The Impact of Cultural Dimensions on Online Learning

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ABSTRACT

Due to the increasingly multicultural nature of e-learning environments, it is critical that instructors and instructional designers be aware of the importance of cultural factors in education and that they deliver culturally adaptive instruction. The main challenge of this paper is identifying the critical success factors for multicultural online learning from learners' perceptions and their relationships with the six-dimensional Hofstede cultural model. Specifically, a categorization of the students' perceptions is proposed by combining multiple correspondence and clustering analyses. To that end, two surveys were conducted in four e-learning universities in four different countries: Spain, the USA, China, and Mexico. Findings from clustering analysis show that learners are categorized according to their autonomy levels at the beginning of the educational process, and they are classified according to their satisfaction levels at the end of the instruction.

Introduction

Despite the relatively recent emergence of Internet-based training, online learning has evolved rapidly. Thus, blended learning (Bonk & Graham, 2012) and mobile learning (Baran, 2014) are some examples of the advances within this learning discipline. Different types of problems related to online learning have been analyzed in the literature, such as the study of the discipline's effectiveness and efficiency (Cooper & Higgins, 2015) or the analysis of its advantages and disadvantages compared with other learning alternatives (Lim, Morris & Kupritz, 2014). In this research, we will focus our efforts on analyzing students' perceptions with respect to online learning. In line with students' perceptions in online education, several research papers have been published in recent years. For example, Paechter and Maier (2010) investigated students' perceptions of online learning compared with traditional education, and Irwin, Ball, Desbrow and Leveritt (2012) analyzed learners' perceptions about the use of Facebook as a tool to promote active learning.

Multicultural contexts are currently widespread in society. Although cultural diversity leads to individual and collective enrichment, several confrontations and misunderstandings between people can result from cultural differences, which also affect the education discipline. Culture greatly influences social behavior, communication, cognitive processes, and pedagogical technologies (Vatrapi, 2008). All of these elements are key components in the online learning discipline. Hence, the design of online programs requires cautious study of how people learn, what people learn and what people perceive as important to learn, depending on their culture. Understanding the set of cultural and learning/teaching features will help the educational community to provide better quality yet also culturally sensitive instruction.

Different authors have researched how culture affects societies through years. For example, Trompenaars and Hampden-Turner (1998) identified seven cultural dimensions in order to determine how people solve problems and reconcile dilemmas. Schwartz (1999) presented a theory of basic human values based on seven cultural dimensions. Inglehart (2008) categorized countries according to two values: (i) survival values versus self-expression values and (ii) traditional values versus secular-rational values. Finally, Hofstede (2011) tried to clarify the values that prevail in different national cultures, first, through a four-dimensional (4D) model, second, through a five-dimensional (5D) model and, third, through a six-dimensional (6D) model.

The specific objectives of this research are as follows: (1) To identify the most important variables in the online learning process, as perceived by students with significantly different cultural backgrounds and (2) to link our findings to the Hofstede 6D model. Thus, the main differences of this inquiry with respect to the online learning literature that analyzes these problems are as follows:

- We analyzed the main educational variables that define a complete educational process (including the stage where the students are not yet enrolled in the course, the variables involved while the student is taking the course, and finally the variables implicated after the course), unlike state-of-the-art research works that focus on specific parts of the online course. For example, Liu, Liu, Lee and Magjuka (2010) focused their attention on how culture affects course design variables (e.g., language, communication tools, and time zone differences); Marambe, Vermunt and Boshuizen (2012) analyzed the differences in learning strategies and orientations and conceptions of learning among Dutch and Asian students; and Brito Neto, Smith and Pedersen (2014) analyzed a multicultural group of flight attendants' perception of e-learning courses, with a particular focus on course relevance and learner motivation, cultural sensitivity, course organization, and course interactivity.

- After an extensive review of the literature, Hofstede's model remains the most widely adopted in the field of education (Viberg & Grönlund, 2013; Nistor, Göğüş & Lerche, 2013). Despite the existence of the updated 6D model, educational researchers still use the outdated 4D/5D model (Marambe et al., 2012; Viberg and Grönlund, 2013; Nistor et al., 2013). This is the second educational contribution of this study.

Finally, from a methodological point of view, multiple correspondence analysis was combined with cluster analysis to categorize international students' perceptions and to determine the most important variables in online learning that deliver culturally sensitive instruction. Based on the multiple correspondence analysis method, we aim to obtain a global picture of the salient relationships among learner, institutional, and outcome variables.

The cultural dimensions of learning based on the Hofstede's model: The cases in Spain, the US, Mexico and China

From 1968 to 1972, Professor Geert Hofstede, leaning on his IBM experience, developed a model to characterize national cultures based on four dimensions (Hofstede, 1983). In 1991, based on Michael Harris Bond's study (Hofstede & Bond, 1988), Hofstede added a fifth dimension, and finally Hofstede transformed his 5D model to a 6D one, which includes the following dimensions (adapted and described for the educational community):

- Power distance index (PDI). This dimension refers to the extent to which the members of organizations accept an equal or unequal power distribution. Countries with a high PDI are more likely to accept a hierarchical structure. Meanwhile, in countries with a low PDI, authority is decentralized and leadership is a bit more democratic (Hofstede, 2011).

- Individualism vs. collectivism (IDV). Societies with high IDV are considered "behavioral" (McFeeters, 2003). Students expect to be treated as fundamentally equal to peers and faculty and teachers are in charge of stimulating passive learners, using prizes and negative reinforcement or punishment to achieve this goal. Societies with low IDV are considered "constructivist" (McFeeters, 2003). Teachers are merely facilitators in the teaching-learning system, and students show a greater dependence on social relationships.

