PSYCHOMETRIC VALIDITY OF A TOOL FOR ASSESSING THE EDUCATIONAL QUALITY OF BLENDED LEARNING SYSTEMS

Bárbara Mariana Gutiérrez-Pérez, University of Salamanca
Antonio Víctor Martín-García, University of Salamanca

ABSTRACT

Quality assessment systems have recently expanded, serving as indicators for the assessment and ranking of higher education institutions worldwide. The growing development of new educational methodologies, like Blended Learning, requires the design and validation of tools that allow for their assessment. The objective of this article is to describe the process of statistically validating a tool designed to assess the educational quality of Blended Learning courses. This paper presents a systematic conceptualization of the educational quality in Blended Learning systems and provides a reliable and valid tool for quality assessment of the design and implementation of combined learning methodologies.

Keywords: *hybrid learning, higher education, validation, factor analysis, questionnaire*

INTRODUCTION

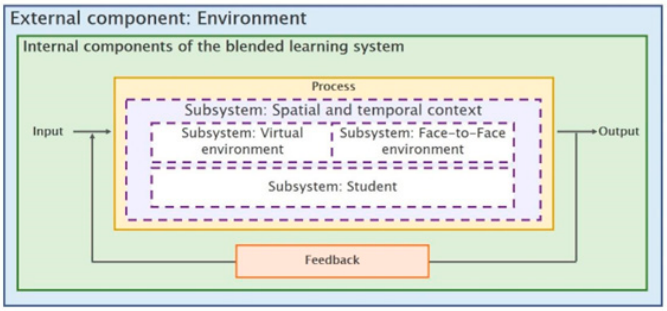
The integration of Information and Communication Technologies as learning tools has allowed for the combination of different strategies, resources, experiences and even environments and formats of learning that favor the consolidation of the training method known as Blended Learning (Cacciamani et al., 2021; Jebraeily et al., 2020; Bokolo et al., 2021; McGee & Poojary, 2020; Smith & Hill, 2019). The Blended Learning system is considered by some authors (for example, Dziuban et al., 2018; Hadiyanto et al., 2022; Horn & Staker, 2011; Bokolo et al., 2019; Smith & Hill, 2019) to be the new "traditional model" or "new pedagogical approach" within higher education. From a perspective of quality (Hrastinski, 2019), Blended Learning is the planned and reflexive combination or integration of different elements of face-to-face and virtual learning that combine the benefits of a traditional education with the pedagogical application of technological advances (Abid et al., 2021; Alsalhi et al., 2021) for the purpose of student-led construction of knowledge.

The combination of the face-to-face and virtual elements allows for the analysis of the Blended Learning approach from the perspective of the General System Theory in three ways: (a) Blended Learning presents a series of internal components that can be analyzed and evaluated as inputs, process, and outputs, and that are present in the system's structure; (b) the design of both Blended Learning environments and its systems is based on the achievement of one or several objectives; and (c) the structure and the functionality of the Blended Learning environment, as well as its systems, should be analyzed as a whole in which the actions produced in one component will affect the other components. Based on these approaches and the conceptualization of Blended Learning from a perspective of quality (Hrastinski, 2019), Figure 1 shows a graphic representation of the internal components of the Blended Learning system.

In the structure presented in Figure 1, four subsystems are involved in the Blended Learning model: (a) two components that converge and correspond with the face-to-face subsystem and the virtual subsystem; (b) the student; (c) the student's learning process; and (d) named the spatial and

temporal context that encompasses the interrelationships produced between the other subsystems and among them. The different relationships produced by the interaction of these components determines the levels in the construction of knowledge by the student, which will correspond, to a greater or lesser extent, to the student's achievement of the established learning objectives. Finally, the degree of correspondence will establish a relevant correlation with the educational quality level in the implemented process.

Figure 1. Structure of the Blended Learning System



In order to specify the level of quality in an educational process it is necessary to understand what is meant by educational quality and how it should be measured and assessed. Providing a clear answer to both questions forms part of a long tradition of reflection, study, and debate in the field of pedagogy. Conceptualizing what is meant by educational quality is a great challenge because it is a polysemic, complex, and nonstatic concept, which makes its exact and unequivocal definition difficult (Casanova Rodríguez, 2012; Martínez-Iñinguez et al., 2020; Montané López et al., 2017; Vera-Millalén, 2018). Consequently, an analysis of the educational quality makes it difficult to give a clear answer to the previously raised questions: To what extent can a high-quality education, and the quality of it, be assessed (Dicker et al., 2019; Huisman et al., 2015; Tiana Ferrer, 2006)?

What does remain clear is the scientific community's acceptance of three aspects of quality Blended Learning: (a) quality is a multidimensional and systematic concept that can be conceptualized on the basis of the complementarity of different perspectives such as the extent to which objectives are met, its efficiency and ability to transform, and student satisfaction; (b) quality is a construct that can be assessed based on different described approaches with terms such as efficacy, efficiency, functionality, accountability, and educational improvement, among others; and (c) quality should be assessed based on established dimensions, indicators, or parameters that permit an integral and adequate assessment of quality in educational outcomes (de la Orden Hoz, 2013; Gallego-Ortega & Rodríguez-Fuentes, 2016; Harvey & Green, 1993; Mejía-Rodríguez & Mejía-Leguía, 2021; Rodríguez Espinar, 2013; Sola-Martínez et al., 2020).

Regarding quality assessment in Blended Learning systems, this line of research has begun to gain momentum. It is geared towards an analysis that allows for the general assessment of qualifications, courses, or subjects designed for this mode of teaching and learning (Alizadeh et al., 2019; Armellini et al., 2021; Matosas-López et al., 2019; Montalvo-García et al., 2020). However, a number of studies on the educational quality of Blended Learning systems are inferior in comparison to the studies directed towards quality assessment in courses that are exclusively virtual or face-to-face (Gutiérrez-Pérez & Martín-García, 2021). Thus, when a literature review is carried out on quality assessment in Blended Learning systems, the research has different perspectives and approaches. Some research focuses on one aspect in particular on the quality of, or in the establishment of, mechanisms that assess only one part of implementation (Alizadeh et al., 2019; Casanova & Moreira, 2017; Gruba et al., 2016). To a lesser extent, other studies pay attention to quality assessment in Blended Learning systems from a wider, systematic, and multidimensional perspective, covering different elements that intervene in its design and implementation (Gutiérrez-Pérez & Martín-García, 2020; Montalvo-García et al., 2020; Mozelius & Hettiarachchi, 2017).

