

Validation and use of a framework to assess challenges to virtual education in the context of emergency remote teaching: Peru and Spain

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Abstract. *In this study, the validity and use of a recently developed evaluation Framework to Assess Challenges To Virtual Education (FACVE) were tested and refined using a comparative perspective between students from Peru and Spain. The findings provide a limited endorsement for the validity of the assessment framework while also highlighting interesting similarities and differences between the students from both countries in terms of the challenges faced in the context of virtual education. This study demonstrates that the FACVE is a valid assessment instrument and can be used in any country or institutional context by selecting the relevant dimensions and sub-dimensions of interest.*

Keywords. Virtual education challenges, FACVE, emergency remote teaching, e-learning readiness.

1 Introduction

The outbreak of COVID-19 and the resulting pandemic presented a significant obstacle to education at all levels. A staggering 168 million schoolchildren across 14 nations were affected by school closures (Unicef, 2021). Higher education, like other levels of education, required an adaptation and reconfiguration of its traditional teaching methodology. Teaching suffered a forced transformation process to an online model, which involved the acquisition of certain competencies and characteristics specific to online education (Area

Moreira et al., 2020), as well as some challenges arising from the transition.

This forced adaptation from a face-to-face model to a distance model has been called emergency distance education by some authors (Adell, 2020) or Emergency Remote Teaching (ERT), which, in contrast with long-planned online experiences, is an abrupt and temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances (Charles Hodges et al., 2020; Whittle et al., 2020). Both faculty and students were forced to change their traditional practices having to respond to the same assessment models (Ligardo-Herrera et al., 2022).

The transformations and adjustments experienced in university education have yielded valuable insights for virtual education. This paper delves into the analysis and solution of the impediments to virtual education in the ERT framework. The focus is particularly on individuals who have traditionally pursued face-to-face education and were compelled to shift to virtual learning in two distinct countries.

2 Theoretical Background

An evaluation framework was recently proposed to assess challenges to virtual education in the case of ERT (Mu et al., 2022). It was developed in the context of a pandemic in a specific developing country (Peru) and from a student perspective. What makes this framework unique is that it was developed from the

students' perceptions of challenges faced in the ERT context using a mixed qualitative and quantitative research approach. Various frameworks regarding virtual education have been discovered in the literature while FACVE is the first to deal with ERT contexts (Elahi et al., 2023; Mukasheva et al., 2023; Tiemann & Annaggar, 2023; van den Beemt et al., 2023).

In this study, the validity and use of this assessment framework in other contexts were explored and refined using a comparative perspective. The virtual education challenge assessment framework (FACVE) is structured in a way that it can be used in any country or regional context simply by selecting the relevant dimensions and sub-dimensions of interest. The present case study was developed by surveying students in Peru and Spain using relevant criteria. Those indicators directly related to the pandemic were not considered, given that the data collection for the present study took place a considerable time after the pandemic was over. The goal was first, to confirm the validity of the proposed evaluation framework and second, to use this framework to compare the original results from institutions in Peru with those in Spain; two countries with different levels of socio-economic development. Hence, the aim of the present study was to test and refine a framework to assess the challenges of virtual education in the context of ERT. This study provides the first confirmation of the validity and convenience of using the proposed *Framework for the Assessment of Challenges in Virtual Education (FACVE)* as well as highlights the unexpected differences in virtual education challenges based on different economic contexts. This research is significant as it is the first to confirm the validity of the FACVE and to be tested in a real educational context, adding to the growing body of the existing literature on virtual education (Bearman et al., 2023; Mou, 2023; Wong, 2023).

3 Methodology

The study was developed using a quantitative approach. Students from Peru and Spain were surveyed using the recently developed FACVE (Mu et al., 2022).

The target institution in Peru is a private leading higher education institution. The participants were all graduate business students taking courses at the time of the study. At the beginning of the pandemic, the University was closed to facilitate the reorganization to remote work. Previously, virtual teaching was not used or was used very little (work was always performed in person on the University campus). The university closed while their faculty was trained in the use of technology to teach in virtual environments. Furthermore, some more technically savvy instructors were used as additional trainers and advisors in virtual teaching for the least technology-oriented teachers.

