Impact of Distance Learning on Education Quality in Regulated Access Institutions

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Abstract. Our research aims to assess the relative impacts of "Methods and Pedagogy," "Materials and Didactic Support," "Atmosphere and Interaction between Students and Teachers," and "Psychological Dimension" on the performance of online education. Employing structural modeling with latent variables through XLSTAT on a sample of 152 students from Hassan II University of Casablanca, we concluded that these selected factors generally have a weak to very weak impact on performance in distance education. Nonetheless, two invalid correlations were identified: one between "Methods and Pedagogy" and "Psychological State," and another between "Materials and Didactic Support" and "Psychological State." However, the psychological dimension does have a moderately positive impact on outcomes related to distance education. Indeed, our study indicates that distance education does not match the effectiveness of face-to-face instruction. While this new educational approach has prevented a year of academic loss for students, it still requires significant enhancements in pedagogical, didactic, and psychological domains.

Keywords: Distance Learning, Quality of Education, Causal Model, Structural Equations, PLS Approaches.

1 Introduction:

The health crisis Attributable to Covid-19 has led to an unprecedented pandemic situation, disrupting our routines and leading to changes in various contexts (educational, economic, sociological, political, etc.). In Morocco, on the educational level, in order to ensure pedagogical continuity since the lockdown on March 20, 2020, as face to face learning was replaced by distance learning (DL). This new mode of teaching required teachers to organize themselves and communicate directly with learners through digital platforms, which imposed the need to address additional contextual constraints (socio-cultural and material). This emergency solution primarily focused hardware and software tools, with the requirements of teaching quality assurance in teaching not being a

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priority. After over a year of practicing distance learning, reflection is necessary on the integration of practices and tools of this teaching mode into the quality approach for better satisfaction of relevant stakeholders.

It is worth noting that a positive outcome of this pandemic was the significant number of teachers compelled to mobilize to make distance learning successful **[1] [24] [26] [32] [33]**. During the lockdown, teachers' practice became the designated variable for organizing "virtual classes" **[7]**. Additionally, emergency remote teaching was not based on a pre-existing framework, as this period of confinement was not anticipated **[6]**.

Indeed, based on a literature review, we observed that the period of the Covid-19-related health crisis is characterized by a significant number of scientific publications from the start of the pandemic **[1] [9] [10] [11] [20] [24] [27] [28] [30] [32] [33] [41]**. A substantial portion of these publications focuses on the psychological dimensions of confinement for the population. Following a descriptive approach using an online questionnaire distributed to university students from various regions, asserted that the majority of Moroccan students share common views on distance learning, which broadly touch on dissatisfaction with past experiences and the "devices" implemented by universities, a lack of planning and ineffective management of online courses, insufficient time devoted by professors to televised distance teaching compared face to face teaching, and the fragility of administrative and technical support from university institutions. Moreover, this situation was exacerbated by difficulties related to internet connectivity. On the contrary, **[12]** shown that most students had a favorable opinion of distance learning, as long as the DL system useful for the learning process was easy to use, which positively influenced the acceptance of DL.

This article aims to propose some avenues for improving distance learning in a regulated accessed institution. To achieve this, we focus on the student as a stakeholder, and we ask how the student experienced almost three semesters of distance learning? We propose a causal model through which we seek to measure how students perceive these tools and the challenges they have encountered, as well as how the usage of distance learning technologies affects the quality of education. This purpose, we use structural modelling with latent variables, based on PLS approaches, on a sample of 152 students from the Hassan 2 University of CASABLANCA. Our exploratory study will be conducted through a survey using questionnaires administered to students. Thus, our study aims to identify the various psychological, social, cultural, and material barriers of distance learning in a regulated accessed university and to emphasize the different mechanisms that can enhance the quality of education.

