E-Learning Critical Success Factors in Moroccan Universities during the Covid-19 Pandemic: Case Moulay Ismail University

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Abstract: The pandemic COVID-19 has significantly disrupted the world, higher Education is among the most impacted activities when schools and universities remained closed all over the world. In response to the state of health emergency implemented by Moroccan authorities to minimize the spread of the coronavirus, the Ministry of Higher Education, Scientific Research and Professional Training have decided to suspend classroom courses in all educational institutions from 16 March 2020 until further notice. This paper proposes to identify the critical success factors (CSFs) for the remote learning mode adopted by the Moroccan universities during the COVID-19 pandemic by using two techniques, the first one is the multi-criteria Analytic Hierarchy Process (AHP), and the second is Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). This study was carried out on a sample of 244 teachers and 3877 students who participated in the surveys established by Moulay Ismail University.

1 INTRODUCTION

The pandemic COVID-19 has significantly disrupted the world, higher Education is among the most impacted activities when education institutions remained closed all over the world. As a result of this situation, Moroccan authorities declared a state of emergency on 16 March 2020 [1], and many precautionary measures have been taken to ensure a pedagogical continuity, including suspension of the classroom courses in all public and private schools and universities, and adopting distance learning mode, to avoid the spread of the coronavirus[2].

In this pandemic context of the coronavirus Covid-19, Moulay Ismail University has deployed a pedagogical continuity plan to continue the training of its more than 70,000 students through distance learning.

In this study, we determinate the critical success factors (CSFs) during the COVID-19 pandemic from the perspectives of teachers and students by evaluating the E-learning experience during the spring session using multi-criteria decision-making methods.

This research can help decision-makers in Moroccan universities to determine the best strategy to adopt during a crisis by improving the most critical factors to be taken into consideration when implementing any remote learning process.

2 RESEARCH CONTEXT: E-LEARNING IN MOROCCO

Over the last few years, higher Education knows a new dynamic aimed at improving the quality of higher Education and modernize its practices by putting the learner in the center of educational action, and integrating ICT (Information and Communication Technology) into Education, as part of the national strategy. “Maroc Numeric 2013”[3]

To improve performance, quality and productivity, and harmonize with standards

[1] News, Morocco World (19 March 2020). "COVID-19: Morocco Declares State of Emergency". Morocco World News. Retrieved 19 March 2020

[2] Courses Suspended in Morocco from March 16 Until Further Notice". Maghreb Arabe Press. 13 March 2020. Retrieved 14 March 2020.

[3] https://lematin.ma/journal/2012/NTI_Strategie-de-Maroc-Numeric-2013--un-premier-bilan-globalement-positif/170317.html

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international organizations and to make it a vector of development, the Moroccan education system has been the subject of numerous reforms and upgrading programs (Alem , 2012):

- The Education Reform (Law 0100), initiated in 2002/2003, consists of establishing the LMD (Bachelor's-Master's-Doctorate) system (Bologna process 1999). The significant contribution of this new reform was the reference to ICT both as an object and as a learning and governance tool for all disciplines and higher education institutions.
- The Emergency Program (2009-2012) aims to increase the reception capacity of universities, improve the quality of training and promote scientific and technical research. This program emphasizes the continuing Education of teachers and requires the university to acquire a Digital Work Environment (ENT) and a strategy for integrating educational technologies in university-wide training.
- Maroc Numeric 2013 is a national strategy, aiming to position Morocco as a regional technological hub and to insert it into the global knowledge economy through its companies and universities. At the university level, it consists of supporting them in equipment and teacher training.
- All these initiatives and efforts have made ICT a vital component as an object and a learning tool in the education system.

3 LITERATURE REVIEW

3.1 Definition of e-Learning

E-learning, also referred to as distance learning, online learning (Sangra, 2011), virtual learning (VL)(Bezhovski et al, 2016), Computer-Based Learning (CBL) (Fenouillet et al, 2006*)* "is a conjunction of information and telecommunication technology (ICT) with educational world" (Grubisic et al, 2009). (Sun et al, 2008) stated that e-learning is delivering and transferring educational learning information through information and communication technology (ICT). The most essential advantages of e-learning are increasing teacher/student interactions and relations between students without location and time limitations via synchronous and asynchronous educational network models (Hameed et al, 2008).

According to (Beningo et al, 2000), e-learning is conducted on the internet, where students can access lectures online at any place and time as needed, and allows them the possibility to review the information many times.