The data in Spain was collected from two institutions. Both institutions are public universities,

one oriented toward social sciences and the other toward engineering. As a result of the health emergency caused by COVID-19, in March 2020, teaching at both institutions switched from traditional to virtual instruction through specialized platforms such as Microsoft Teams. No additional instructions were provided to the faculty.

Finally, for practical terms, the data collection in both countries was conducted during January 2021 to March 2022, once the lockdown period was over and the pandemic controlled.

The main aspects related to the methodology are detailed as follows.

3.1 Data collection

The original FACVE proposed seven dimensions (Table 1). These dimensions were screened in order to select only those relevant for the comparison of the data in the two different contexts of Peru and Spain.

Two criteria were considered when screening the dimensions. The first was to eliminate all the dimensions that were directly related to the pandemic such as "Personal and Psychological Issues" (C3). This dimension includes sub-dimensions such as "Health Concerns" that had indicators that were specifically linked to the pandemic context (e.g. "I am concerned about family/friends who have become ill"), which was over at the time of the current data collection. The second criterion was the ability of the variables to allow a fair comparison of the results for both countries. For this reason, dimension C6 "Financial Issues" (e.g. "I am worried about my financial situation") was discarded given that the financial issues of the students were expected to be very different between the two countries, given that Peru is a developing country while Spain is a developed country. Finally, dimension C7 "University Administration and Costs" was discarded given that the indicators were not applicable to the public education context in Spain, unlike in the original framework that was developed mainly with students from a private institution. Table 1 summarizes the dimensions selected for the comparison study.

Table 1. FACVE Dimensions

Dimensions	Selected for the comparison
C1. Perceived quality of instruction and learning	Yes
C2. Poor Internet connectivity and lack of proper equipment	Yes
C3. Personal and psychological issues	No
C4. Lack of appropriate home infrastructure	Yes

Dimensions	Selected for the comparison
C5. Learning platform and access to resources	Yes
C6. Financial issues related to students and families	No
C7. General concerns related to the university administration and costs and others	No

The same questionnaire developed in the FACVE (Mu et al., 2022) was used to collect the data (Table 2). A link to the web-based questionnaire was sent via email to the invited participants who responded anonymously during the period January 2021 to March 2022.

Table 2. Description of the questionnaire

Dimensions	Number of questions	Questions
C1. Challenges to the quality of virtual instruction	18	Q13.1 - Q13.7
		Q14.1 - Q14.6
		Q15.1 - Q15.5
C2. Connectivity & equipment	5	Q10.1 - Q10.5
C4. Home infrastructure & study environment	4	Q12.1 - Q12.4
C5. Learning platform and access to resources	8	Q11.1 - Q11.8

In Spain, 400 students from four different programs were invited to participate in the study with a response rate of 28%. After cleaning and debugging the responses received, the sample size was 94. The participants in Spain are undergraduate and graduate students, mainly between 20-34 years of age. The proportion of participants was slightly higher for the engineering area (55%) than for the social sciences (45%). In addition, 73% had never received any type of distance or virtual training, which indicates that the situation was totally unprecedented for most of the participants.

In Peru, 570 postgraduate MBA students from one of the top private Peruvian universities were invited to participate in this survey, and 165 students responded, yielding a survey response rate of 29%. The participants are mainly 25-35 years old. The proportion of participants was higher for men (64%) than for women (36%).

3.2 Data Validation and Analysis

Before analyzing and comparing the data both databases were tested following well established statistical practices. Exploratory Factor Analysis (EFA) was used in order to analyze the convergence of the individual indicators into their thematic categories or sub-dimensions. Loading factors of 0.4 were used as a lower threshold (Field, 2009). Dimension C1 was not considered in the EFA analysis for the Spanish dataset, due to the sample size (18 questions while our sample was only of 94 students). Therefore, the same three sub-dimensions obtained from the Peruvian dataset remain. Table 3 shows the disaggregation of challenges into the convergence dimensions and sub-dimensions.

Table 3. Disaggregation of dimensions, sub-dimensions and challenges.