- Masculinity vs. femininity (MAS). This dimension gives details about how an education system can focus on cooperation and security or recognition and advancement (Cambridge, 2012). Countries with a high MAS index encourage competition between students and teachers only reward the excellence. On the other hand, countries with a low MAS index promote a friendly and collaborative learning environment.

- Uncertainty avoidance index (UAI). This dimension refers to the degree to which a person feels uncomfortable due to a sense of uncertainty and ambiguity, and it is associated with students' behaviors toward knowledge construction in the learning context. In cultures with a high level of uncertainty avoidance, students focus on getting the right answer from their teachers. In countries with a low uncertainty avoidance index, there is an open-minded learning process, and learners are allowed to contribute to discussions (Hofstede, 2011).

- Pragmatic vs. normative (PRA). A pragmatic pedagogy is based on the "learning by doing" approach. Students establish knowledge by practising by themselves instead of garnering knowledge through repetition. Teachers' functions are providing learning content and guiding learners to use the research instruments an efficient and effective way. Additionally, a normative approach (a low index score) is based on stable knowledge and rules (Hofstede, 2011); this approach characteristically privileges talents and

aptitudes related to abstract science and theory. Students want immediate gratification and are rarely creative. They attribute success and failure to luck.

- Indulgence vs. restraint (IND). In this dimension, an indulgence score generally implies that the culture allows freedom of speech. A relaxed structure governs the relationship between teachers and learners. The opposite pole of this spectrum relates to restraint. A restraint score implies that learners occupy a subordinate position in relation to teachers, and student motivation tends to be weak in this very stable learning structure.

As will be discussed below, this paper relates the Hofstede cultural dimensions to the cases of the Open University of Catalonia (UOC) in Spain, the University of New Mexico (UNM) in the US, the University of Peking (PKU) in China, and the Autonomous Popular University of the State of Puebla (UPAEP) in Mexico from an educational perspective. These universities were selected for two different reasons. First, all institutions have implemented a learning process of the highest quality for more than 20 years and have more than 10 years of e-learning experience. Second, the studied universities are located in countries that differ significantly in cultural terms.

Although Hofstede's model has been used as a framework in this study and in numerous cultural research studies of the state of the art, the literature contains several critiques of the model. Most of these studies have identified the conceptualization of the culture as nation as a limitation in the work of Hofstede and the method of data collection or set culture as static rather than as dynamic are some criticisms that Hofstede's work have received over the years (McLeay & Wesson, 2014). However, in spite of these criticisms, Hofstede's framework is the most widely accepted in cross-cultural educational studies (Marambe et al., 2012; Viberg & Grönlund, 2013; Nistor et al., 2013). Furthermore, Trompenaars and Hampden-Turner (1998) already detected that the country has the lowest entropy of classification and therefore, country is the major contributor in explaining the cultural orientation of their dimensions. We will also analyze the contribution of the country, but in this case in the creation of clusters to determine the homogeneity of students' perceptions within the same country.

Materials and methods

Sample description

This research work considered a sample of students from UOC, UNM, PKU, and UPAEP. Data were collected using two surveys. The first survey was sent to participants at the beginning of the course, and the second survey was sent at the end of the course. The surveys and accompanying consent forms were originally written in English then translated into the official language(s) of the universities. They were then developed using Opinio and hosted on the University of New Mexico Health Sciences' secure application server. Participants were invited via email to respond to the online questionnaire and were given four weeks to respond. One reminder was sent to all respondents after the first two weeks. All factors in the questionnaire were scored on a four-point Likert scale. The reliability results of each of the educational variables are detailed in Appendix 1.

This research study adopted the input-process-output model of learning proposed by Barbera and Linder-VanBerschot (2011). The first survey included five learner (i.e., input) factors:
- General self-efficacy (GSE)
- Self-efficacy online (SEO)
- Motivation (M)
- Prior knowledge (PK)
- The students' course expectations (CE)

The second survey included eight institutional (i.e., process) factors and three outcome (i.e., output) factors. The eight institutional factors were as follows:
- Learner support (LS)
- Social presence (SP)
- Instruction (I)
- The quality of the learning platform (LP)
- Instructor interaction (II)
- Learner interaction (LI)

- Learning content (LC)
- Course design (CD)

There were three outcome factors:
- Learner satisfaction (LST)
- Knowledge acquisition (KA)
- Ability to transfer (AT)

Analysis methodology

Data cleaning

The first part of the experiment includes the preprocessing and data cleaning stage. A sample of 1,175 and 709 student evaluations from UOC, PKU, UNM, and UPAEP are analyzed in this study. The first survey has fourteen questions, whereas the second survey has thirty-three questions. Ten of the fourteen questions on the first survey are control questions and are not considered in the study. They were included to determine the validity of the students' responses. The same holds true for the second survey: only eleven of the thirty-three questions were considered in the study.

Table 1. Number of participants for the first and second surveys

University	First survey				Second survey			
	ISS	SME	MDR	FSS	ISS	SME	MDR	FSS
UOC	734	44	23	667	383	118	22	243
UNM	62	2	7	53	41	15	0	26
PKU	180	29	24	127	85	16	11	58
UPAEP	199	0	0	199	200	15	7	178
Total	1,175	75	54	1,046	709	164	40	505

Note. ISS = initial sample size; MDR = missing data records; SME = single-minded evaluators; FSS = final sample size.