E-learning has two aspects: The first aspect is related to structural issues (technology, learning process, learning design), and the other aspect is related to communicational issues (trainees habits, skills and communication patterns (Beningo et al, 2000).

3.2 Analytic Hierarchy Process (AHP)

In 1980 Saaty developed the Analytic Hierarchy Process (AHP) (Saaty, 1988). This technique is used to manage qualitative and quantitative multi-criteria elements involving in decision-making behavior.

AHP is one of the most inclusive systems, which is considered to make decisions with multiple criteria because this method gives to formulate the problem as a hierarchical and believe a mixture of quantitative and qualitative criteria as well (Taherdoost, 2017).

3.3 Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

The (TOPSIS) method has been developed by Hwang and Yoon in 1981 (Hwang et al, 1981).

This method is used to choose the best alternative among a group of alternatives (Backmann et al, 1981), also, it allows knowing the distance of both the positive and the negative alternatives of the ideal solution (Prakash et al, 2015).

3.4 CSF and Types of e-Learning Systems

The critical success factors are referred to as "characteristics, conditions, or variables that, when properly sustained, maintained, or managed, can have a significant impact on the success of a firm competing in a particular industry" 16 (Alhabeeb et al, 2018). The three types of e-learning systems used in this study are defined in Table 1, to determine the best type of e-learning system associated with AHP and the TOPSIS technique during COVID-19. In Table 2, we defined the factors that were considered in this paper. Fig1 explain the critical success factor hierarchy problem discussed in this study based on the multiple-criteria decision analysis problem representation.

Table 1: Types of E-learning systems

Type	Definition
Face to face learning	Traditional learning where the course content and learning material are taught from teacher to student. This allows for live interaction between a learner and an instructor. (Thai et al 2017) (Young et al, 2014)
Blended Learning	A mix of traditional and online classes. (Graham et al, 2013) (Young et al, 2014)
Synchronous Learning	A real-time interaction distance learning. (Rowe, 2019)

Table 2: definitions and studies related to CSF of e-learning

Factor	Criteria
Learner's dimension	Motivation, learning speed, computer skill, commitment. (Bhuasiri et al, 2012)(Anggrainingsih et al, 2018)
Instructor's dimension	Teaching style, instructor attitude to the student, knowledge of learning technology. (Bhuasiri et al, 2012)(Anggrainingsih et al, 2018)
Learning Environment dimension	Learning management system, technical infrastructure, design of user interface, network security. (Bhuasiri et al, 2012) (Anggrainingsih et al, 2018)
Course dimension	Sufficient, updated and understandable content. (Bhuasiri et al, 2012) (Anggrainingsih et al, 2018)
Support dimension	Providing financial support, communication tools, help disk availability, and training. (Bhuasiri et al, 2012) (Anggrainingsih et al, 2018)

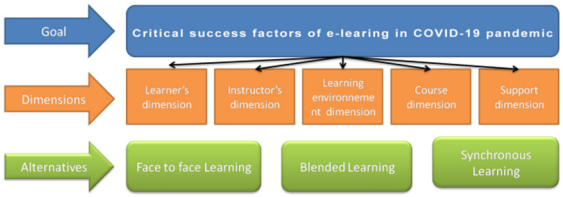

Figure 1: Hierarchical structure for dimensions and CSFs of E-learning system.

4 RESEARCH METHODOLOGY

The methodology used in this paper is based on three parts, a survey, the AHP method, and the TOPSIS method, a detailed description of each part will be presented in the next sections.

4.1 Data Collection

This study is based on data collected from two surveys released by Moulay Ismail University, the first was for teachers [4], and the second was for students [5]. Table 3 summarizes the teachers who participated in the study regarding seniority, disciplinary field, degrees concerned by E-learning, and table 4 summarizes the students who participated regarding gender, place of residence, faculty, and cycles of studies.

Table 3: Teachers demographic data

		Frequency	Percentage
Seniority	Less than 5 years	54	22%
	From 5 to 10 years	48	20%
	From 11 to 20 years	32	13%
	More to 20 years	110	45%
disciplinary field	Sciences and techniques	83	34%
	Legal sciences	17	7%
	Economic Science and Business Administration	23	9%
	Letters and human sciences	73	30%
	Engineering Sciences	39	16%
	Educational Sciences	9	4%
degrees concerned by E-learning	Technological University Degree	22	6%
	Bachelor	187	54%
	Master	105	30%
	Engineering degree	33	9%
	ENCG degree	2	1%

[4]https://questionnaire.umi.ac.ma/index.php/179221
[5]https://questionnaire.umi.ac.ma/index.php/747239