Dimensions	Sub-dimensions	Challenges
C1. Challenges to the quality of virtual instruction	C1.1. Teaching quality	C1.1.1 Teachers are not trained to teach a virtual class in a didactic way
		C1.1.2 Students do not have knowledge of how to study in a virtual class
		C1.1.3 Teachers teach fewer hours than they should
		C1.1.4 Teachers are not motivated to teach classes online
	C1.2. Interaction	C1.2.1 Interaction between classmates is very little
		C1.2.2 Interaction with the teacher is very little
		C1.2.3 It is very difficult to do group tasks
		C1.2.4 No spaces to interact with classmates
		C1.2.5 It is not possible to form study groups
		C1.2.6 Interaction in a virtual class is less than in a face-to-face class
	C1.3 Assessment	C1.3.1 Academic overload for students in virtual classes
		C1.3.2 Exams are not suitable for online classes
		C1.3.3 Lack of good feedback on the assignments
		C1.3.4 Lack of flexibility of teachers in terms of deadlines
		C1.3.5 Quality of assignments and exams is lower in virtual classes
C2. Connectivity & Equipment	C2.1 I do not have (or have limited) access to the internet where I live	
	C2.2 My internet speed is not adequate for my classes	

Dimensions	Sub-dimensions	Challenges
		C2.3 I do not have access (or it is rather limited) to a computer at home
		C2.4 There are many technical problems while accessing classes or study material
		C2.5 My educational institution does not have the appropriate computer equipment (e.g., servers) for virtual teaching
C4. Home infrastructure & Study environment		C4.1 My home does not have adequate physical space for my virtual classes
		C4.2 Activities of other people at home produce a lot of noise and interruptions
		C4.3 I do not have adequate furniture at home (e.g. desk, chair) for my virtual classes
		C4.4 The physical infrastructure that one has at home for virtual classes is less than in the educational institution
C5. Learning platform and access to resources	C5.1 Learning platform	C5.1.1 The educational platform in use is not suitable for virtual instruction
		C5.1.2 Teachers do not know how to use the platform
		C5.1.3 Students do not know how to use the platform
		C5.1.4 There is no information about the use of the platform
	C5.2 Access to resources	C5.2.1 Lack of access to library books is a severe limitation
		C5.2.2 Lack of access to laboratories is a problem
		C5.2.3 It is necessary to have access to more study material (e.g., PPTs) in addition to the recordings of the class
		C5.2.4 Access to teaching resources is less in virtual instruction

Later, the means for the dimensions and sub-dimensions were calculated. In the case of Peru, the scale was from 1 to 5, while for Spain it was from 1 to 7. Hence, for later analysis and comparison the values obtained in both countries were normalized (from 0 to 1 scale). Therefore, the intensity of the challenges has a range from 0 to 1; where 0 corresponds to a non-existent challenge and 1 corresponds to an extreme challenge concern

4 Results

Figure 1 shows the overall results for the dimensions and sub-dimensions. The questions in the survey required to indicate to what extent a participant agreed that the listed situation constituted a challenge. The normalized scale from 0 to 1 represents the extent to which each of the challenges is present, ranging from “not at all” (0) to “definitely yes” (1). In principle, given that the “not at all” constitutes the total absence of the challenge, any value above 0 should be cause of concern and be investigated. However, this is neither feasible nor recommended in practice. For this reason, the 0.2 value (green line in Figure 1) is used in this study to consider a sub-dimension as a potential challenge concern, given that it constitutes 20% of the total possible score. These are sub-dimensions that represent, in this study terminology, **minor concern problems**. On the other hand, and any score above 0.5 (red line in Figure 1) are considered **major concern problems** (red line in Figure 1). Still, some

organizations may prefer to use different thresholds given their particular circumstances but taking into account that the ideal situation is the total absence of the virtual education challenge.

