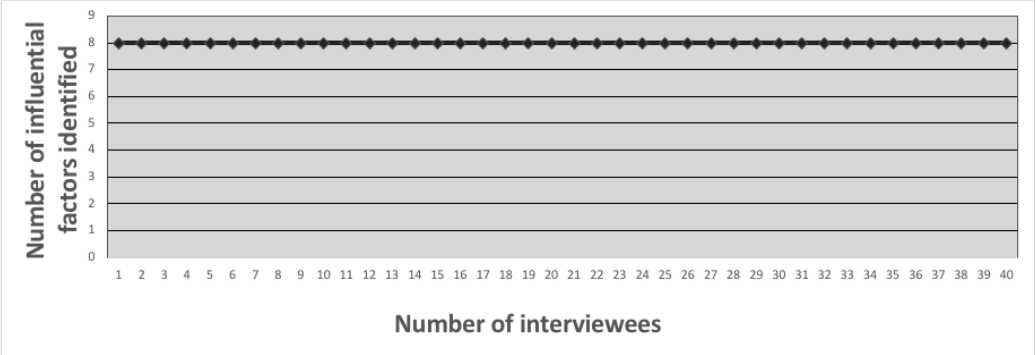

Figure 1 Number of factors identified in each of the interviews. Source: Self-made

participate in the research (the invitation was sent to a professor of recognized prestige by each Spanish university).

4 RESULTS

All the experts validated the factors in the list as the factors involved in this system (none added or eliminated factors), and all identified the existing causal relationships between them, generating a causal map per interviewee and obtaining a global causal map (with the average valuation of the experts) formed by 8 factors and 34 causal connections (Table 1). It should not be forgotten that these evaluations were given according to the causal influences existing between the factors.

By processing these data with the FCMappers software (based on Microsoft Excel), it was possible to obtain the factors that had the most influence on the other factors, the factors that received the most influence from the other factors and the most determining factors of this system.

The factors that most influenced the other factors were (from greatest to least influence): university support of e-learning activities, instructor's attitude towards and control of the technology, effectiveness of information technology infrastructure, ease of on-campus internet access, student interactive collaboration, instructor's teaching style, student motivation and technical competency, and learning course content and structure (Figure 2).

As seen above, the factor that most influenced the other factors was university support of e-learning activities; it was given a score of 5.60 by the FCMappers software. This software generates these scores based on the evaluations of the experts on the level of causal influences existing between the factors involved in this system. Four of the eight factors were above the mean (3.60) of the difference between the factor with the highest score (5.60) and the factor with the lowest score (1.80).

Regarding the factors that received the most influence from the other factors, these were (from greater to lesser influence received): learning course content and structure, student interactive collaboration, instructor's teaching style, student motivation and technical

Table 1 Global causal map. Source: Self-made

	Instructor's attitude towards and control of the technology	Instructor's teaching style	Student motivation and technical competency	Student interactive collaboration	e-Learning course content and structure	Ease of on-campus internet access	Effectiveness of information technology infrastructure	University support of e-learning activities
Instructor's attitude towards and control of the technology	0,00	1,00	0,90	0,90	1,00	0,20	0,85	0,00
Instructor's teaching style	0,00	0,00	0,80	0,90	1,00	0,00	0,00	0,00
Student motivation and technical competency	0,00	0,90	0,00	0,80	1,00	0,00	0,00	0,00
Student interactive collaboration	0,65	0,95	0,70	0,00	0,85	0,00	0,00	0,00
e-Learning course content and structure	0,00	0,00	0,60	1,00	0,00	0,00	0,00	0,00
Ease of on-campus internet access	0,00	1,00	0,90	0,90	0,70	0,00	1,00	0,00
Effectiveness of information technology infrastructure	1,00	1,00	0,90	0,90	0,95	0,00	0,00	0,00
University support of e-learning activities	1,00	1,00	0,90	0,90	0,90	0,00	0,90	0,00

competency, effectiveness of information technology infrastructure, instructor's attitude towards and control of the technology, ease of on-campus internet access, and university support of e-learning activities (Figure 3).