In view of the growing expansion of Blended Learning systems and the necessary guarantee and improvement of educational quality within these systems, it is essential to use models and tools that allow for the assessment of constructs from both a multidimensional and integral perspective within the field of higher education. These must be based on solid theoretical foundations that support and justify the dimensions and indicators established for this purpose. Thus, the objective of our research is to apply an exploratory and confirmatory factor analysis to carry out the statistical validation of an

instrument designed to measure the perceptions of higher education students on the quality of their courses based on Blended Learning systems.

MATERIALS AND METHODS

Instrument Design and Content Validation

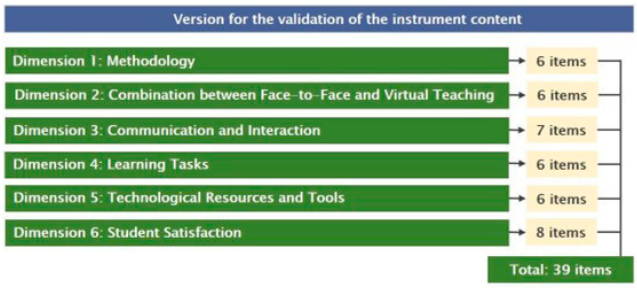
We used a questionnaire based on a profound and reflexive literature review published in relation to Blended Learning and educational quality combined with the General System Theory interpretation of the Blended Learning approach. Based on the results obtained in the literature review and on the structure of the Blended Learning system presented above, we identified six dimensions of educational quality: (a) Methodology, (b) Combination of Face-to-Face and Virtual Teaching, (c) Learning Tasks, (d) Communication and Interaction, (e) Technological Resources and Tools, and (f) Student Satisfaction. Table 1 shows the description of each dimension and their corresponding indicators.

Table 1. Instrument Design

Dimension	Description	Indicators
Methodology	Values whether the implementation of the Blended Learning system is based on pedagogical strategies directed at the construction and coconstruction of learning that fosters in the student both self-regulation strategies and higher order cognitive skills through the active application of these in the teaching-learning process.	a. Achievement of objectives b. Student autonomy c. Student self-regulation d. Participation e. Collaborative learning f. Student motivation
Combination of Face-to-Face and Virtual Teaching	Values whether the convergence of modalities maintains a continuum that allows for the exchange of actions and learning processes from one environment to the other and the degree of flexibility and adaptability in the course regarding learning times and environments, as well as the system's capacity to adapt to the needs, characteristics, and rhythms of the students' learning.	a. Flexibility of learning or work environments b. Temporal flexibility c. Convergence between environments (face-to-face and virtual) d. Complementarity of environments (face-to-face and virtual) e. Adaptability towards students
Learning Tasks	Values the congruence of activities relating to the established learning objectives and the significance and relevance of these for developing higher order skills and promoting the construction of knowledge—both individually and in groups—and the capacity of these to extrapolate the theoretical content in practical contexts and real situations outside the classroom.	a. Connection of previous and new knowledge b. Improvement in content comprehension c. Group work d. Independent learning e. Connection of theory and practice
Communication and Interaction	Values the level, intensity, and frequency of interactive and communicative processes in student-student and teacher-student interactions and the effect of these processes on the construction and improvement of learning as well as the social presence of students in the virtual learning environment.	a. Student-student interaction b. Teacher-student interaction c. Social presence d. Construction of learning
Technological Resources and Tools	Values whether technological tools and resources promote, facilitate, and improve the construction of learning through cognitive support aimed at the student and promote the adoption of these for the development of the learning process.	a. Ease of use b. Variety c. Appropriateness to learning process d. Student autonomy e. Student involvement f. Adaption to student
Student Satisfaction	Values the level of student satisfaction after completing the course in relation to the different pedagogical and didactic elements implemented and the fulfillment of students' expectations regarding the obtained results.	a. Satisfaction regarding learning results b. Satisfaction regarding learning process c. Fulfillment of students' expectations

The content was validated by 11 independent experts with experience in the design, implementation, and assessment of the Blended Learning model resulting in a questionnaire comprising the six aforementioned dimensions and 39 items. The structure of this version is presented in Figure 2.

Figure 2. Version for the Validation of the Content



The experts assessed the adequacy, coherence, and clarity of each item of the questionnaire based on a scale of 1 (*does not meet the criteria*) to 4 (*meets the criteria*). In order to determine the content validity, we calculated the Coefficient of Variation of each of the scores given to the items. To strengthen the obtained results, we also applied Kendall's W Test. After the content validation, the dimensions Methodology and Combination of Face-to-Face and Virtual Teaching were combined and six items were excluded. The remaining 31 items were reformulated and the original wording of four items was maintained. Thus, the questionnaire comprised five dimensions and 41 items. The relationship between each dimension and item can be seen in Tables 2– 6, according to each dimension.

Table 2. Relationship between the Combination of Face-to-Face Dimension and Items

Dimension 1. Combination of Face-to-Face and Virtual Teaching	
Initial item number	Item
01	The content and/or activities carried out in both virtual and face-to-face classes have shown a clear continuity or sequencing.
02	The face-to-face and virtual classes complemented each other.
03	The combination of face-to-face and virtual teaching has encouraged your autonomy in learning (for example, taking the initiative to carry out your own research and/or carrying out complementary tasks, clearing up doubts...).
04	The combination of face-to-face and virtual learning has encouraged self-regulation in your learning (for example, establishing priorities, planning tasks, organizing content study...).
05	The combination of face-to-face and virtual learning has provided you with the option to choose your place of work and/or study in a more flexible manner.
06	The combination of face-to-face and virtual learning has allowed you to distribute and organize your time in a more flexible manner.
07	The combination of face-to-face and virtual learning has allowed you to adapt the development of the subject to your own pace of learning.
08	The combination of face-to-face and virtual learning has improved your learning results.
09	The combination of face-to-face and virtual learning has improved your motivation towards the study of the subject(s).