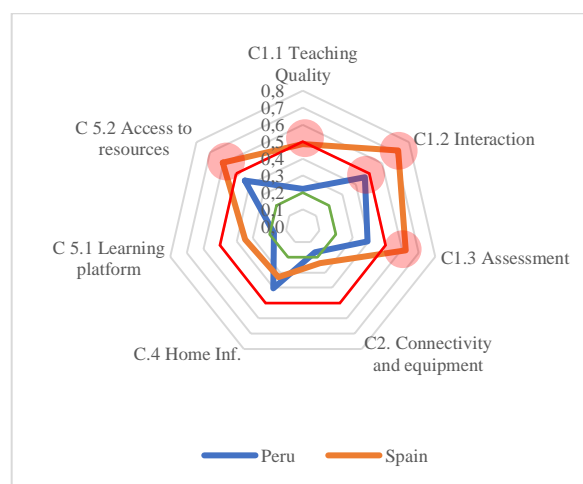


Figure 1. General comparison. Green line: minor concern threshold; Red line: major concern threshold

In the case of Spain, four of the sub-dimensions were considered major concern problems: Teaching quality (C1.1), Interaction (C1.2), Assessment (C1.3) and Access to resources (C5.2). Interaction was the main challenge faced while Connectivity and equipment were the least problematic. In the case of Peru, Interaction (C1.2) represented the major concern problem, while Teaching quality (C1.1), Connectivity

and equipment (C2), and Learning platform (C5.1) were of the least concern.

Figure 1 also clearly shows the differences between the two groups. As can be seen, the intensity of the challenges faced by the Spanish students was much higher in almost all the sub-dimensions in comparison with the Peruvian students, except for the case of Home infrastructure (C4.). This makes sense because of the difference in resources and infrastructure between the contexts.

Challenges to the Quality of virtual instruction (C1) in Spain were much more a major concern than in Peru. This means that Spanish students perceived a lower quality of education compared to Peruvian students. One possible explanation may be the fact that the Peruvian university trained its faculty members to teach virtual classes during a two-week period prior to restarting classes and continued with ongoing monitoring of their faculty and students' needs in the virtual environment.

Connectivity and equipment (C2) was a slightly more concerning problem in Spain than in Peru. This is surprising, given the differences in the contexts; however, both values are below 0.25. Therefore, these were the least of the challenges. Again, we learned that the Peruvian higher education institution supplied laptops, routers and internet access to faculty and students who were in need.

Moreover, Learning platform (C5.1) was another minor concern for both groups. This may be due to the fact that in both contexts specialized e-learning platforms were contracted to support the teaching and learning process (Microsoft Teams or Adobe Connect).

Finally, Access to resources (C5.2) was another major difference between the two groups, being more dramatic in the case of the students in Spain. This may be caused by the fact that while all students in the Peruvian sample were business students, the Spanish sample had many engineering students as participants and their resource needs may have been far more sophisticated (e.g., labs).

From Figure 1, we can conclude that the main similarity between the two groups was the concern about Interaction (C1.2), while the main differences were identified in Teaching quality (C1.1), Assessment (C1.3) and Access to resources (C5.2). These four sub-dimensions are discussed in detail in the next section.

4.1 Disaggregation by Sub-dimensions

The detailed results for the sub-dimensions Interaction (C1.2), Teaching quality (C1.1), Assessment (C1.3) and Access to resources (C5.2) are given in the following figures (2-5). In all four subdimensions, Peruvian students perceived to have faced less or equal challenges than the Spanish students.

Students in Spain showed a greater concern for the of dimension Quality of virtual education (C1). In terms of Teaching quality, Peruvian students did not perceive any of these challenges as important; while

for Spanish students, the most important challenges were those related to teachers' training and motivation (C1.1.1 and C1.1.4), followed by student preparation for virtual lessons (C1.1.2). The time spent in lessons (C1.1.3) was not perceived as a challenge by either group.