As seen above, the factor that received the most influence from the other factors was learning course content and structure, it was given a rating of 6.40 by the FCMappers software. Four of the eight factors were above the mean (3.20) of the difference between the factor with the highest score (6.40) and the factor with the lowest score (0.00).

Finally, regarding the most determining factors of this system, these were (from highest to lowest importance): student interactive collaboration, instructor's teaching style, student motivation and technical competency, learning course content and structure, instructor's attitude towards and control of the technology, effectiveness of information technology infrastructure, university support of e-learning activities, and ease of on-campus internet access (Figure 4).

The most determining factors are those with the highest degree of participation in a system, so the degree of participation of each of these factors is determined by the sum of

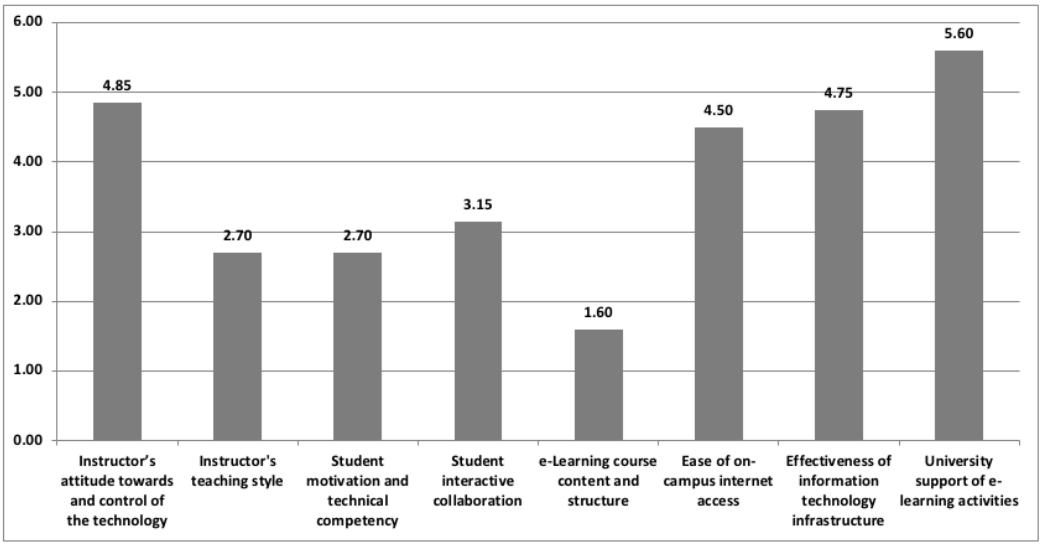

Figure 2 Factors that most influenced the other factors. Source: Self-made

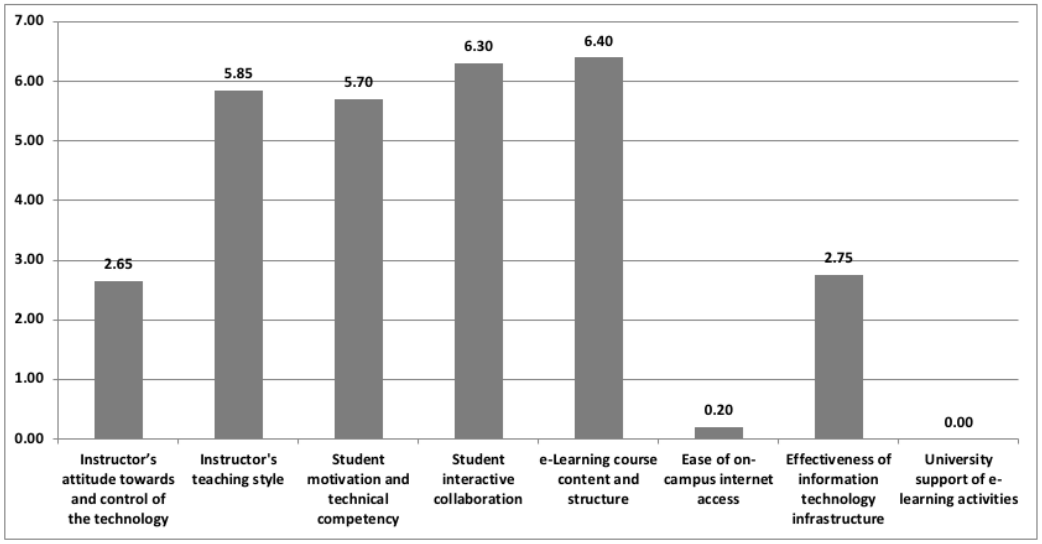

Figure 3 Factors that received the most influences from the other factors. Source: Self-made

the level of influences that it exerts on the other factors and the level of influences that it receives from the other factors (Özesmi & Özesmi, 2003).