2 State of the Art:

Examples of teaching models: In 2020, physical distance will force many teachers to adopt teaching models that were new to them. The selection process varied from educational institution to educational institution, and teacher to teacher. There were several types, focusing primarily on remotely based cases. We can consider an eight-level curriculum model **[25] [31]**:

- face-to-face: A course that is taught in a classroom setting utilizing a variety of techniques (lecture, workshop, laboratory, etc.), and where ICT is utilized either through computer-assisted tools or for simulation.
- Face-to-face distance learning: Online courses that combine video conferencing with in-person instruction.
- Hybrid courses are those in which virtual activities take the place of a significant portion of in-person instruction.
- Asynchronous Online Learning: This type of learning involves providing all resources and tasks to students, letting them decide when to complete and allowing them to message classmates or the instructor as required.
- Synchronous Online Learning: This type of learning involves providing all resources and services to students who require them to participate in particular classes or transitions at particular times and with particular technological tools.
- Blended learning (Hybrid online): Online education that combines synchronous and asynchronous learning methods.
- Flexible, Comodal, or Hyflex: Online (synchronous or asynchronous) and in-person choices are offered to students enrolled in these courses. During the course, this procedure can be completed.

Concept and Definition of Distance Learning. The French Standardization Association (AFNOR) defines distance learning as a type of instruction intended to enable learners to acquire knowledge without the requirement for physical presence of a teacher or travel to the training site. The more general idea of open and remote learning encompasses distance learning. Stated differently, this sort of education refers to a teaching approach offered by an organization that does not necessitate the instructor and pupils being there in person. According to **[3]**, remote learning is typically used to provide educational and training opportunities for professionals and students who lack the time or physical capacity to attend classes provided by public or commercial organizations.

Characteristics of Distance Learning. According to a study of the research, accessibility, contextualization, flexibility, and interaction and teamwork are the key elements of distant learning.

- Accessibility: As per references **[17]** and **[25]**, e-learning or distant learning is typified by adaptability in terms of time and place. This makes learning easier for students and provides teaching and learning scenarios that consider the unique limitations of every student **[25]**.
- Contextualization: As stated in **[17],** distant learning enables people to acquire knowledge in the local environment in which it would normally be applied. It keeps continuous, direct, and instantaneous interaction with the different elements of the surroundings **[25]**.

- Flexibility: According to **[17]**, distant learning employs strategies that let students schedule their study sessions in terms of both time and location and determine their own learning pace. Additionally, it may create activities that provide the student options for interactions, material, and methods—thereby accounting for individual characteristics **[18]**.
- Collaboration and Interaction: As stated by **[25]**, the learning process is largely dependent on the student-teacher and student-peer interactions. According to the author, learners must first comprehend and assimilate the course material, which requires them to examine and reorganize their own understandings. This is accomplished by having conversations with peers, or other students, and the tutor, which enables them to come to a mutually agreeable agreement between the various students and the tutor **[25]**. This kind of engagement can also take place in group work when learners and tutors exchange ideas during a lesson, with each student actively contributing to the group's solution of the given task **[25]**.

Research Model and Hypothesis A literature review was conducted initially to develop our conceptual model, but we could not find models that measure how distant learning affected students' academic performance. However, there are many models developed in other scientific fields, such as quality-performance, quality-CSR, quality-growth... **[2] [4] [5] [22] [23] [4]**.
We want to quantify the influence of distant learning on academic achievement and ascertain the degree to which it can replace in-person instruction using our causal model (Fig. 1 and Table 1). In order to do this, the following general hypothesis was developed: "In regulated access institutions, face-to-face instruction has a stronger influence on academic performance than distance learning."
We thus developed a derived hypothesis (a total of 4 derived hypotheses) for each causal link.