Table 4: Students demographic data

		Frequency	Percentage
Gender	Male	1898	49%
	Female	1979	51%
Place of residence	Rural area	1060	27%
	Urban area	2817	73%
Faculty / school	FLSH	412	11%
	FSJES	611	16%
	FS	624	16%
	FST	476	12%
	FP	233	6%
	ENSAM	744	19%
	ENS	132	3%
	EST	217	6%
	ENCG	2	0%
	No response	426	11%
Cycle of studies	Bac + 2	299	8%
	Bac + 3	1813	47%
	Bac + 5	1258	32%
	Other	457	12%
	No response	50	1%

4.2 The Analytic Hierarchy Process

To use the AHP method, the following steps are applied (Saaty, 1988) (Alqahtani, 2020):

1. Completing the pairwise comparison matrix Table 5 using the ratings in the table 6, by evaluating every two criteria at a time in terms of their relative importance. The diagonal of the matrix contains only values of 1.

Table 5: Pairwise comparison matrix

	Students dimension	Instructors dimension	Learning Environment dimension	Instructional Design dimension	Support dimension
Students dimension	1	1/2	1	1	1
Instructors dimension	2	1	3	2	2
Learning Environment dimension	1	1/3	1	1/2	1/3
Course dimension	1	1/2	2	1	1/3
Support dimension	1	1/2	3	3	1

Table 6: Analytic Hierarchy Process (AHP) ratings

Verbal Judgment of Preference	Numerical Rating
3	Extremely preferred
2	Strongly preferred
1	Equally preferred

2. Calculating the criteria weight, by creating a normalized comparison matrix where each value in the matrix is divided by the sum of its column table 7.

Table 7: Normalized matrix

	Students dimension	Instructors dimension	Learning Environment dimension	Instructional Design dimension	Support dimension
Students dimension	0,166	0,166	0,100	0,142	0,217
Instructors dimension	0,330	0,357	0,300	0,285	0,434
Learning dimension	0,166	0,119	0,100	0,070	0,070
Course dimension	0,166	0,166	0,200	0,142	0,070
Support dimension	0,166	0,166	0,300	0,428	0,217

3. Determine the average priority vector by averaging across the rows, the sum of all elements in priority vector is 1. The priority vector shows relative weights among the things that we compare, as shown in table 8.

Table 8: priority vectors

Students dimension	Instructors dimension	Learning Environment dimension	Instructional Design dimension	Support dimension
0,158	0,341	0,105	0,141	0,255

4.3 The Technique for Order Preference by Similarity to Ideal Solution

The TOPSIS process is carried out by applying the following steps as defined on (Alqahtani, 2020) (Sunardi, 2019):

1. Form the matrix expressed as follows:

$$D = \begin{Bmatrix} A_1 & X_1 & X_2 & \cdots & \cdots & X_n \\ A_2 & X_{11} & X_{12} & \cdots & \cdots & X_{1n} \\ A_3 & X_{21} & X_{22} & \cdots & \cdots & X_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ A_m & X_{m1} & X_{m2} & \cdots & \cdots & X_{mn} \end{Bmatrix}$$

Where:

Ai = ith alternative project and Xij= the numerical outcome of the ith alternative project compared to the jth criterion.

Table 9 is the result of the TOPSIS matrix.

Table 9: TOPSIS matrix

	Students dimension	Instructors dimension	Learning Environment dimension	Course dimension	Support dimension
Face to Face Learning	3	3	1	3	1
Blended Learning	2	3	3	2	2
Synchronous Learning	2	2	1	2	2

2. The normalized matrix is obtained by applying the following formula :

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{n} X_{ij}^2}} \quad (1)$$

Table 10 shows the TOPSIS normalize matrix.

Table 10: TOPSIS normalize matrix

	Students dimension	Instructors dimension	Learning Environment dimension	Course dimension	Support dimension
Face to Face Learning	0,727606875	0,639602149	0,301511345	0,727606875	0,33333333
Blended Learning	0,48507125	0,639602149	0,904534034	0,48507125	0,66666667
Synchronous Learning	0,48507125	0,426401433	0,301511345	0,48507125	0,66666667

3. During this step, we construct the weighted normalize decision matrix by multiplying the normalized decision matrix by its relative weights, the result is shown in table 11. The following formula is applied to calculate the weighted normalized value V_{ij}

$$V_{ij} = W_{ij} R_{ij} \quad (2)$$

Table 11: weighted normalize decision matrix

	Students dimension	Instructors dimension	Learning Environment dimension	Course dimension	Support dimension
Face to Face Learning	0,115107408	0,218232253	0,031658691	0,108267903	0,08513333
Blended Learning	0,076738272	0,218232253	0,094976074	0,072178602	0,17026667
Synchronous Learning	0,076738272	0,145488169	0,031658691	0,072178602	0,17026667

4. Define both the ideal best and ideal worst value

$$V^+ = (max\ v_{ij}) \quad (3)$$

$$V^- = (min\ v_{ij}) \quad (4)$$

Table 12 shows the TOPSIS positive and negative ideal solutions.