Table 3. Relationship between the Learning Tasks Dimension and Items

Dimension 2. Learning Tasks	
Initial item number	Item
10	The learning tasks facilitated the connection of learning acquired throughout the course with previously acquired knowledge.
11	The learning tasks improved your understanding of content worked on throughout the course.
12	The learning tasks allowed you to apply your theoretical knowledge to real-life or practical cases.
13	The learning tasks presented varying levels of difficulty (with some activities being more simple and others more complex).
14	The learning tasks required you to apply different types of abilities (for example: summarizing, understanding, analyzing, and evaluating...).
15	The learning tasks required you to carry out different types of activities (individual, group, revision, and self-assessment...).
16	The learning tasks strengthened group learning with your peers.
17	The learning tasks allowed you to carry out an assessment of your own academic progress throughout the course.

Table 4. Relationship between the Communication and Interaction Dimension and Items

Dimension 3. Communication and Interaction	
Initial item number	Item
18	The different settings of interaction, both face-to-face and virtually, have been sufficient to share information and/or knowledge with your peers.
19	The different setting of interaction, both face-to-face and virtually, have been sufficient to share information and/or knowledge with your teacher.
20	The development of the course has facilitated interaction with your peers.
21	The development of the course has facilitated interaction with your teacher.
22	Communication and interaction with your peers has contributed positively to the results of your learning.
23	Communication and interaction with your teacher has contributed positively to the results of your learning.
24	The interaction achieved in your subject has favored your integration with your class group.

Table 5. Relationship between the Technological Resources and Tools Dimension and Items

Dimension 4. Technological Resources and Tools	
Initial item number	Item
25	Ease of use of resources present in the virtual classroom (chat function, forums, videoconferencing...)
26	The variety of formats in which the subject content was produced (text, video, audio, presentations...)
27	Suitability of technological resources for the proper implementation of the activities carried out throughout the course
28	Your learning of the contents studied throughout the course
29	Your autonomy in learning
30	Your involvement and motivation in the development of proposed activities in the course
31	Group work
32	Adapted the development of the course to your learning (for example: adaptation to your level of knowledge, your abilities and interests, your training and/or personal needs...)

Table 6. Relationship between the Students Satisfaction Dimension and Items

Dimension 5. Student Satisfaction	
Initial item number	Item
33	The obtained results of your learning
34	The fulfillment of your expectations towards the subject
35	The methodology of the subject (in other words: the way in which it has been carried out)
36	The combination of face-to-face and online learning and teaching activities
37	The activities and tasks carried out throughout the development of the course
38	The interaction with your peers throughout the development of the course
39	The interaction with your teacher throughout the development of the course
40	The technological resources and tools used in the subject
41	The Blended Learning modality in comparison with other modalities (purely face-to-face and/or virtual)

STATISTICAL VALIDATION

Participants

The sample for the statistical validation of the questionnaire was made up of 496 students enrolled in Spanish universities: 88.3% of the participants were from the University of Salamanca and the remaining 11.7% studied at the Madrid Complutense University. For the sample selection we used a nonprobabilistic convenience sampling method. The number of cases met the established parameters regarding the number of participants for the factorial validity of a tool, which is a sample size greater than 200 participants

(Ferrando & Anguiano-Carrasco, 2012; Lloret-Segura et al., 2014; Preacher & MacCallum, 2003).

Data analysis

We estimated the reliability of the set of items through Cronbach's Alpha Coefficient. Once the internal consistency of the tool was established, we proceeded to verify whether the sample data set met the conditions necessary for its factorization, for which we carried out the Kaiser-Meyer-Olkin KMO test and the Bartlett Sphericity Test. Then we applied the Exploratory factor analysis (EFA) technique to identify the baseline dimensional structure using the extraction method of Principal Axis Factoring and Promax Rotation. Once the unidimensionality of each subset of items in the resulting model was verified, we repeated the reliability analysis using Cronbach's Alpha coefficient. Finally, we performed Confirmatory Factor Analysis (CFA). In this process, the R-Studio tests and the calculation of different adjustment indices (RMSEA, CFI, TLI, and CMIN/DF) were applied. For all these analyses, we used the statistical analysis package SPSSv.26 (License of *Anonymized*).

RESULTS

Reliability Analysis

Based on the obtained results using Cronbach's Alpha Coefficient (Table 7), we affirmed that the questionnaire presents a high value of reliability (α = .967 – IC 95% = .963–.971), with any value above .90 being accepted as excellent. This level of reliability was repeated in the corresponding dimensions in Communication and Interaction (α = .914) and Student Satisfaction (α = .915), and in the remaining dimensions the level of reliability was also satisfactory, achieving scores varying from 0.8 to 0.9.

Table 7. Internal Consistency Analysis. Cronbach's alpha

Factor	Cronbach's α	N elements
Dimension 1. Combination of Face-to-Face and Virtual Teaching	.889	9
Dimension 2. Learning Tasks	.895	8
Dimension 3. Communication and Interaction	.914	7
Dimension 4. Technological Resources and Tools	.890	8
Dimension 5. Student Satisfaction	.915	9
Complete Questionnaire	.967	41

Exploratory Factor Analysis

Regarding the KMO measures of sampling adequacy, the result obtained after applying this coefficient was .96. Since it was greater than .70 the indicated correlation corresponds to a high value. Moreover, regarding the Bartlett Sphericity Test, the result obtained was highly significant with $p < .001$ (value = 15318.57; p-value = .000). Both this result and those of the KMO test demonstrate the suitability of the data for performing the factorization.

After applying the Principal Axis Factoring as extraction method and Promax Rotation as a rotation method, we verified that items initially numbered: 01, 02, 17, 28, 29, 30, and 32 did not provide enough information to be considered valid. Consequently, these items were eliminated for the rest of the factorization process, reducing the number of items in the questionnaire to 34.