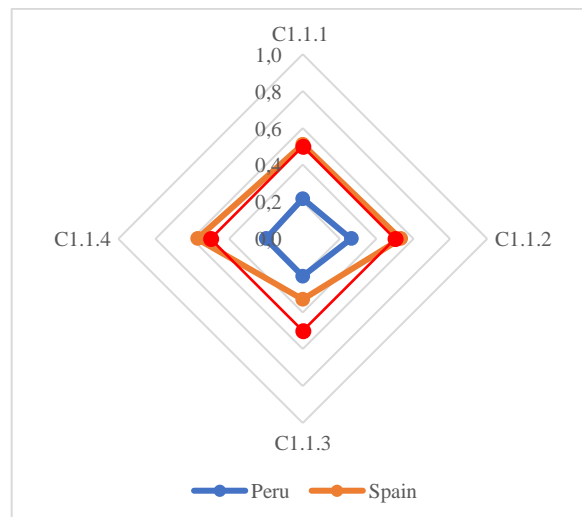


Figure 2. Teaching quality. Red line: major concern threshold

All challenges related to interaction scored close to or greater than 0.5. The inability to interact as much as in face-to-face classes and the lack of opportunities to interact (C1.2.4 and C1.2.6) were the biggest challenges for both groups.

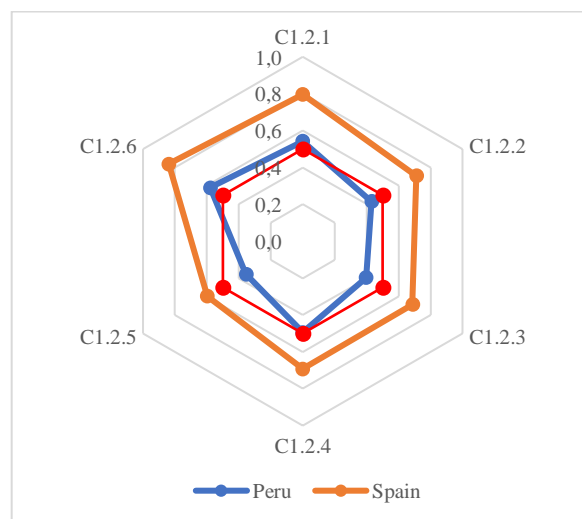


Figure 3. Interaction. Red line: major concern threshold

The intensity of the challenges faced by the Spanish students regarding Assessment was still higher. However, for both groups, the main challenges faced were academic overload for students and the lack of good feedback on the assignments (C1.3.1, and

C1.3.3). Spanish students also expressed major concern about the kinds of exams and the lack of flexibility of teachers in terms of deadlines (C1.3.2, C1.3.4 and C1.3.5).

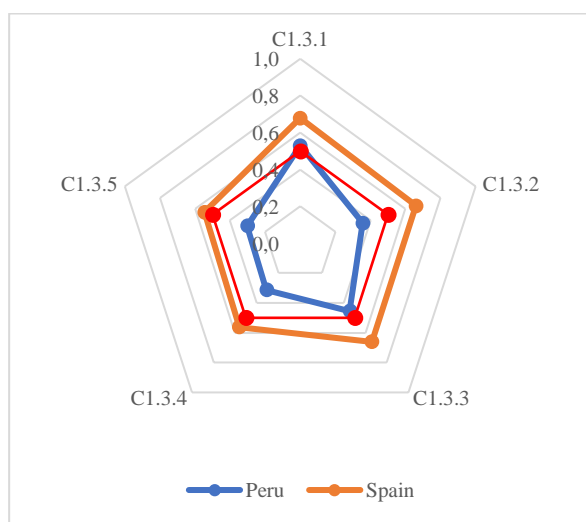


Figure 4. Assessment. Red line: major concern threshold

Although Spanish students maintain a higher valuation of the challenges related to access to resources, in this subdimension, the degree of estimation of the concerns of both groups is closer. They both expressed a limitation in the lack of access to a library and teaching resources (C5.2.1, C5.2.4). Spanish students also consider access to laboratories important (C5.2.2). This may be due to the engineering profile of Spanish students.