Analyzing the data robustness and quality of the entire dataset is required before performing computational experiments. In this study, 75 of 1,175 students gave the same scores for all fourteen questions on the first survey (including the control variables and the studied variables), and 164 of 709 students provided the same evaluation criteria for all thirty-three questions on the second survey. These evaluators were called single-minded evaluators, and they were removed from the final dataset (as suggested in Fokoue & Gündüz, 2013).

Furthermore, participants with missing values for the study variables were also excluded from the dataset. This exclusion process was considered an adequate strategy because the missing values were assumed to be missing completely at random (Little & Rubin, 2014) and the sample size was still above 250 after the exclusion of participants with missing data in the two surveys. Table 1 describes initial sample size (ISS), missing data records (MDR), single-minded evaluators (SME), and final sample size (FSS).

Multiple correspondence analysis

Multiple correspondence analysis (MCA) is used to uncover a low-dimensional space of multivariate categorical variables where the interdependencies among these categorical data are graphically visualized. MCA is an extension of correspondence analysis, which allows one to analyze the existing relationships between several categorical variables (Le Roux & Rouanet, 2010). In this study, MCA is used to characterize the different elements involved in the learning experience (i.e., learner, institutional, and outcome factors) and to obtain individual scores for the clustering space.

Cluster analysis

Clustering is used to identify relatively homogeneous clusters of student respondents' profiles. In this work, cluster analysis uses the students' scores on the first two dimensions of the MCA as input variables. Two clustering solutions are provided (one per survey). In that way, cluster analysis is used to classify students into groups based on the students' perceptions when they enroll in the course and when they finish it.

Results and discussion

Characterizing students' perceptions in the studied countries

Analyzing the learner factors

From the multiple correspondence analysis, a two-dimensional solution was considered the most adequate. The first and second dimensions presented have eigenvalues of 2.229 and 1.469, inertia values of 0.446 and 0.294, and Cronbach's alpha values of 0.689 and 0.399, respectively. Discrimination measures (Figure 1) and a joint plot of category points (Figure 2) were obtained. The most discriminant variables for Dimension 1 were M (0.564), SEO (0.498) and GSE (0.455); the most discriminant variables for Dimension 2 were M (0.397), GSE (0.383) and SEO (0.359) (Figure 1). As seen in Figure 1, the two dimensions are described through a combination of the same three categorical variables (M, GSE, and SEO); PK and CE are the variables with the least discriminant power in the two projections considered.

From the results and their graphical visualization, the two dimensions have been termed "learners' autonomy," and the two variables involved are efficacy and motivation, which are actually two of the most important defining variables for the theoretical level of autonomy. Basically, participants are ranked in these two dimensions based on their motivation and self-confidence levels. Students from UOC and UNM are the students with the highest levels of autonomy, followed by students from PKU and UPAEP. Furthermore, in these two dimensions, the variables with the highest correlations are M, SEO and GSE. Bénabou and Tirole (2002) argued that motivation is correlated to self-efficacy, so our findings are consistent with the literature.

China and Mexico, which each have a high power distance index, are more likely to accept a hierarchical structure and their students' attitudes tend to be more passive, which directly implies lower motivation levels. Meanwhile, in countries with a low power distance index (e.g., Spain or the US), teachers expect students to take initiative; these students are thus expected to be more highly motivated. These expectations are substantiated in Figure 2, where UNM and UOC students are associated with higher motivation values than are PKU and UPAEP students.
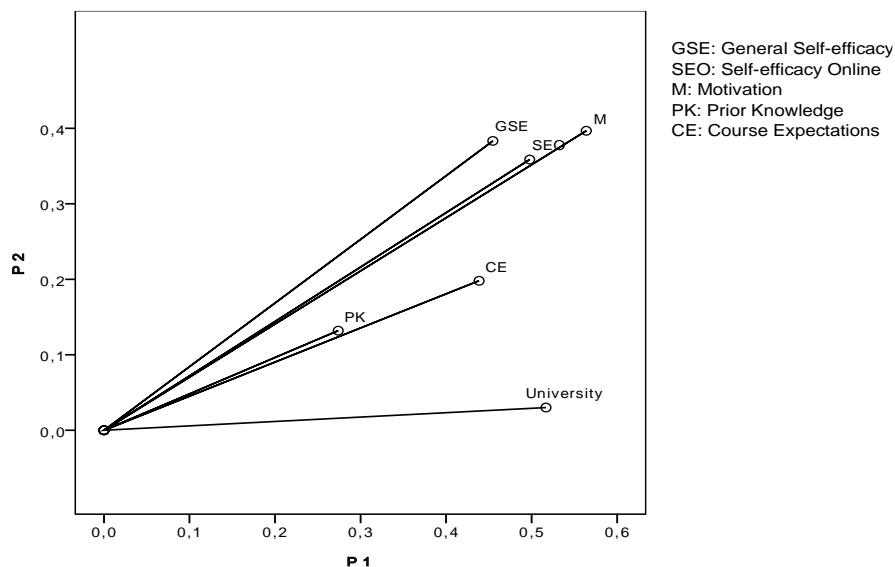

Figure 1. Multiple correspondence analysis learners' dimensions: discrimination measures

UOC and UNM students reported being more motivated than PKU and UPAEP students, which could also be connected to the Hofstede individualism dimension. Kwan and Wong (2015) noted that motivation and achievement are strongly linked to individualism and collectivism, which is also consistent with our results. In our study, individualistic societies (UNM and UOC) tend to have higher motivation values, whereas collectivistic societies (PKU and UPAEP) tend to have lower motivation values. Finally, it is also worth mentioning that most results suggest that there are conditions under which individualists will be more motivated to perform than collectivists and conditions under which collectivists will perform better than individualists.