With the 34 selected items, the EFA provided a statistically sound final solution that was largely compatible with the initial theoretical approach for the construction of the questionnaire. This final solution (Table 8) determined the existence of four main dimensions. The following dimensions remain the same: Combination of Face-to-Face and Virtual Teaching, Learning Tasks and Communication and Interaction, whereas the two remaining dimensions were combined, making the fourth dimension Technology and Student Satisfaction. This subset of dimensions explains a satisfactory 62% of the total variability. As a result, the dimensions and items that make up this structure were the following:

- Dimension 1. Combination of Face-to-Face and Virtual Teaching explains the 16.1% of variability. It is made up of the items initially labeled: 03, 04, 05, 06, 07, 08, 09, 36, and 41.
- Dimension 2. Learning Tasks explains the 10.8% of variability. It contains the items numbered: 10, 11, 12, 13, 14, 15, 16, and 17.
- Dimension 3. Communication and Interaction explains the 19.6% of variability, with this percentage being the highest. It encompasses the items initially numbered: 18, 19, 20, 21, 22, 23, 24, 31, 38, y 39.
- Dimension 4. Technology and Student Satisfaction explains the remaining 15.5% of variability. It is composed of the items

initially numbered: 25, 26, 27, 33, 34, 35, 37, and 40.

Table 8 shows that all the quantities of the item factor loadings are high (factor loading range = .50–.79), these being superior to an absolute value of .400. These results demonstrate in a solid way how the items belong and contribute to the dimension in which they correlate. Lastly, regarding the commonalities, the EFA yields high values, demonstrating a satisfactory representation of each one of the items in the dimension to which it corresponds.

Table 8. Exploratory Factor Analysis. Method of Factor Analysis of the Main Axes with Promax Rotation

Item	Content	Commonality	Factorial Loads >.400			
			Dim. 1	Dim.2	Dim. 3	Dim. 4
03	Student_autonomy	.548	.68			
04	Student_self-regulation	.624	.72			
05	Space_flexibility	.463	.59			
06	Time_flexibility	.559	.69			
07	Adaptation_pace_of_learning	.698	.77			
08	Improving_student_results	.658	.75			
09	Improving_student_motivation	.711	.79			
36	Combination_modalities	.636	.60			
41	Modality	.597	.63			
10	Connection_new_prior_knowledge	.630		.52		
11	Improving_student_understanding	.642		.55		
12	Knowledge_application	.563		.52		
13	Activities_variety_difficulties	.573		.71		
14	Application_different_abilities	.710		.78		
15	Activities_different_types	.628		.75		
16	Collaborative_learning	.528		.51		
18	Sufficients_settings_ interaction (students)	.615			.71	
19	Sufficients_settings_ interaction (teacher)	.548			.63	
20	Facilitated_interaction_students	.742			.79	
21	Facilitated_interaction_teachers	.625			.67	
22	Contributes_positively_ results (students)	.658			x.73	
23	Contributes_positively_ results (teachers)	.630			.66	
24	Social_integration	.654			.76	
31	Group_work	.489			.58	
38	Students_interaction	.635			.74	
39	Teacher_interaction	.637			.62	
25	Ease_of_use	.520				.70
26	Variety	.646				.74
27	Suitability_for_activities	.701				.76
40	Resources_tools	.651				.62
33	Results	.585				.50

34	Fulfilment_of_expectations	.598				.60
35	Methodology	.714				.70
37	Learning_tasks	.645				.63
Correlation between dimensions		D1	--	.56	.69	.53
		D2	.56	-	.61	.43
		D3	.69	.61	--	.50
		D4	.53	.43	.50	--
KMO=0.947	Total % variance explained		16.1%	10.8%	19.6%	15.5%
Bartlett: p<.0000000	Accumulated % variance		16.1%	26.9%	46.5%	62.0%

Subsequently, we completed a factorial study verifying the unidimensionality of each subset of items with EFA (Table 9). As a result, the first three dimensions (Combination of Face-to-Face and Virtual Teaching, Learning Tasks, and Communication and Interaction) yielded high factor loadings (min. = .66; max. = .86) with satisfactory percentages of explained variability (around 60%), demonstrating the unidimensionality of the aforementioned dimensions. The fourth dimension is made up of two subdimensions, each one composed of four items. The first (4a) contains the items 25, 26, 27, and 40, corresponding with the Technology part, while the second (4b) contains the items 33, 34, 35, and 37, corresponding with Student Satisfaction. Ultimately, the exploration carried out with EFA produced a structure with 34 items organized into three unidimensional theoretical constructs and a fourth bifactorial construct.

Table 9. Exploratory Factor Analysis. Verification of the Unidimensionality of Each Subset of Items

Dimension 1		Dimension 2		Dimension 3		Dimension 4		
Item	Factor Loading	Item	Factor Loading	Item	Factor Loading	Item	Factor Loading	Factor Loading
03	.71	10	.81	18	.79	25	.81	
04	.76	11	.83	19	.77	26	.88	
05	.66	12	.79	20	.86	27	.88	
06	.74	13	.72	21	.81	40	.74	
07	.83	14	.80	22	.76	33		.85
08	.78	15	.71	23	.80	34		.90
09	.82	16	.69	24	.78	35		.89
36	.76			31	.69	37		.84
41	.75			38	.77			
				39	.77			
Explic. Var.	57.7%	Explic. Var.	58.8%	Explic. Var.	61.1%	Explic. Var.	74.2%	

Once this structure had been established, we estimated the reliability of the tool using Cronbach's Alpha Coefficient once again. The results (see Table 10) indicate that the tool's degree of reliability, both as a whole (α = .96) and in each one if its dimensions (range α = .86–.90), is very high. Consequently, this new structure of the tool is as reliable as it was in its initial version, completely guaranteeing the fulfillment of this psychometric property.

