The Relationship Between National Culture and the Usability of an E-Learning System

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This study sought to measure the relationship between national culture and the usability of an e-Learning system by using Hofstede's cultural dimensions and Nielson's usability attributes. The study revealed that high uncertainty avoidance cultures found the system more frustrating to use. The study also revealed that individuals from cultures with low power distance indicators (e.g., people more accepting of uneven power distribution) rated the system's usability higher than individuals from high power distance cultures.

Keywords: E-Learning, National Culture, Usability

Social, technological, and economic drivers are transforming education around the world. As globalization encompasses local economies like never before, the development of a skilled workforce becomes a genuinely international concern. Human capital is becoming the chief source of economic value and education and training are becoming lifelong endeavors for millions of workers (Stokes, 2003; Urdan & Weggen, 2000). This is because business success depends more and more on high-quality employee performance, which in turn requires high-quality training. Corporate executives are beginning to understand that enhancing employee skills is key to creating a sustainable competitive advantage. In the quest to remain competitive in today's labor-tight market, companies are exploiting advances in technology to train employees more rapidly, more effectively, and at less expense than in the past (Berg, 1998; Urdan & Weggen, 2000).

Advances in information technology and falling trade barriers facilitate business around the globe. As borders become less meaningful, global competition intensifies. International expansion and accelerating mergers and acquisition activity have led to larger and more complex corporations. Today's businesses have more locations in different time zones and employ larger numbers of workers with diverse cultural backgrounds and educational levels than ever. Thus, more information has to be delivered in increasingly larger organizations, challenging internal planning, logistics, and distribution. Corporations worldwide are now seeking more innovative and efficient ways to deliver training to their geographically-dispersed workforce (Hill, 1997; Hites, 1996; Urdan & Weggen, 2000). A growing technology-based training solution that addresses the global training needs of corporations is e-Learning.

Today's workforce has to process more information in a shorter amount of time. New products and services are emerging with accelerating speed. As production cycles and life spans of products continue to shorten, information and training quickly become obsolete. There is an urgency for trainers to deliver knowledge and skills more rapidly and efficiently whenever and wherever needed. In the age of just-in-time production, just-in-time training becomes a critical element to organizational success (Rosenberg, 2001; Urdan & Weggen, 2000). E-learning solutions facilitate the delivery of the right information and skills to the right people at the right time (Ruttenbur, Spickler, & Lurie, 2000). However, without an effective interface an e-Learning system can not be efficient. A properly designed interface is able to draw the learners' attention, motivate them toward interaction with the system, and help them achieve their goals without confusion and fatigue (Faiola, 1989, Galitz, 1989; Jacques, Preece, & Carey, 1995). This also contributes to the quality and usability of the system (Tufte, 1992).

The term usability generally refers to the ease of use and operational suitability of the interactive displays and controls that serve as the user interface to a computing system (Murphy, Norman, & Moshinsky, 1999). Usability is the measure of the quality of the user experience with interacting with something whether a website, a traditional software application, or any device the user can operate in some way or another (Nielsen, 1997). According to Nielsen (1997), usability is one of the most important aspects of web design, but often the most neglected. Many web usability problems may arise due to variations in behaviors and cultural differences. Such variations may be found in color, graphics, phrases, icons, character sets, pictures, symbols, date and time format, and so forth (Onibere, Morgan, Busang, & Mpoeleng, 2000). Users from different cultures may understand the same websites in totally different ways. Some metaphors, navigation, interaction, or the web-site appearance might be misunderstood and confuse, or even offend the users (Evers & Day, 1997; Marcus & Gould, 2000; Mahemoff & Johnston, 1998).

According to Reeves (1997) not enough is known about the ramifications of cultural inclusivity of cognitive design of on-line learning systems and that further research is needed. Collis, Parisi, and Ligorio (1996) similarly concluded that there is little existing research on instructional design for cross-cultural on-line learning programs. Wild and Henderson (1997) called for investigative research on cultural appropriateness of web-based instructional delivery. When coupling the growth of e-Learning with globalization, it becomes imperative to gain a better understanding of the relationship between the user's cultural differences and usability of e-Learning systems. This study therefore, focuses on the relationship between national culture and the usability of an E-Learning System.

For the sake of eliminating possible confusion, it should be pointed out that usability studies are *not* contingent upon the content within the e-Learning system (e.g., the lessons). They are, in fact, measures of the system's design and ease of use, not the quality of the instructional materials therein. Bearing that in mind, it is time to focus on the overall purpose of this study.

Purpose of Study

The purpose of this study was to explore the relationship between national culture and the usability of an e-Learning system. The following research questions guided the study:

1. What is the relationship between power distance and the usability (learnability, error rate, and user's satisfaction) of an e-Learning system
2. What is the relationship between individualism and collectivism and usability (learnability, error rate, and user's satisfaction) of an e-Learning system?
3. What is the relationship between femininity/masculinity and the usability (learnability, error rate, and user's satisfaction) of an e-Learning system?
4. What is the relationship between uncertainty avoidance and the usability (learnability, error rate, and user's satisfaction) of an e-Learning system?