Fig. 1. Proposed Model

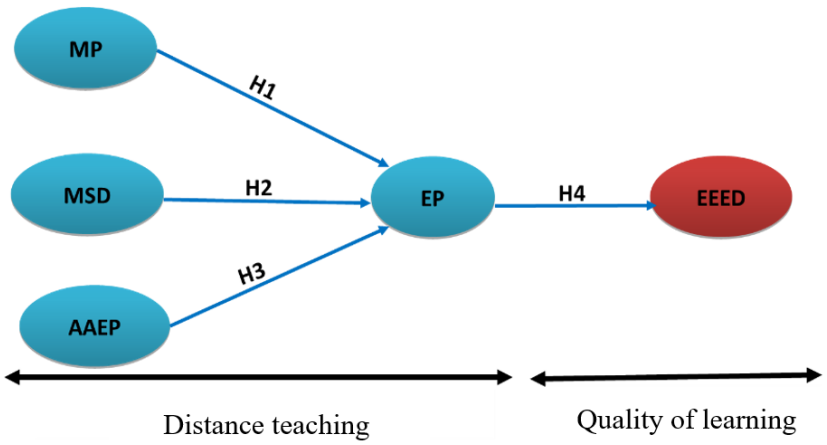


Table 1. Titles of codes used in the research model Constructed

Construct the proposed model	Code	Title
Distance Teaching	**MP**	Method and Pedagogy
	MSD	Materials and Didactic Support
	AAEP	Atmosphere and Interaction between Students and Professors
	EP	Psychological State
Quality of Learning	**EEED**	Evaluation of the Effectiveness of Distance Learning

Methodological Framework of the Research

Sampling: Students at HASSAN 2 University of CASABLANCA. were given a questionnaire via Google Forms, and this was used to collect data.

Model selection: In our study, we applied the PLS method to structural modeling, which involves latent variable equations. There have been identified two primary families of structural equation modeling **[12]**:

- covariance-based methods, modeled with LISREL
- variance-based methods, especially partial least squares (PLS)

The PLS method is especially appropriate for modeling smaller studies and exploratory studies, such as **[13]** and **[29]** showing that it is preferable when the concepts are tentative and measurements are in the developmental stages because it increases the interpretability of the measurement and design model, which takes is involved in this study and therefore we choose the PLS method.

Methodological Framework of the Research: There are five latent variables in the research model, four for distance learning and one for learning quality. A series of questions are used to implement these variables, and the questions are assessed on a five-point Likert scale that goes from "1: very low" to "5: very high".

We analyzed the scale's dependability before confirming the conceptual model's internal and external validity.

Reliability of the measure: Using Cronbach's alpha coefficient to analyze the consistency of the items in each item, we evaluated the measure's reliability. According to **[35]** recommendations, each dimension's consistency above 0.75 (Table 2). This suggests excellent levels of reliability.

In addition, we assessed overall reliability using the Dillon-Goldstein (D.G.) rho coefficient from exploratory factor analysis, where Table 2 shows the satisfac-ry results. Furthermore, Rho coefficient according to exploratory factor analysis was used to evaluate overall dependability. According to the recommendations in **[19]**, all calibration models had D.G. rho values more than 0.8, and Table 2's findings demonstrate that the outcomes were adequate.

Table 2. Reliability of Measures

Latent Variable	Number of Items	Cronbach's Alpha	Rho D.G. (ACP)
MP	9	0,9020	0,9208
MSD	6	0,8500	0,8893
AAEP	7	0,8491	0,8862
EP	10	0,800	0,8452
EEED	8	0,7918	0,8477

Table 3. Eigenvalues of Latent Variables in the Model

MP	**MSD**	**AAEP**	**EP**	**EEED**
5,0994	**3,4409**	**3,7008**	**4,2973**	**3,4075**
0,8305	1,0579	0,8324	1,2234	1,0438
0,7513	0,5269	0,7577	1,1206	0,8818
0,5780	0,4382	0,5874	0,8231	0,8087
0,4812	0,3038	0,4276	0,6959	0,5428
0,3850	0,2324	0,3786	0,5234	0,5245
0,3395		0,3155	0,4156	0,4298
0,2840			0,3976	0,3611
0,2511			0,3012	
			0,2020	

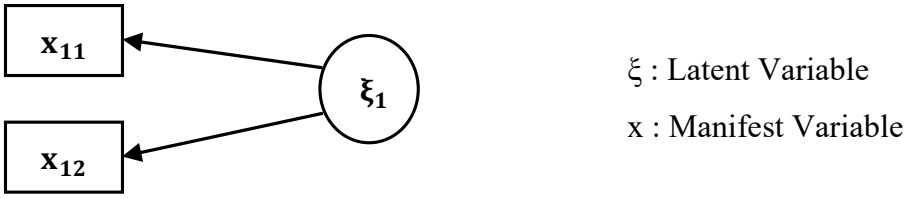
According to Table 3, we can see that the first "eigenvalue (EV)" for each "latent variable" is greater than 1. This "EV" far exceeds the other eigenvalues belonging to each latent variable. These results confirm the good reliability of all measurement scales.