Table 10. Exploratory Factor Analysis. Internal Consistency Analysis. Cronbach's Alpha

Dimension	Cronbach's α	N elements
Dimension 1. Combination of Face-to-Face and Virtual Teaching	.91	9
Dimension 2. Learning Tasks	.88	7
Dimension 3. Communication and Interaction	.93	10
Dimension 4. Technology and Student Satisfaction	.91	8
Dimension 4a. Technology	.86	4
Dimension 4b. Student Satisfaction	.90	4
Complete Questionnaire	.96	34

Confirmatory Factor Analysis

In order to carry out the CFA, we proceeded to renumber the items in a sequential manner from 1 to 34, following the structure identified in the previous EFA. As a result, the order of the items in the final version of the questionnaire corresponds to those presented in Table 11.

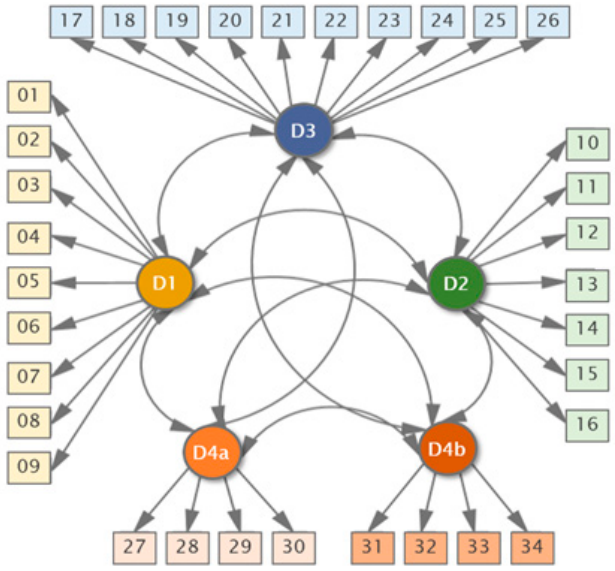
Table 11. Equivalence between the Numbering of the Items of the Initial Version to be Tested and those that Confirm their Validity for the Final Version of the Questionnaire

Dimension	Content	Initial item number	Final item number
Dimension 1. Combination of Face-to-Face and Virtual Teaching	Student_autonomy	03	01
	Student_self-regulation	04	02
	Space_flexibility	05	03
	Time_flexibility	06	04
	Adaptation_pace_of_learning	07	05
	Improving_student_results	08	06
	Improving_student_motivation	09	07
	Combination_modalities	36	08
	Modality	41	09
Dimension 2. Learning Tasks	Connection_new_prior_knowledge	10	10
	Improving_student_understanding	11	11
	Knowledge_application	12	12
	Activities_variety_difficulties	13	13
	Application_different_abilities	14	14
	Activities_different_types	15	15
	Collaborative_learning	16	16

Dimension 3. Communication and Interaction		Sufficients_settings_interaction (students)	18	17
		Sufficients_settings_interaction (teacher)	19	18
		Facilitated_interaction_students	20	19
		Facilitated_interaction_teachers	21	20
		Contributes_positively_results (students)	22	21
		Contributes_positively_results (teachers)	23	22
		Social_integration	24	23
		Group_work	31	24
		Students_interaction	38	25
		Teacher_interaction	39	26
Dimension 4. Technology and Student Satisfaction	Dimension 4a. Technology	Ease_of_use	25	27
		Variety	26	28
		Suitability_for_activities	27	29
		Resources_tools	40	30
	Dimension 4b. Student Satisfaction	Results	33	31
		Fulfilment_of_expectations	34	32
		Methodology	35	33
		Learning_tasks	37	34

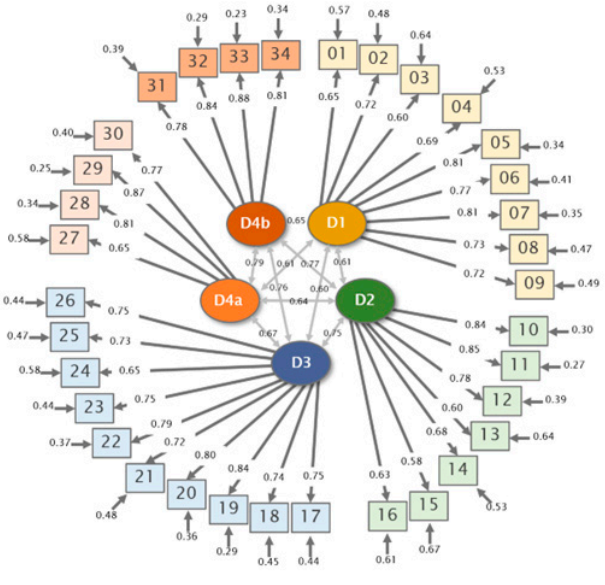
With the new order of the items established, we created a graphic representation of the model to be tested (Figure 3).

Figure 3. Confirmatory Factor Analysis. Model to be Tested



After the factoring of the model presented in Figure 3 through the application R-Studio, the results shown in Figure 4 were obtained.

Figure 4. Confirmatory Factor Analysis with R-Studio. Output Model: Standardized Coefficients



The represented values are standardized coefficients on a scale [0–1]. These coefficients present high or very high values, even higher than those found in the previous EFA. Consequently, the association between each item and the expected dimension in the test model is guaranteed. Similarly, there are high loadings (min.:

.60) between some dimensions and others, thus confirming the relationship between the different dimensions. Thus, the dimensional structure subjected to contrast in the CFA is definitively confirmed.

Lastly, in order to know the degree of adjustment of the empirical data (sample responses) with this theoretical model, we estimated that the RMSEA index had a value of .074 (IC 90% = .070–.078), which demonstrates an adequate adjustment of the model. In this same vein, the CFI presented a value of .833, the TLI index presented a rating of .819, and the CMIN/DF presented a value of 3.83. All these indices confirm a good adjustment of the assessment model.

DISCUSSION AND CONCLUSION

Quality is not just a desired attribute; it has become an element that holds a significant influence over decision-making regarding the acquisition or utilization of a product or service in society. Therefore, educational institutions, particularly in higher education, cannot remain exempt from offering, in their educational processes, an education or training that generates high quality results (Dicker et al., 2019; García Aretio, 2017; Vera-Millalén, 2018). Due to the complexity of conceptualizing and operationalizing educational quality, different elements or indicators of quality have been identified in the literature.