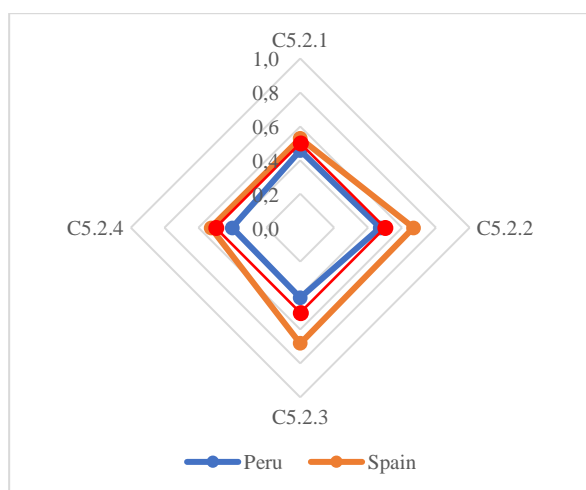


Figure 5. Access to resources. Red line: major concern threshold

All the previous figures confirm that the Spanish students faced more challenges during the period of ERT. It is possible that the preparation time that the teachers had in Peru allowed them to better adjust the content of the classes and the type of evaluation as well

as better prepare material. This was reflected in the evaluation of these concerns.

Moreover, we analyzed the dimension of Home infrastructure and study environment (C4) because it was the only one in which Peruvian students expressed having faced greater challenges than Spanish students. Figure 6 shows that interruptions caused by other people at home and the lesser conditions of the physical infrastructure at home in comparison to the educational institution (C4.2 and C4.4) were the points of greatest agreement between the two groups.

The lack of adequate physical space and furniture at home (C4.1 and C4.3) represented a major challenge for Peruvian students which makes sense when considering the contexts of these students. Peruvian students tend to share spaces with the family, while Spanish students tend to share spaces with other students which provides more suitable conditions for students.

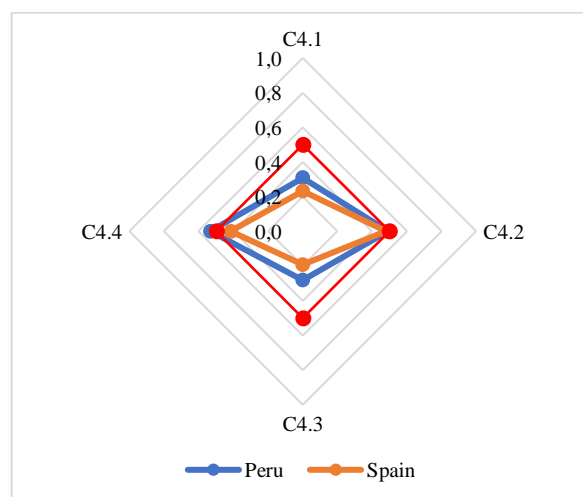


Figure 6. Home infrastructure and study environment. Red line: major concern threshold

5 Conclusions

In conclusion, this study shows the statistical validity and versatility of the FACVE framework to assess the extent of challenges to virtual education in an ERT context. Also, the comparative analysis of the existing challenges leads us to suggest some possible ways to minimize these challenges as follows:

1. Training prior to virtual teaching. The Peruvian institution stopped providing classes for several weeks while training their faculty. The comparison institution trained their faculty on the go and students suffered because of this and complained about the overall quality of the virtual instruction.
2. Assist students with home infrastructure and study environment (e.g. noisy, lack of own desk). Universities could provide (or rent) to students in need some simple material such as headphones

(to minimize noises), portable desk (so the student does not need to connect virtually from bed) and similar. This was a more serious issue in Peru than in Spain although it was present in both countries.

3. Update the activities and evaluation systems to the virtual environment. Taking into account the differences in time available, opportunities for interaction between students, etc.
4. Providing some additional opportunities for interaction among students and between students and teachers. For instance: Blogs, Chat rooms, discussion forums, etc. Where they can more freely exchange questions, comments, materials, etc.
5. In general, having extra time for planning may provide a positive difference in results even when compared with institutions in better socio-economic situations.

One of the limitations of our study was the size of the sample which did not allow for statistically testing the challenge dimension (C1) with the greatest number of indicators. On the other hand, the next step in this study is to assess the different challenges in terms of their assessed relative importance by the students. Finally, this comparative study does not attempt to illustrate country differences in the way they address ERT, but simply highlight how a quick and effective higher-education management response may help to overcome socio-economic differences in an ERT situation.

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