The universities are ranked with respect to their overall PK as follows: PKU, UOC, UNM, and UPAEP (Figure 2). The same ranking also applies when considering the Hofstede pragmatism dimension. PK and AT are highly

correlated because the more PK the student has on one topic, the easier it is for that student to relate the new knowledge to their own experiences and learn more effectively (Rias & Zaman, 2013). It seems likely that these types of students (PKU students) are prone to have better PK. Conversely, students with normative educations (UPAEP students) are rarely creative and need immediate gratification. In this context, the students with previous normative education should have lower PK than the students with previous pragmatic education, as confirmed in Figure 2.

Finally, individuals with high indulgence scores generally exhibit a willingness to realize their impulses/desires in terms of enjoying life and having fun. They place a higher degree of importance on leisure time and a lower degree of importance to commitment. Hofstede classified Mexico as an indulgent society, whereas the remaining countries qualified as restrained societies (with the US hovering between indulgence and restraint). In general, students in societies with high indulgence scores will tend to have less motivation than students in restrained societies to enroll in and start an online educational course (Figure 2). These findings are aligned with the psychology literature and specifically with the study of Van den Berg (2011) in which commitment is presented as one of several energizing forces for motivated behaviour. This is consistent not only with our teaching experience but also with the statistical data reported by the Mexican students (Figure 2).
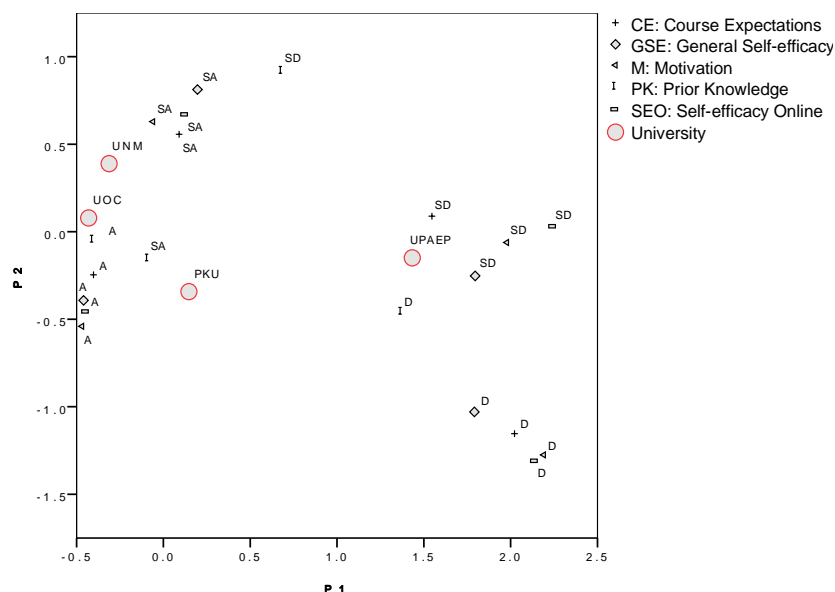

Figure 2. Multiple correspondence analysis learners' dimensions: Joint category plot

Analyzing the institutional factors

As in the previous case, the results from the multiple correspondence analysis are reflected in a two-dimensional figure (Figures 3 and 4). Inertia data (0.506 for Dimension 1 and 0.340 for Dimension 2) and Cronbach's alpha values (0.861 for Dimension 1 and 0.723 for Dimension 2) can be extracted from this multiple correspondence analysis. The discrimination measurement is illustrated in Figure 3. The most discriminant variables for Dimension 1 were CD (0.649), LC (0.608) and SP/I (0.591), whereas the most discriminant variables for Dimension 2 were CD (0.529), II (0.455), and I (0.490). Thus, LS, LP, and LI are the variables with the least discriminant power in the two-dimensional MCA analysis.

Dimension 1 is defined by institutional variables (CD, LC, and SP), whereas Dimension 2 is defined by instruction variables (CD, I and II). Dimension 1 shows more variance than Dimension 2, which perhaps suggests that students enrolled in online programs place more importance on institution-related factors than on instructor-related factors. In this way, online learning and face-to-face learning seem to have opposing preferences. It makes sense that online students show preferences for institutional variables. A university's prestige and ranking are among the top variables that students analyze when they are choosing which university to enroll in for the next academic year; online students will most likely never meet their professors, which justifies their preference for institutional factors. The design and structure of the theoretical content (CD and LC) must be thoroughly prepared because e-learning students organize their studies according to their personal circumstances. Furthermore, these findings show that learners want to feel that others appreciate their work (SP). Teachers should not neglect this value. These findings may help teachers to know which (institutional or instructional) aspects have the best value, which depends on the type of education in which they are involved.
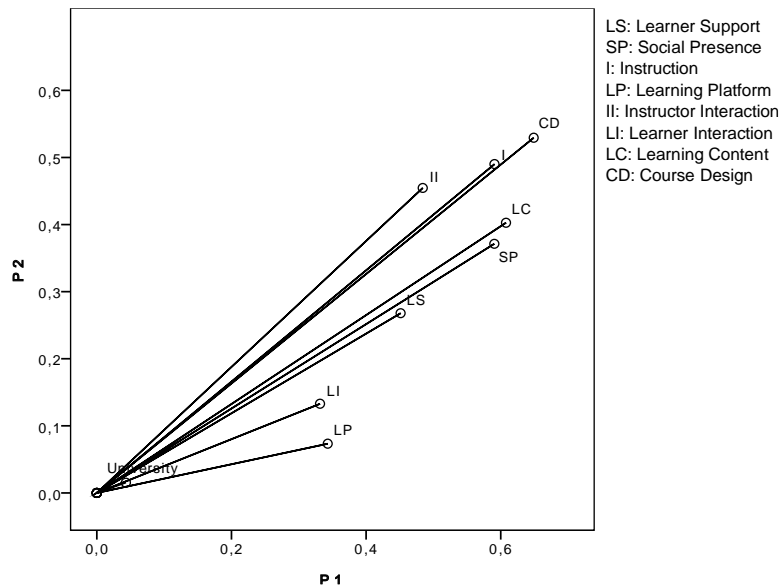
Figure 3. Multiple correspondence analysis institutional dimensions: Discrimination measures