As a result, elements such as permanent learning, implementing student-centered methodologies, meeting students' needs, and paying attention to emerging societal trends have been interpreted as criteria of educational quality, with these aspects becoming some of the main priorities in higher education. In our research, in addition to approaching the very complexity of establishing what is meant by educational quality and how to assess it, we face the inherent complexity of Blended Learning systems. This difficulty is owed, in part, to the necessity of understanding and assessing this model from a convergence of two different scenarios (face-to-face and virtual) in which distinct models and levels of combination arise, involving different key factors that influence the quality of these systems. With the purpose of reducing both complexities, the aim of our research is embodied in the validation of a questionnaire designed to assess the educational quality of the Blended Learning system from a student-based perspective. The relevance of this research derives from the lack of previous research carried out in this environment and, consequently, the lack of availability of reliable and valid tools for assessing educational quality in Blended Learning systems. This study was grounded in an instrument designed and based on different investigations that established five dimensions of quality in its initial version. After the validation process the statistical validity of the following four dimensions was confirmed for the final version of the questionnaire: (a) Combination of Face-to-Face and Virtual Teaching, (b) Learning Tasks, (c) Communication and Interaction, and (d) Technology and Student Satisfaction.

The resulting dimensional structure of the factorization of the tool coincides with the findings presented in different studies. The studies carried out by some researchers (for example, Aldana Vargas & Osorio, 2019; Alizadeh et al., 2019; Armellini et al., 2021; Casanova & Moreira, 2017; Mejía Madrid, 2019; Montalvo-García et al., 2020; Shukla et al., 2020; among others) concluded that the pedagogical aspects of Blended Learning, such as the convergence of face-to-face and virtual environments, learning tasks and experiences, communication processes and student-student/student-teacher interactions, are considered key aspects that significantly influence the quality of Blended Learning systems. Likewise, the same is true of the technological aspects found in the design and implementation of Blended Learning. Thus, elements such as the variety of technological resources, the use and facility of these, and the possibilities that technologies provide pupils throughout their learning process, are clear indicators to be used to measure the efficacy, efficiency, and functionality of Blended Learning systems is found in a number of studies that interpret these terms as determining factors for the assessment of educational quality (such as Aldana Vargas & Osorio, 2019; Alizadeh et al., 2019; Binyamin et al., 2019; Casanova & Moreira, 2017; Castaño et al., 2017; Kintu et al., 2017; Mejía Madrid, 2019; Montalvo-García et al., 2020; Mozelius & Hettiarachchi, 2017; Sayaf et al., 2021; Shukla et al., 2020; Zhang & Dang, 2020),. Lastly, student satisfaction as a dimension of educational quality is also established in other research as a factor to measure whether students' needs and expectations

are met regarding the obtained results and their satisfaction with regard to the teaching-learning process (for example, Alizadeh et al., 2019; Castaño et al., 2017; Dericks et al., 2019; Fisher et al., 2018; Galvis, 2018; Kanwar & Sanjeeva, 2022; Kintu et al., 2017; Montalvo-García et al., 2020; Mozelius & Hettiarachchi, 2017; Sholikah & Sutirman, 2020; Taghizadeh & Hajhosseini, 2021; Zhang & Dang, 2020).

Ultimately, this research provides both educators and researchers a reliable and valid tool that allows for the assessment, both internal and external, of courses and subjects based on a Blended Learning approach from a global, systematic, and pedagogical perspective, that enables the assessment of these systems in response to aspects related to the improvement of educational practice.

RESEARCH LIMITATIONS

Although this study was carried out using a rigorous research process, there are a number of limitations related to the study sample that must be considered when analyzing the results. Firstly, the sample was limited to just two Spanish universities and two subject areas (Social and Legal Sciences and Arts and Humanities), factors that could affect the universal validity of this questionnaire. Secondly, although some researchers would deem the sample size as adequate for statistical validation, for other, more demanding researchers in this field, the number of cases analyzed could be considered insufficient. Thirdly, the homogeneity of the sample regarding sex, age, and qualifications limited any statistical analyses of a descriptive or inferential nature that could have enriched this research. However, while the calculated adjustment indices (RMSEA, CFI, TLI, CMIN/DF) do not present an excellent adjustment of the model, their adjustment is indeed satisfactory, and it is probable that exploring these measuring errors associated with empirical variables (items) and the correlations between these errors will yield a better adjustment of the model.

References

Abid, T., Zahid, G., Shahid, N., & Bukhari, M. (2021). Online teaching experience during the COVID-19 in Pakistan: Pedagogy–technology balance and student engagement. Fudan Journal of the Humanities and Social Sciences, 14(3), 367–391. https://doi.org/10.1007/s40647-021-00325-7

Aldana Vargas, M. F., & Osorio, L. A. (2019). Pedagogical guidelines for the design of blended learning environments [Lineamientos pedagógicos para el diseño de ambientes de aprendizaje Blended. Transformación de la enseñanza y el aprendizaje.] EDUTECH REVIEW. International Education Technologies Review, 6(1), 23–37. https://doi.org/10.37467/gka-revedutech.v6.2012

Alizadeh, M., Mehran, P., Koguchi, I., & Takemura, H. (2019). Evaluating a blended course for Japanese learners of English: Why quality matters. International Journal of Educational Technology in Higher Education, 16, 1–21. https://doi.org/10.1186/s41239-019-0137-2

Alsalhi, N. R., Al-Qatawneh, S., Eltahir, M., & Aqel, K. (2021). Does blended learning improve the academic achievement of undergraduate students in the mathematics course?: A case study in higher education. Eurasia Journal of Mathematics, Science and Technology Education, 17(4), Article No: em1951. https://doi.org/10.29333/EJMSTE/10781

Armellini, A., Teixeira Antunes, V., & Howe, R. (2021). Student perspectives on learning experiences in a higher education active blended learning contex. TechTrends, 65(4), 433–443. https://doi.org/10.1007/s11528-021-00593-w