The most determining factor in this system was student interactive collaboration, with a score of 9.45 given by the FCMappers software. Six of the eight factors were above the mean (7.075) of the difference between the factor with the highest score (9.45) and the factor with the lowest score (4.70).

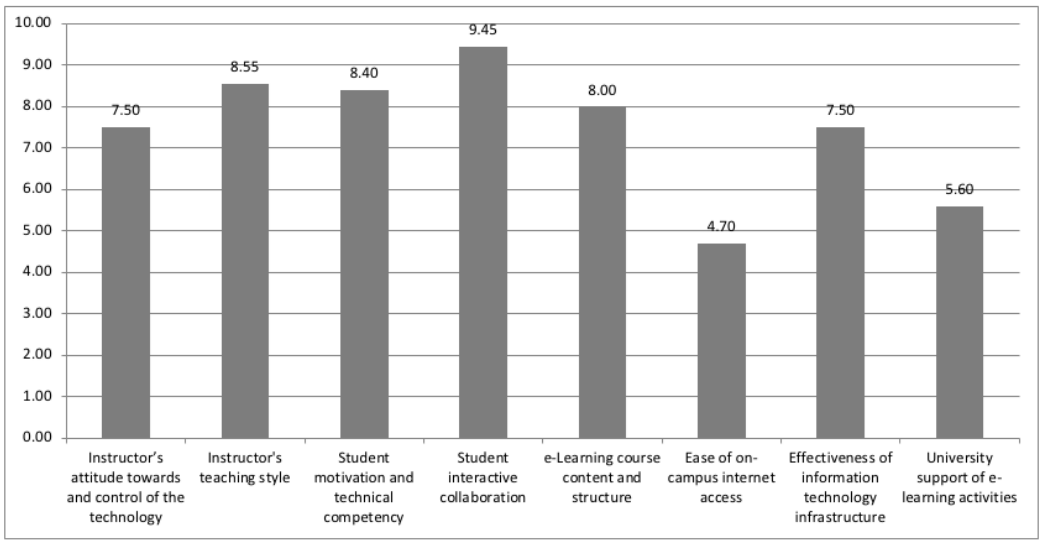

Figure 4 Most determining factors. Source: Self-made

5 DISCUSSION

These results indicated the key factors for the success of the virtualization of teaching in Spanish universities during the COVID-19 pandemic, and as was already intuited in the Introduction, these factors were not linked to the digital environment wherein the training process takes place (which already existed prior to this pandemic), but were linked to the pedagogical aspect. As noted previously, this was something that Cabero (2006) had already highlighted about online teaching before the emergence of the pandemic.

The three most determining factors were student interactive collaboration, instructor's teaching style, and student motivation and technical competency, all factors linked to the pedagogical aspect. Furthermore, among these factors, it is worth highlighting the relevance of the student's role in this success, something that was little observed in the studies that analyzed this situation during this period (García-Peñalvo, Corell, Abella-García, & Grande, 2020; Gewerc, Persico, & Rodés-Paragarino, 2020; Gourlay, 2021; Hernández-Mangas & Álvarez, 2021), but which carries the greatest relevance here.