The correlations among the categorical variables represented in Figure 3 are analyzed as follows. The first group includes CD and I, and the second group includes LC and SP:

- On the one hand, a positive correlation between CD and I was detected. Most decisions that influence a course's success take place before a course begins. Therefore, cautious planning during the design stage makes teaching and learning activities easier (Moore, 2013).
- On the other hand, a positive correlation between LC and SP was found. If students are very interested in the learning content, it is very likely that they will feel the need to interact with the learning community to extract information of interest (Shackelford & Maxwell, 2012).

Hereafter, our focal point is Figure 4. As described in the cultural dimension of the learning section, PKU and UPAEP are universities with behavioral educational systems that have lower rates of individualism (see China's and Mexico's indulgence Hofstede scores). Recently, online university practitioners have tried to convince society that the constructivist educational model is characteristic of this type of university (Tam, 2000). However, how is it possible that online students in China and Mexico (with behavioral education systems) are satisfied with the constructivist education received? Chinese and Mexican online universities still tend to have a bit of a behavioral flavor (despite great efforts by online university practitioners to impose a constructivist educational model). These behavioral remnants are also understandable, given the nature of online universities and online university students. Despite these inconsistencies, online university students are generally pleased with the education that they receive, given the universities' proximity to positive assessments.
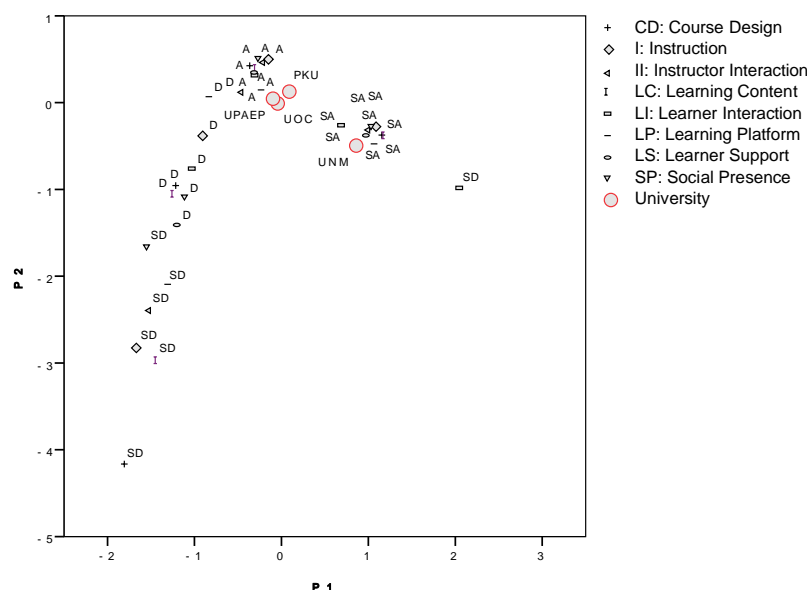

Figure 4. Multiple correspondence analysis institutional dimensions: Joint category plot

Analyzing the outcome factors

The outcome factors are also subjected to a multiple correspondence analysis, leading to a two-dimensional graph that summarizes the students' perceptions. Inertia data (0.647 for Dimension 1 and 0.590 for Dimension 2) and Cronbach's alpha (0.727 for Dimension 1 and 0.653 for Dimension 2) values can be extracted from this inquiry. Moreover, Figures 5 and 6 show the discrimination measures plot and the conjoint categorical correlation plot, respectively. The most discriminant variables in Figure 5 were LST (0.653) and AT (0.681) for Dimension 1 and LST (0.615) and AT (0.640) for Dimension 2. Thus, the two-dimensional illustration is drawn by combining two elements (LST, AT), and KA has the magnitude with the least impact. From the second plot, an interpretation of points demonstrates how cultural differences are unnoticed after the course is finalized.