Binyamin, S. S., Rutter, M. J., & Smith, S. (2019). Extending the technology acceptance model to understand students' use of learning management systems in Saudi higher education. International Journal of Emerging Technologies in Learning, 14(3), 4–21. https://doi.org/10.3991/ijet.v14i03.9732

Bokolo, A., Jr., Kamaludin, A., Romli, A., Raffei, A. F. M., Phon, D. N. A. E., Abdullah, A., Ming, G. L., Shukor, N. A., Nordin, M. S., & Baba, S. (2019). Exploring the role of blended learning for teaching and learning effectiveness in institutions of higher learning: An empirical investigation. Education and Information Technologies, 24(6), 3433–3466. https://doi.org/10.1007/s10639-019-09941-z

Bokolo, A., Jr., Kamaludin, A., Romli, A., Raffei, A. F. M., Phon, D. N. A. L. E., Abdullah, A., Ming, G. L., Shukor, N. A., Nordin, M. S., & Baba, S. (2021). An integrative framework to investigate the impact of blended learning adoption in higher education: A theoretical perspective. International Journal of Technology Enhanced Learning, 13(2), 182–207. https://doi.org/10.1504/IJTEL.2021.114074

Cacciamani, S., Perrucci, V., & Fujita, N. (2021). Promoting students' collective cognitive responsibility through concurrent, embedded and transformative assessment in blended higher education courses. Technology, Knowledge and Learning. https://doi.org/10.1007/s10758-021-09535-0

Casanova, D., & Moreira, A. (2017). A model for discussing the quality of technology-enhanced learning in blended learning programmes. International Journal of Mobile and Blended Learning, 9(4), 1–20. https://doi.org/10.4018/IJMBL.2017100101

Casanova Rodríguez, M. (2012). El diseño curricular como factor de calidad educativa. REICE. Revista Iberoamericana sobre Calidad, Eficacia y Cambio en Educación, 10(4), 6–20. http://www.redalyc.org/articulo.oa?id=55124841002

Castaño, R., Jenaro, C., & Flores, N. (2017). Percepciones de estudiantes del Grado de Maestro sobre el proceso y resultados de la enseñanza semipresencial-Blended Learning. Revista de Educación a Distancia (RED), 17(52), 1–19. https://revistas.um.es/red/article/view/282161

de la Orden Hoz, A. (2013). Autonomía de los centros escolares y calidad de la educación. Participación Educativa, 2(2), 61–68. https://sede.educacion.gob.es/publiventa/d/16056/19/0

Dericks, G., Thompson, E., Roberts, M., & Phua, F. (2019). Determinants of PhD student satisfaction: The roles of supervisor, department, and peer qualities. Assessment & Evaluation in Higher Education, 44(7), 1053–1068. https://doi.org/10.1080/02602938.2019.1570484

Dicker, R., Garcia, M., Kelly, A., & Mulrooney, H. (2019). What does 'quality' in higher education mean? Perceptions of staff, students and employers. Studies in Higher Education, 44(8), 1425–1441. https://doi.org/10.1080/03075079.2018.1445987

Dziuban, C., Graham, C., Moskal, P., Norberg, A., & Sicilia, N. (2018). Blended learning: The new normal and emerging technologies. International Journal of Educational Technology in Higher Education, 15, Article number: 3. https://doi.org/10.1186/s41239-017-0087-5

Ferrando, P. J., & Anguiano-Carrasco, C. (2012). El análisis factorial como técnica de investigación en psicología. Papeles del Psicólogo, 21(1), 18–33.

Fisher, R., Perényi, Á., & Birdthistle, N. (2018). The positive relationship between flipped and blended learning and student engagement, performance and satisfaction. Active Learning in Higher Education, 22(2), 97–113. https://doi.org/10.1177/1469787418801702

Gallego-Ortega, J. L., & Rodríguez-Fuentes, A. (2016). La alteridad en educación. Teoría e investigación. Ediciones.

Galvis, Á. H. (2018). Supporting decision-making processes on blended learning in higher education: Literature and good practices review. International Journal of Educational

Technology in Higher Education, 15, Article number: 25. https://doi.org/10.1186/s41239-018-0106-1

García Aretio, L. (2017). Educación a distancia y virtual: Calidad, disrupción, aprendizajes adaptativo y móvil. RIED. Revista Iberoamericana de Educación a Distancia, 20(2), 9–25. https://doi.org/10.5944/ried.20.2.18737

Gruba, P., Cárdenas-Claros, M. S., Suvorov, R., & Rick, K. (2016). Blended language program evaluation. Springer.

Gutiérrez-Pérez, B. M., & Martín-García, A. V. (2020). Evaluation of quality in blended learning training. In A. V. Martín-García (Ed.), Blended learning: Convergence between technology and pedagogy (pp. 91–111). Springer. https://doi.org/10.1007/978-3-030-45781-5_5

Gutiérrez-Pérez, B. M., & Martín-García, A. V. (2021). Content validation of an instrument used to assess the educational quality of blended learning courses. Journal of Hunan University Natural Sciences, 48(10), 585–594. http://jonuns.com/index.php/journal/article/view/823/818

Hadiyanto, H., Sulistiyo, U., Mukminin, A., Haryanto, E., & Syaiful, S. (2022) The effect of blended learning on EFL students' performance in research methodology and practice of 21st century skills. Journal of Educators Online, 19(3). https://doi.org/10.9743/JEO.2022.19.3.8

Harvey, L., & Green, D. (1993). Defining quality. Assessment & Evaluation in Higher Education, 18(1), 9–34. https://doi.org/10.1080/0260293930180102

Horn, M. B., & Staker, H. (2011). The rise of K–12 blended learning. Innosight.

Hrastinski, S. (2019). What do we mean by blended learning? TechTrends, 63, 564–569. https://doi.org/10.1007/s11528-019-00375-5

Huisman, J., Brockerhoff, L., & Laufer, M. (2015). Factors affecting the quality of higher education: A literature review. CHEGG, Ghent University.