Measurement Model Evaluation. It is noteworthy that [31] states that there exist three distinct methods for establishing a relationship between manifest and latent variables. These methods include formative, reflective, and MIMEC schemes. The scheme (formative, reflective, or MIMEC) used will determine how measurement models (external) are evaluated.

According to the same author, the reflecting scheme (Fig. 3) is the most appropriate in the majority of structural equation models using latent variables; the choice is heavily

influenced by the subjectivity of the researcher. Every visible and hidden variable has an easy regression relationship:

Fig. 2. Figure 2: Reflective Scheme



The following represents the relationship between the latent variable and all of its associated manifest variables:

$$\mathbf{x_{kj} = \pi_{kj} * \xi_k + \varepsilon_{kj}}$$

With:
x_{kj}: Vector linked to the latent variable's jth manifest variable ξ_k
ξ: Latent variable
k: Index of latent variables
kj: Index of manifest variables in block k
π: Loading associated with x_{kj}
ε_{kj}: Error term (measurement errors of manifest variables)

Convergent Validity. By looking at the extracted average variance (AVE), convergent validity was assessed. Table 4 of the study indicates that each component has appropriate AVE thresholds (> 0.5) in accordance with the standards provided in **[19]**, showing high convergent validity. Put otherwise, the variance of each standardized item should be shared by its latent concept more so than by its mistake. Good convergent validity is confirmed by the Dillon-Goldstein (D.G.) rho coefficient from confirmatory factor analysis, which also shows significant for all measurement models.

Table 4. Quality index of measurement models

Latent Variable	AVE	Average Redundancy	Rho de D.G.
MP	0,5646	-	0,9208
MSD	0,5731	-	0,8893
AAEP	0,5253	-	0,8862
EP	0,3734	0,0688	0,8452
EEED	0,4060	0,0908	0,8477

Discriminant Validity. The discriminant validity is tested in accordance with [15]'s recommendations. This method allows for the evaluation of discriminant validity by comparing the two-way correlation between the factorials, for each factor, with the square root of the extracted variance (AVE). When the AVE's square root is higher than the factor correlations, discriminant validity is excellent. Divergent validity is achieved when there is more information flow between latent variables and their indicators than there is between other latent variables. Put otherwise, there need to be at least a minimum connection between the questions measuring one occurrence and the ones evaluating one construction.

Table 5. Discriminant Validity

	MSD	**AAEP**	**EP**	**EEED**	**AVE**
MSD	**0,7570***				0,5731
AAEP	0,3886	**0,7248***			0,5253
EP	0,1196	0,2232	**0,6110***		0,3734
EEED	0,2229	**0,5440**	0,1695	**0,6372***	0,4060

* The square root of the AVE

Validation of the Structural Model. The kind of the connections within the latent variables is specified by the structural model. It is significant to remember that while discussing the variance analysis using the PLS method, there are no adjustment indices to evaluate the model's fit. Thus, the predictive significance of the metrics serves as the foundation for the PLS model's assessment.

We will use the following criteria to do this:

- **Index of Goodness of Fit (GoF):** This index takes into considering both the measurement model's and the structural model's performance **[39]**. It is defined as the average R^2 related to the endogenous latent variables ($\overline{R^2}$) and the geometric mean of the average communities (AVE) across all latent variables ($\overline{H^2}$):

$$GoF = \sqrt{\overline{H^2} \times \overline{R^2}}$$

The standard indications for this index are $0.1, 0.25,$ and $0.36,$ according to **[40]**. These reflect low, medium, and high degrees of model adequacy, respectively. Therefore, the research model may be maintained in its current form with regard to the threshold (GoF>0.5) in line with the results (Table 6) and in accordance with **[40]**.