The LST and AT variables (which explain the dimensions described in Figure 6) are also highly correlated (as shown in Figure 5). AT is defined as the extent to which students are able to apply their learning to future situations. Instructional activities promote student skills that are related to knowledge transfer. Therefore, according to the empirical results, the instructional activities were correctly carried out in the online universities of this case study. On the other hand, online students' motivations vary widely. In our case study, it is assumed that learners need to acquire knowledge for work-related reasons. In this sense, students assess very positively the instructional activities that allow them to apply their acquired knowledge in their working lives. This finding could justify the correlation between AT and LST.
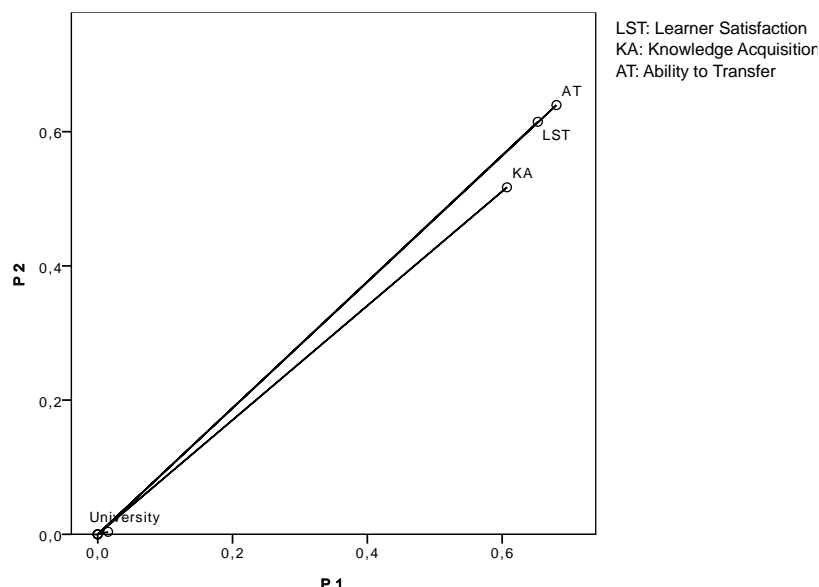

Figure 5. Multiple correspondence analysis outcome dimensions: Discrimination measures

The extent to which members of different cultures vary in their reactions to uncertainty may have a major impact on how perceived learning quality affects students' satisfaction. Students from countries with high uncertainty avoidance levels are comfortable in a learning process that is structured by teachers; in contrast, in countries with low uncertainty avoidance levels, students are comfortable in an open-minded learning environment. Figure 6 shows that students from cultures with high degrees of uncertainty avoidance are slightly less satisfied (students from UPAEP and UOC) than are students from cultures with low degrees of uncertainty avoidance (students from UNM and PKU). This lesser degree of satisfaction occurs when their learning expectations have not been met, perhaps as a result of an educational problem. In light of the tolerance zone concept, this finding suggests a narrower range of acceptable learning outcomes for cultures with high levels of uncertainty avoidance. Therefore, learning quality efforts should be explicitly designed to reflect intercultural differences in the planning and training of service personnel.

These findings also suggest that online learning is more related to open-minded learning than a traditional learning scenario. In this way, American (UNM) and Chinese (PKU) students were acclimatized to flexible structures (according to Hofstede scores), and Spanish (UOC) and Mexican (UPAEP) students were unacclimatized to open-minded training. We observed during our experience in the online programs under study that students with a high level of uncertainty avoidance (Spanish and Mexicans students) needed stricter teaching guidance throughout the course. Moreover, these students were insecure and felt anxious when they needed to make decisions (Hofstede, 2011). We experienced this low level of acclimatization in open-minded environments when group activities were proposed. Students from countries with high UAI (Spanish and Mexicans students)

showed high reluctance toward these activities. Despite these examples, the American and Chinese students appreciated this open-minded approach, as did UOC and UPAEP learners, who acknowledged that enrolling in the course allowed them to transfer their knowledge to their daily routines.
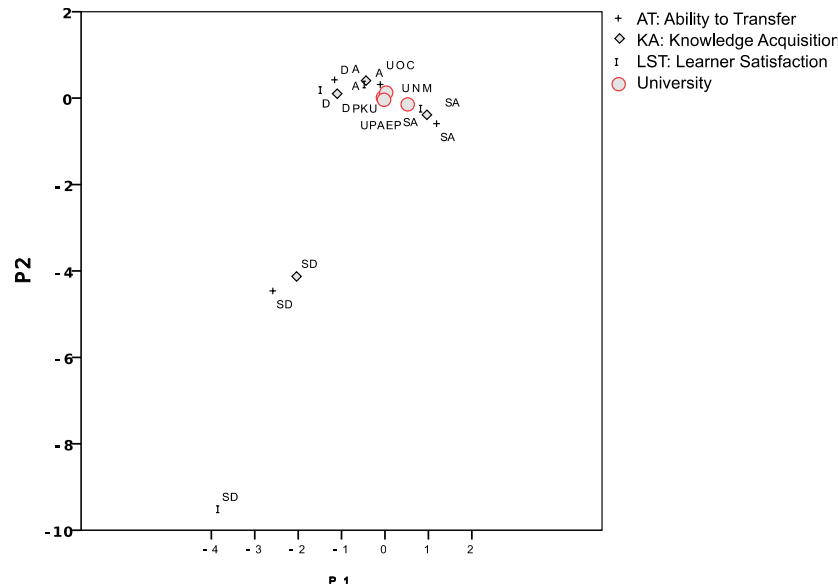

Figure 6. Multiple correspondence analysis outcome dimensions: Joint category plot

Cluster analysis of the student's perceptions

First survey

Table 2 shows cross-tabulations that relate the four groups with the most discriminant variables (general self-efficacy, self-efficacy online, and motivation) and the four universities (UOC, UNM, PKU, and UPAEP) of the case study. Table 2 shows the distribution of students' perceptions according to the most discriminant variables and the distribution of students' perceptions with respect to the universities.