Many of these previous studies focused on the role of teachers and their ability to use technologies in granting them success (Álvarez Herrero, Martínez-Roig, & Urrea-Solano, 2021; Cahapay & Bangoc, 2021; Melara-Gutiérrez & González-López, 2021). This is something that this study does not want to detract from, but it is true that based on the results of this research (in which the degree of influence of each of the factors on the success of the system is not independently assessed, but rather the influences existing between the factors that make up the system are taken into account), and if the research is limited to the pandemic period, the main responsibility for the success of online teaching in this period lay with the students (specifically with their interactive collaboration and their motivations and technical skills).

Teachers, technological infrastructure and university support all exerted influences on these two factors involving students, which generated student interest in following the training process (which, consequently, made the online teaching process a success). For this reason, despite the relevance of teachers, technological infrastructure and university support (although all performed as would be assumed and did what was expected of them), it was the attitude of the students, their aptitude and their predisposition to continue with the teaching-learning process that was the key, something to which they were not psyched and knew how to adapt.

This indicates success in terms of the level of technological knowledge of students in Spain, something that was already seen in previous studies (A. Infante-Moro, Infante-Moro, & Gallardo-Pérez, 2019, 2020, 2021a, 2021b; A. Infante-Moro, Infante-Moro, Gallardo-Pérez, Martínez-López, & García-Ordaz, 2021; Salas & Pavón, 2020; Salgado-Ferreira, Infante-Moro, Infante-Moro, & Gallardo-Pérez, 2020). What is more, this success is obviously due to the professors who brought that knowledge to students before the pandemic.

6 CONCLUSIONS

The virtualization of university teaching in Spain caused by the COVID-19 pandemic was a success, both because of the digital environment where the training process was carried out and because of the pedagogical aspect.

To this day, online teaching continues to be carried out in many of these universities (due to the continuation of the pandemic), which has allowed many of the factors that should have been taken into account in the transition from face-to-face teaching to online teaching in this pandemic to be omitted due to the urgent nature of the situation.

Thus, in order to find out and analyze the factors causing the success of this virtualization of teaching in Spanish universities and take measures to address the weak points of this process in order for teachers to maintain part of what has been achieved in this virtualization if required in support of their face-to-face teaching, this study focused on locating the determining factors in the success of the virtualization of teaching in Spanish universities during the COVID-19 pandemic.

This study located these determining factors in the role of the student, specifically in the factors of motivation and technical competence of the student, and interactive collaboration of the student. These factors involve the attitude of the students, their aptitude and their predisposition to continue with the teaching-learning process, and in this the work of the teacher has main relevance, as it is the variable that has the greatest influence on these factors.

In this way, attitude towards and control of technology, virtual teaching style, and the creation and structuring of content should be reinforced in teachers, if the use of online teaching is to be maintained as support for face-to-face teaching. To this end, the support of the university institutions must come in the form of training courses in relation to these aspects and in the form of technical assistance.

This would reinforce this online teaching process in institutions that still continue with part of their teaching remotely and would add value and success to the teaching process for teachers who would like to maintain some of the tools used during this virtualization to support their face-to-face teaching. This is in addition to the fact that if any circumstance were to arise again that would necessitate compulsory online teaching, it would cause less concern about the loss of quality in the teaching process.

This research was limited to the study of the determining factors in the success of virtualization of teaching in Spanish universities during the COVID-19 pandemic in order to take measures to address any weak points of this process in case teaching staff would like to maintain use of online teaching as support for face-to-face teaching, but when talking about maintaining the use of online teaching, we are talking about a very generalized process, since there are many tools used in this process and the success in the use of each one depends on different factors. Thus, this generalization of the process could be eliminated in future studies and the studies could be delimited to locate the key factors in the success of the use of specific tools of the online teaching process during the pandemic.

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