Table 12: the ideal best and worst values

	Students dimension	Instructors dimension	Learning Environment dimension	Course dimension	Support dimension
Face to Face Learning	0,115107408	0,218232253	0,031658691	0,108267903	0,08513333
Blended Learning	0,076738272	0,218232253	0,094976074	0,072178602	0,17026667
Synchronous Learning	0,076738272	0,145488169	0,031658691	0,072178602	0,17026667
V^+ (best value)	0,115107408	0,218232253	0,094976074	0,108267903	0,17026667
V^- (worst value)	0,076738272	0,145488169	0,031658691	0,072178602	0,08513333

5. Calculating the Euclidean distance from ideal best and worst value Table 13, by applying the following formula :

$$S_i^+ = \sqrt{\sum_{j=1}^{n} \left(V_{ij} - V_j^+\right)^2} \quad (5)$$

$$S_i^- = \sqrt{\sum_{j=1}^{n} \left(V_{ij} - V_j^-\right)^2} \quad (6)$$

6. Calculating the performance score P table 13, by using the following formula :

$$P_i = \frac{S^-}{S_i^+ + S_i^-} \quad (7)$$

Table 13: Euclidean distance from best and worst value and performance score

	S^+	S^-	$S^+ + S^-$	P
Face to Face Learning	0,106097952	0,08981275	0,195910702	0,458437182
Blended Learning	0,05267474	0,128640885	0,181315625	0,70948593
Synchronous Learning	0,10988822	0,085133333	0,195021554	0,436532946

7. The last step is ranking the order of preference alternatives. Table 14 shows the result of the ranking of alternatives.

Table 14: ranking the alternatives

	P	Rank
Blended Learning	0,70948593	1
Face to Face Learning	0,458437182	2
Synchronous Learning	0,436532946	3

5 RESULTS AND DISCUSSION

The principal goal of this paper is to identify and analyze the critical success factors of the E-learning system deployed during the COVID-19 pandemic. We used the AHP and TOPSIS methods to analyze the data collected from two surveys. The findings revealed, after calculating every factor's weight, that instructor dimension (0,341), support dimension (0,225), student's dimension (0,158), course dimension (0,141), and learning environment dimension (0,105) table 8 were the most critical success factors influenced the E-learning process during the COVID-19 pandemic.

According to the ranking obtained the most important factors that influencing the remote learning success are:

- The instructor's knowledge of technology: given the importance of this factor, it is necessary to implement a training program for teachers allowing them to integrate educational technologies into their teaching practices.
- Learning environment: This includes the learning management system, networking, technical infrastructure, and other facilities. Decision-makers have to ensure the quality of this infrastructure by allocating an adequate amount of financial and human resources.

On the other hand, and as a result of applying the TOPSIS method, we find that Blended Learning appears to be the best decision alternative for the universities when adopting a distance learning mode during the COVID-19 pandemic with a total weight of 0,709. In the second position, we find face to face learning mode with a total weight of 0,458, and Synchronous learning mode, which was considered to be the third position with a total weight of 0,436 as showing in table 14.

6 CONCLUSION

The universal pandemic Covid-19 in 2020 has helped propel the remote teaching practices of Moroccan universities as in other countries to an unprecedented level. Indeed, the university's pedagogical continuity has been ensured in record time thanks to an up-to-date technological infrastructure of the various university components. Distance Education has proven to be effective in meeting the needs of learners in terms of knowledge acquisition and further study in confinement periods.

This study makes a helpful contribution to better understanding the factors that might impact the adoption and success of e-Learning, and the results found to provide useful information to the decisions makers in the universities in their process of implementing and adopting e-Learning mode in Education.