Table 2. Cluster analysis of the first survey

		C_1 (n(%))	C_2 (n(%))	C_3 (n(%))	C_4 (n(%))
General self-efficacy	SD	6 (14%)	**24 (55.8%)**	4 (9.3%)	9 (20.9%)
	D	9 (14.3%)	28 (44.4%)	1 (1.6%)	**25 (39.7%)**
	A	**486 (85.1%)**	16 (2.8%)	55 (9.6%)	14 (2.5%)
	SA	117 (31.7%)	42 (11.4%)	**201 (54.5%)**	9 (2.4%)
Self-efficacy online	SD	0 (0%)	**26 (59.1%)**	5 (11.4%)	13 (29.5%)
	D	3 (7.3%)	16 (39%)	0 (0%)	**22 (53.7%)**
	A	**454 (86.3%)**	20 (3.8%)	40 (7.6%)	12 (2.3%)
	SA	161 (37%)	48 (11%)	**216 (49.7%)**	10 (2.3%)
Motivation	SD	4 (7%)	**36 (63.2%)**	5 (8.8%)	12 (21.1%)
	D	2 (3.6%)	19 (33.9%)	0 (0%)	**35 (62.5%)**
	A	**388 (88.6%)**	16 (3.7%)	28 (6.4%)	6 (1.4%)
	SA	224 (45.3%)	39 (7.9%)	**228 (46.1%)**	4 (0.8%)
Universities	UOC	493 (73.9%)	9 (1.3%)	165 (24.7%)	0 (0%)
	UNM	29 (54.7%)	1 (1.9%)	23 (43.4%)	0 (0%)
	PKU	73 (57.5%)	5 (3.9%)	35 (27.6%)	14 (11%)
	UPAEP	23 (11.6%)	95 (47.7%)	38 (19.1%)	43 (21.6%)

Note. SD = strongly disagree; D = disagree; A= agree; SA= strongly agree.

The elbow criterion determined the optimal numbers of clusters, i.e., four for the first survey (C_1, C_2, C_3, C_4). Each group corresponds to an autonomy level: a very high level of autonomy, a high level of autonomy, a medium level of autonomy, and a low level of autonomy. C_2 includes students with the lowest autonomy level; C_4 includes students with the second lowest autonomy level; C_1 includes students with a high autonomy level; and C_3 includes the students with the highest autonomy level. Furthermore, cross-tabulations also allow us to

associate a level of the most discriminant variables with an autonomy level. For example, the 55.8% of students with the lowest general self-efficiency values are included in the second cluster, which groups students with the lowest possible autonomy values.

Universities are also ranked according to the degree of their students' autonomy. Thus, the US ranks first (UNM is the university with the greatest number of students with a very high autonomy levels and the second greatest number of students with high autonomy levels); Spain ranks second (73.9% of UOC students have high levels of autonomy); and China and Mexico rank third and fourth, respectively.

Second survey

Table 3 is a cross-tabulation table that includes the following factors: the three groups (C_1, C_2, C_3) that are determined by the elbow criterion, the most discriminant variables for the second survey (instruction, learner content, course design, learner satisfaction, and ability to transfer), and the four online universities. In this case, universities and students are ranked according to their levels of satisfaction.

The elbow criterion procedure determined that the optimal number of groups for the second survey was three. The three groups relate to the students' different levels of satisfaction: very satisfied, satisfied, and unsatisfied. The groups rank as follows: C_1 includes the unsatisfied students; C_2 includes the satisfied students; and C_3 includes the unsatisfied ones. Furthermore, Table 3 correlates the grade of each variable (SD, D, A, SA) with the group, which allows us to know the proportion of students that agrees or disagrees on a specific variable included in each group. For example, the 67.6% of students who are highly satisfied with instruction (SA/I) are included in C_3. Table 3 also allows us to determine the most important variables that characterize the final satisfaction level. For example, learners from asynchronous online systems evaluate the course design (83.4%) and learning content (80.7%) more positively than the instruction (67.6%).

Table 3. Cluster analysis second survey

		C_1 (n(%))	C_2 (n(%))	C_3 (n(%))
Instruction	SD	**18 (90%)**	2 (10%)	0 (0%)
	D	18 (20.5%)	68 (77.3%)	2 (2.3%)
	A	6 (2.3%)	**208 (80.6%)**	44 (17.1%)
	SA	1 (0.7%)	44 (31.7%)	**94 (67.6%)**
Learner content	SD	**7 (70%)**	3 (30%)	0 (0%)
	D	22 (53.7%)	19 (46.3%)	0 (0%)
	A	14 (4.5%)	**273 (86.9%)**	27 (8.6%)
	SA	0 (0%)	27 (19.3%)	**113 (80.7%)**
Course design	SD	**9 (100%)**	0 (0%)	0 (0%)
	D	21 (55.3%)	17 (44.7%)	0 (0%)
	A	12 (3.9%)	**281 (91.5%)**	14 (4.6%)
	SA	1 (0.7%)	24 (15.9%)	**126 (83.4%)**
Learner satisfaction	SD	**3 (100%)**	0 (0%)	0 (0%)
	D	18 (50%)	17 (47.2%)	1 (2.8%)
	A	17 (7%)	**214 (87.7%)**	13 (5.3%)
	SA	5 (2.3%)	91 (41%)	**126 (56.8%)**
Ability to transfer	SD	**9 (75%)**	3 (25%)	0 (0%)
	D	18 (26.9%)	48 (71.6%)	1 (1.5%)
	A	12 (3.9%)	**242 (79.1%)**	52 (17%)
	SA	4 (3.3%)	29 (24.2%)	**87 (72.5%)**
Universities	UOC	22 (9.1%)	156 (64.2%)	65 (26.7%)
	UNM	2 (7.7%)	8 (30.8%)	16 (61.5%)
	PKU	1 (1.7%)	41 (70.7%)	16 (27.6%)
	UPAEP	18 (10.1%)	117 (65.7%)	43 (24.2%)

Note. SD = strongly disagree; D = disagree; A= agree; SA= strongly agree.