Table 6. Adjustment Indices

	GoF	**Standard Error**	**Critical Ratio (CR)**
Absolute	0,3145	0,0420	7,4824
Relative	0,6488	0,0555	11,6899

External Model	0,9777	0,0321	30,4451
Internal Model	0,6636	0,0519	12,7813

- **R^2**: It typically has three values: 0.67, 0.33, and 0.19. They are classified as considerable, moderate, and weak, in that order **[14]**. The R^2 and adjusted R^2 results displayed in Table 7 can be retained for all internal models according to **[14]** guidelines**.**

Table 7. R^2 and Adjusted

	MP	**MSD**	**AAEP**	**EP**	**EEED**
R^2	-	-	-	0,2432	0,2331
Adjusted R^2	-	-	-	0,1695	0,1695

- **Effect Size (f^2):** The structural coefficients' validity and magnitude are guaranteed by this index. It is determined by contrasting the amount of variation explained by the model with and without the explanatory latent variable taken into account. Take note of this:

$$f^2 = \frac{R^2\text{incl} - R^2\text{excl}}{1 - R^2\text{incl}}$$

These are its typical values: 0.02, 0.15, and 0.35. According to reference **[16]**, these numbers represent mild, medium, and substantial impacts, respectively. The survey's results show the validity of both the internal structural model and the exterior measurement model.

Structural Equations of the Conceptual Model.
Two endogenous variables and three exogenous variables make up our model. An error term, one or more variables, and each endogenous variable explain the data. The linear equations that link the latent variables to one another define the internal model. We have the following for every endogenous variable ξk :

$$\xi k = \sum_{i:\xi i \to \xi k} \beta_{kj} + \zeta_k$$

where the coefficient related to the correlation between the variables ξk et ξi is denoted by β_{kj}.
ζk is an error term, and $\xi i \to \xi k$: ξi explains ξk in the model.

Two equations in the model were evaluated with the XLSTAT program and the PLS approach. The conceptual model's structural equations are shown as follows:

EP = 0.23599MP - 0.01184MSD + 0.29453AAEP
EEED = 0.41165EP

Hypotheses Testing. Four derived hypotheses (Table 8) and one global hypothesis (HG) will be tested.

The global hypothesis HG being: "distance learning had a weak impact on academic performance in regulated access institutions."

Table 8: Research Hypothesis Testing

Hypothetical Relationships	**Path Coef-ficient (β)**	**Stu-dent's T**	**Effect Size f²**	**Signifi-cance**	**Hypothe-ses Vali-dation**	**Nature of Relation-ship**
H1: MP----→ EP	0,2360	1,7555	0,0208	**No**	**Invalid**	**Weak**
H2: MSD----→ EP	-0,0118	-0,1112	0,0001	**No**	**Invalid**	**Very weak**
H3:AAEP----→EP	0,2945	2,5367	0,0435	**Yes**	**Valid**	**Weak to medium**
H4: EP----→EEED	0,4116	5,5321	0,2040	**Yes**	**Valid**	**Medium to large**

Student's T test values greater than |2.775| (|1.960|) indicate significant parameters at the 1% (5%) level.

Table 8 indicates that two of the hypotheses, 3 and 4, are true (T>|1.960|); the other two are not (T<|1.960|).

The completed model may be shown as follows:

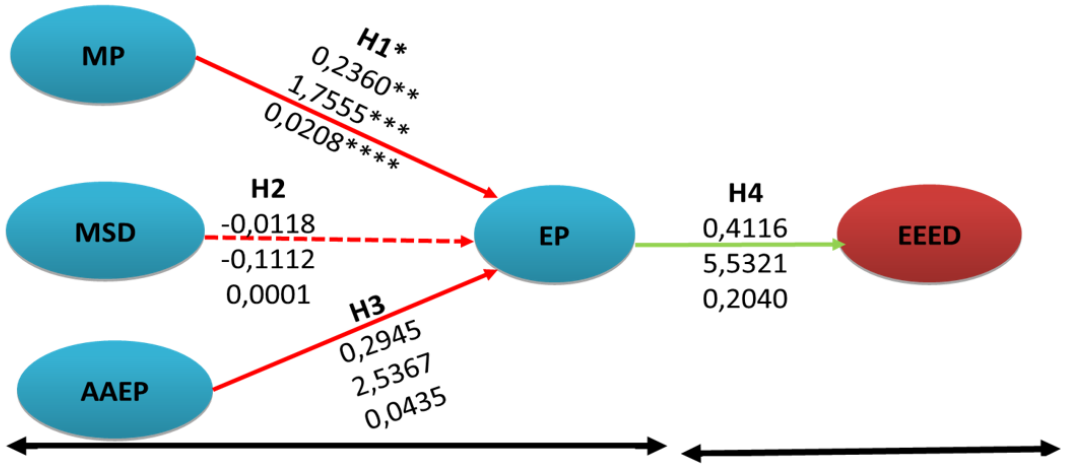


Fig. 3. Final Model Estimated by the PLS Approach

Table 9. Indirect Effects between Latent Variables

	MP	MSD	AAEP	EP
MP				
MSD	0,0000			
AAEP	0,0000	0,0000		
EP	0,0000	0,0000	0,0000	
EEED	0,0971	-0,0049	0,1212	0,0000

Interpretation of Results.
It is important to note that the primary goals of this empirical study are to determine whether certain elements have an effect on students' psychological well-being in regulated access institutions and whether distant learning can completely replace in-person education.

To do this, four research hypotheses were formulated. Our study concludes that two of these hypotheses are valid (T>1.96) while the other two are not (T<1.96).

The following were emphasized in light of **Table 8** and **Figure 3** results:

Direct Effects between Distance Learning Factors and Academic Performance are:

- The variable 'Teaching Methods and Pedagogy' has positive influences that are statistically non-significant (T<|1.960|) and have low effect sizes on the latent variable 'Psychological State' (β =0.236, f^2 =0.0208, t = 1.755, p > 0.05).
- The variable 'Material and Didactic Support' has a very weak and negative impact that is statistically non-significant (T<|1.960|, β =-0.0118, f^2 =0.0001, t = -0.1112, p > 0.01).
- The atmosphere and interaction between students and teachers have positive influences that are statistically significant (T>|1.960|) with low effect sizes on the latent variable 'Psychological State'.
- The latent variable 'Psychological State' has positive influences, statistically significant, and has medium-sized effects on academic performance (β =0.4116, f^2 = 0.2040, t = 5.5321, p < 0.01).

Indirect Effects between Distance Learning Factors and Academic Performance:

Referring to Table 9, we can observe that the factors 'Teaching Methods and Pedagogy', 'Material and Didactic Support', and 'Atmosphere and Interaction between Students and Teachers' have very weak to weak impacts on distance academic performance.

In fact, our results are similar to those of **[21]**, indicating a lower satisfaction of distance students, even taking into account their more atypical profile: distance students are generally slightly less satisfied with their education. On the other hand, a study by **[8]** on Master's students in French Language and Linguistic Diversity at the Faculty of Letters and Human Sciences in Kénitra showed that the majority of students agree that online courses are more motivating and profitable than traditional ones.

Conclusion

According to our study, it is now possible to affirm that the selected factors related to distance learning generally have a very weak to weak impact on academic performance in terms of theoretical and practical achievement. Also, we found that the psychological dimension moderately influences academic performance, which requires learner preparation to encourage and motivate them to participate actively and, above all, to be involved in building their own knowledge and engage in course construction with the teacher and their colleagues.

Therefore, to improve the academic performance of regulated access institutions, it is imperative to review pedagogical methods, didactic tools and materials, and focus on the psychological dimension. In other words, it is necessary to look for new didactic and material tools adapted to this type of teaching, expand and strengthen network coverage, and emphasize the training of teachers and trainers to improve the effectiveness of teaching in distance education.

Limitations of this Research

It should be noted that each research effort, including this one, has its limits for a number of reasons:

- There are several drawbacks to the questionnaire-based data collecting approach. It solely permits the gathering of subjective information and data (student perceptions).
- It is noteworthy that additional factors may potentially have an influence on the axis associated with academic achievement.

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