REFERENCES

Alem N, (2012), numéro 5,Plates-formes d'enseignement à distance dans l'enseignement supérieur, modes d'appropriation et standardisation des usages, *frantice.net.*

Alqahtani, Y., Rajkhan, A., (2020) E-Learning Critical Success Factors during the COVID-19 Pandemic: A Comprehensive Analysis of E-Learning Managerial Perspectives, *Educ. Sci*

A Grubisic, S. Stankov, M. Rosic, B. Zitko, (2009), Controlled experimentreplication in evaluation of e-learning system s educational influence, *Computer & Education*, vo1.53, pp.591-602.

Sun, P.,Tsai, R., Finger, G., Chen, Y., (2008), What drives a successful elearning? An empirical investigation of the critical factors influencing learner satisfaction, *Computers & Education,* pp. 1183-1202, vo1.50.

Hameed, S. Badii, A. Cullen, A.J., 25–26 May (2008), Effective e-learning integration with traditional learning in a blended learning environment*. In Proceedings of the European and Mediterranean Conference on Information Systems*, *Al BustanRotana*, *Dubai*, pp. 25–26.

Benigno. V, Trentin, G., (2000), "The evaluation of online courses", *Journal of Computer Assisted Learning*. pp. 259-270,vo1.l6

Saaty, T.L., (1988), What is the analytic hierarchy process? In Mathematical Models for Decision Support, *Springer, Berlin/Heidelberg, Germany,* pp. 109–121.

Taherdoost, H., (2017), Decision Making Using the Analytic Hierarchy Process (AHP); A Step by Step Approach*, International Journal of Economics and Management System, IARAS.*

Hwang, C.L., Yoon, K., (1981), Multiple Attribute Decision Making: Methods and Applications, *Springer: Berlin/Heidelberg, Germany.*

Beckmann, M., Künzi, H.P., Hwang, C.L., Yoon, K., (1981), Multiple Attribute Decision Making; Scientific Research *Publishing: Southern California, CA, USA*., volume 186

Prakash, C., Barua, M.K., (2015), Integration of AHP-TOPSIS method for prioritizing the solutions of reverse logistics adoption to overcome its barriers under fuzzy environment, *J. Manuf. Syst*. 37, 599–615.

Leidecker, J.K., Bruno, A.V, (1984), Identifying and using critical success factors*, Long Range Plan*. 17, 23–32.

Alhabeeb, A., Rowley, J., (2018), E-learning critical success factors: Comparing perspectives from academic staff and students, *Comput. Educ,* 127, 1–12.

Scholkmann, A., (2017), What I learn is what I like. How do students in ICT-supported problem-based learning rate the quality of the learning experience, and how does it relate to the acquisition of competences?, *Educ. Inf. Technol,* 22, 2857–2870.

Graham, C.R., Woodfield, W., Harrison, J.B, (2013), A framework for institutional adoption and implementation of blended learning in higher education, *Internet High Educ,* 18, 4–14.

Thai, N., De Wever, B., Valcke, M., (2017)*,* The impact of a flipped classroom design on learning performance in higher education: Looking for the best "blend" of lectures and guiding questions with feedback, *Comput Educ,* 107, 113–126.

Sunardi, ., Robo, S. and Trisno, (2019), MADM Model for Evaluation of Non-permanent Teacher Performance using Fuzzy AHP and TOPSIS Methods *In Proceedings of the International Conferences on Information System and Technology (CONRIST 2019)*, pages 98-104, SCITEPRESS.

Young, T.P., Bailey, C.J., Guptill, M., Thorp, A.W., Thomas, T.L., (2014), The flipped classroom: A modality for mixed asynchronous and synchronous learning in a residency program, *West. J. Emerg. Med*, 15, 938.

Rowe, J.A., (2019)*,* Synchronous and Asynchronous Learning: How Online Supplemental Instruction Influences Academic Performance and Predicts Persistence*. Ph.D. Thesis, Capella University, Minneapolis, MN, USA*.

Alhabeeb, A., Rowley, J., (2018), E-learning critical success factors: Comparing perspectives from academic staff and students, *Comput. Educ*, 127, 1–12.

Bhuasiri, W., Xaymoungkhoun, O., Zo, H., Rho, J.J., Ciganek, A.P., (2012), Critical success factors for e-learning indeveloping countries: A comparative analysis between ICT experts and faculty, *Comput Educ*, 58, 843–855.

Anggrainingsih, R., Umam, M.Z., Setiadi, H., (2018), Determining e-learning success factor in higher education based on user perspective using Fuzzy AHP, *MATEC Web Conf,* 154, 03011.

Behzadian, M., Otaghsara, S.K., Yazdani, M., Ignatius, J., (2012)*,* A state-of the-art survey of TOPSIS applications, *Expert Syst. Appl,* 39, 13051–13069.