Finally, universities can also be ranked according to their students' levels of satisfaction. Because 98.3% of its students are either satisfied or very satisfied with the courses and their relevance, PKU is the university with the most satisfied students. With a low percentage of totally unsatisfied students (only 7.7% of its students are unsatisfied), UNM ranks second. In Spain, 9.9% of UOC students are absolutely unsatisfied, but 90.9% of

students are satisfied or very satisfied with their course. Lastly, 10.1% of UPAEP students in Mexico are very dissatisfied with their course.

Analyzing the limitations of the study

As explained earlier, the main limitation of Hofstede's cultural model is the conceptualization of the culture as nation, i.e., the culture within the same country is assumed to be homogeneous. An advantage that the methodology adopted offers us is the possibility of checking this assumption. If the majority of students in the same country are grouped within the same educational clustering (note that those clusters were created considering only the students' perceptions and without considering their nationality), then we can affirm that there is a high degree of homogeneity in the students' perception of that country.

Tables 2 and 3 report students' nationalities and show how students are grouped according to their learning perceptions. As shown in Table 2, Mexican students reported the highest degree of heterogeneity in their perceptions before enrolling in the course (the majority cluster grouped the lowest percentage of students, 47.7%, when compared with the majority clusters of the remaining countries, UOC 73.9%, UNM 54.7% and PKU 57.5%). On the other hand, during and after the course (Table 3), the most heterogeneous students were the Americans (with the 61.5% of students included in C_3).

It is important to mention that if nationality were not an influential variable for the creation of groups, the percentage of students in the majority group in Table 2 would be 25% (four classes were considered) while for the second case (Table 3) would be 33.3% (three classes were considered). As can be seen in Tables 2 and 5, the majority groups in the most heterogeneous countries in both cases are almost double these percentages. Furthermore, the communities of the universities under study are generally composed of students and professors born in different cities (especially the UOC and UNM universities). Taking these two facts into account, we conclude that the conceptualization of culture as nation for the case of the students' perceptions towards online learning is not a weak assumption for the countries considered.

Conclusions and future work

This paper analyses students' perceptions in four different online learning universities. As a result, the most important institutional and learner factors (both intrinsic and extrinsic values) in e-learning environments are identified. Furthermore, Hofstede's cultural framework was used to justify the cultural differences among the countries under study. Thus, (1) the dimensions implicated in the learners' factors were the Power Distance, Individualism, Pragmatic, and Indulgence dimensions; (2) the Individualism dimension was associated with the institutional factors; and (3) the Uncertainty avoidance dimension was connected with the outcome factors.

On the other hand, the multiple correspondence analysis has allowed us to graphically visualize the cultural differences among the different countries during the course. At the beginning of the educational process, the cultural differences were very noticeable. During the course, the four countries were clustered into two groups (a group composed of Spanish, Chinese, and Mexican students and another group composed of American students). Finally, at the end of the course, the students' perceptions in all countries were very uniform.

Thus, instructional designers and practitioners could benefit from the results of this research.
- For designers: It is important to know how to design courses that truly help people learn. Identifying the critical learning factors for each culture should guide the implementation of online learning environments that include and respect the particular perspectives of international students.
- For teachers: To deliver culturally sensitive instruction, it is essential to be aware of differences among international students' perceptions. Flexibility in teaching activities, including a wide range of learning activities, is crucial.

During the study, we determined the most influential variables of the whole online educational procedure. This could help practitioners and researchers to detect those educational areas of interest that deserve special attention in online environments that have students from different cultural backgrounds. Hence, we will analyze those variables in depth in future work. From a different perspective, the inclusion of instructors' perceptions in the analysis and their differences regarding learners' perceptions will be also considered in future research.

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Appendix 1

Table 4 includes the items defining the educational variables mentioned in the study. Content validity and reliability were checked at the beginning of the surveys to ensure the readability and clarity of the questionnaire items. The values of Cronbach's alpha for the first and second survey were 0.84 and 0.86, respectively, which suggest that the questionnaires had adequate reliability.

Table 4. Instrument used in the study

	First survey
GSE	I am confident that I can effectively deal with any unexpected event (personal or academic) during the course.
SEO	I am capable of learning in online educational environments.
PK	I feel motivated to learn in this course.
M	I am able to apply information I have learned in other courses to this course.
CE	The course information I received before enrolling gave me an accurate picture of the course.
	Second survey
LS	I received the technical support I needed when I had a problem.
SP	I felt I was a part of a community of learners in this course.
I	The instructor used effective teaching strategies.
LP	All-important site content was easy to locate and identify.
II	The instructor provided individualized guidance that met my needs.
LI	I contributed to the learning environment by responding to my peers.
LC	Content was stimulating to me as a learner.
CD	The objectives of this course were evident in the learning activities.
LST	I recommend that other people enrol in this online course.
KA	I noticed the difference between my PK and the knowledge I gained by the end of the course.
AT	As a result of this course, I am able to apply my learning to a different context, such as my personal or professional life.