Jebraeily, M., Pirnejad, H., Feizi, A., & Niazkhani, Z. (2020). Evaluation of blended medical education from lecturers' and students' viewpoint: A qualitative study in a developing country. BMC Medical Education, 20(482), 1–11. https://doi.org/10.1186/s12909-020-02388-8

Kanwar, A., & Sanjeeva, M. (2022). Student satisfaction survey: A key for quality improvement in the higher education institution. Journal of Innovation and Entrepreneurship, 11, 27. https://doi.org/10.1186/s13731-022-00196-6

Kintu, M. J., Zhu, C., & Kagambe, E. (2017). Blended learning effectiveness: The relationship between student characteristics, design features and outcomes. International Journal of Educational Technology in Higher Education, 14, Article number: 7. https://doi.org/10.1186/s41239-017-0043-4

Lloret-Segura, S., Ferreres-Traver, A., Hernández-Baeza, A., & Tomás-Marco, I. (2014). El análisis factorial exploratorio de los ítems: Una guía práctica, revisada y actualizada. Anales de Psicología, 30(3), 1151–1169. https://doi.org/10.6018/analesps.30.3.199361

Martínez-Iñinguez, J. E., Tobón, S., López-Ramírez, E., & Manzanilla-Granados, H. M. (2020). Calidad educativa: Un estudio documental desde una perspectiva socioformativa. Revista Latinoamericana de Estudios Educativos, 16(1), 233–258. https://www.redalyc.org/journal/1341/134166565011/134166565011.pdf

Matosas-López, L., Aguado-Franco, J. C., & Gómez-Galán, J. (2019). Constructing an instrument with behavioral scales to assess teaching quality in blended learning modalities. Journal of New Approaches in Educational Research, 8(2), 142–165. https://doi.org/10.7821/naer.2019.7.410

McGee, D. E., & Poojary, D. P. (2020). Exploring blended learning relationships in higher education using a systems-based framework. Turkish Online Journal of Distance Education, 21(4), 1–13. https://doi.org/10.17718/TOJDE.803343

Mejía Madrid, G. S. (2019). El proceso de enseñanza aprendizaje apoyado en las tecnologías de la información: Modelo para evaluar la calidad de los cursos b-learning en las universidades. Universidad de Alicante.

Mejía-Rodríguez, D. L., & Mejía-Leguía, E. J. (2021). Evaluación y calidad educativa: Avances, limitaciones y retos actuales. Revista Electrónica Educare, 25(3), 1–14. https://doi.org/10.15359/ree.25-3.38

Montalvo-García, A., Longo, F., Peña-Molina, A., & Torrez-Meruvia, H. (2020). The blended quality development curve: A comparative and longitudinal study on the improvement rate by using blended methodologies in management masters. Universal Journal of Educational Research, 8(5), 1653–1664. https://doi.org/10.13189/ujer.2020.080501

Montané López, A., Beltrán Llavador, J., & Teodoro, A. (2017). La medida de la calidad educativa: Acerca de los rankings universitarios. Revista de La Asociación de Sociología de La Educación (RASE), 10(2), 283–300. https://doi.org/10.7203/RASE.10.2.10145

Mozelius, P., & Hettiarachchi, E. (2017). Critical factors for implementing blended learning in higher education. International Journal of Information and Communication Technologies in Education, 6(2), 37–51. https://doi.org/10.1515/ijicte-2017-0010

Preacher, K. J., & MacCallum, R. C. (2003). Repairing Tom Swift's electric factor analysis machine. Understanding Statistics, 2(1), 13–43. https://doi.org/10.1207/s15328031us0201_02

Rodríguez Espinar, S. (2013). La evaluación de la calidad en la educación superior. Síntesis.

Sayaf, A. M., Alamri, M. M., Alqahtani, M. A., & Al-Rahmi, W. M. (2021). Information and communications technology used in higher education: An empirical study on digital learning as sustainability. Sustainability, 13(13), 7474. https://doi.org/10.3390/su13137074

Sholikah, M., & Sutirman, S. (2020). How Technology Acceptance Model (TAM) factors of electronic learning influence education service quality through students' satisfaction. TEM Journal, 9(3), 1221–1226. https://doi.org/10.18421/TEM93-50

Shukla, T., Dosaya, D., Nirban, V. S., & Vavilala, M. P. (2020). Factors extraction of effective teaching-learning in online and conventional classrooms. International Journal of Information and Education Technology, 10(6), 422–427. https://doi.org/10.18178/ijiet.2020.10.6.1401

Smith, K., & Hill, J. (2019). Defining the nature of blended learning through its depiction in current research. Higher Education Research and Development, 38(2), 383–397. https://doi.org/10.1080/07294360.2018.1517732

Sola-Martínez, T., Cáceres-Reche, M. P., Romero-Rodríguez, J. M., & Ramos-Navas-Parejo, M. (2020). Estudio Bibliométrico de los documentos indexados en Scopus sobre la Formación del Profesorado en TIC que se relacionan con la Calidad Educativa. Revista Electrónica Interuniversitaria de Formación Del Profesorado, 23(2), 19–35. https://doi.org/10.6018/reifop.418611

Taghizadeh, M., & Hajhosseini, F. (2021). Investigating a blended learning environment: Contribution of attitude, interaction, and quality of teaching to satisfaction of graduate students of TEFL. The Asia-Pacific Education Researcher, 30(5), 459–469. https://doi.org/10.1007/s40299-020-00531-z

Tiana Ferrer, A. (2006). La evaluación de la calidad de la educación: Conceptos, modelos e instrumentos. Transatlántica de Educación, 1, 19–30.

Vera-Millalén, F. (2018). Percepción de estudiantes respecto de la calidad educativa y organizacional de la carrera de enfermería de una universidad privada chilena. Revista Electrónica Educare, 22(3), 1–25. https://doi.org/10.15359/ree.22-3.1

Zhang, Y. G., & Dang, M. Y. (2020). Understanding essential factors in influencing technology-supported learning: A model toward blended learning success. Journal of Information Technology Education: Research, 19, 489–510. https://doi.org/10.28945/4597