Methodology

This section describes the methodology aspect of the study. Included in these descriptions are discussions on the study's variables, population and sample, instrumentation, data collection and data analysis procedures.

Study Variables

The theoretical frameworks that were used to guide this study are Hofstede's cultural dimensions, and Nielson's usability attributes. Hofstede (1980, 1997) identified cultural dimensions that the researchers thought may influence user interface and web design. These national dimensions are: power distance, individualism versus collectivism, masculinity versus femininity, and uncertainty avoidance. Hofstede's cultural dimensions have been used and tested by several researchers to explore influence on user-interface and systems design (Bernard, 2000; Dunbar, 1991; Ever and Day, 1997; Marcus & Gould, 2000). Nielson (1993) defines the usability of a computer system in terms of the following attributes: learnability, errors, and satisfaction. Nielsen's usability attributes are used by many researchers to guide usability studies (Borges, Morales, & Rodriguez, 1995; Instone, 1997; Kurosu & Kashimura, 1995; Rajani & Rosenberg, 1999). This particular study required the examination of usability and cultural variables in order to determine potential relationships between national culture and the usability of an e-Learning system.

Usability Variables

Learnability (ease of learning), error (types and rate of errors), and satisfaction (user satisfaction) were the three usability attributes that were used to guide the usability aspect of this study (Nielson, 1993). The three relevant attributes for this study are further explained below.

Learnability. This is measured the time users took to reach a specified level of proficiency. In this study it was used to measure the time it took to perform various tasks and also measured their rates of error in performing the tasks. The rates of error were measured by comparing the number of users clicks with the expected number of clicks required to accomplish a particular task (Calculation of expected number of clicks is explained under Data Analysis Procedure section. Thus learnability had two parts: learnability time (LT) and learnability clicks (LC).

Error. This variable measured the number of errors that occur while users were engaged in a task. An error rate was not used in this study as a separate variable. Rather, error was incorporated into the learnability attribute and was measured by comparing users actual clicks to expected clicks required to perform a particular task.

Satisfaction. This final usability variable measured how pleasing the system was to users. It represented the degree to which a user's perceived personal needs and the need to perform specific tasks are adequately met by a

system (Goodhue & Straub, 1991). Data regarding user satisfaction was collected using a post-task questionnaire to determine the participant's level of satisfaction with the system. Means and standard deviations were calculated for satisfaction. Each participant had one score for satisfaction.

Cultural Variables

The country index scores for the four cultural variables (power distance, individualism/collectivism, masculinity/femininity, and uncertainty avoidance) in this study were based on Hofstede's (1980, 1984, 1997) work on cross-cultural values. The four dimensions on which country cultures differ were revealed through theoretical reasoning and statistical analysis. The following cultural variables: power distance (PD), individualism/collectivism (INDCOL), masculinity/femininity (MASFEM), and uncertainty avoidance (UA) were used to guide the cultural aspect of this study (Hofstede, 1980). Each cultural variable is described below. Please note, the scores associated with each of these variables represent relative, not absolute, positions of individual members of each country.

Power distance. PDI is defined "as the extent to which the less powerful members of institutions and organizations accept and expect that power is distributed unequally" (Hofstede & Bond, 1984. p. 419). The Power Distance Indicator typically has a value between 0 (Low) and 100 (High), but values below 0 and above 100 are technically possible. Thus scores near 0 reflect less acceptance of the unequal distribution of power while scores near 100 reflect greater acceptance of unequal distribution of power within one's culture. In accordance with Hofstede's work, a value less than 50 represented Low PDI and a value of 50 or more represented High PDI.

Individualism and collectivism. INDCOL focuses on the relationship between the individual and groups. Highly individualistic cultures believe that the individual is the most important unit while highly collectivistic cultures believe that the group is the most important unit (Hofstede, 1997). Scores typically are between 0 (Strong Collectivist) and 100 (Strong Individualist), but values below 0 and above 100 are technically possible. A value less than 50 represented COLL and a value of 50 or more represented IND.

Masculinity and femininity. MASFEM represents one of the dimensions of national culture. "Femininity stands for a society in which social roles overlap; both men and women are supposed to be modest, tender, and concerned with the quality of life" (Hofstede, 1997, p. 261). While masculinity culture have very distinct expectation of male and female roles in society. The variables values typically are between 0 (Strongly Feminine) and 100 (Strongly Masculine), but values below 0 and above 100 are technically possible. A value less than 50 indicated FEM and a value of 50 or more indicated MAS cultures.

Uncertainty avoidance. UA focuses on the extent to which a culture feels threatened or anxious about ambiguity and how hard individuals will work to avoid it. These variables focus on how cultures adapt to change and cope with uncertainty. The variables values typically are between 0 (Low Uncertainty Avoidance) and 100 (High Uncertainty Avoidance), but values below 0 and above 100 are technically possible. A value less than 50 represented Low UA and a value of 50 or more represented High UA.

Population And Sample

The population for this study was composed of the 30 attendees in an international workshop on training improvement held in Penang, Malaysia. This population was selected for this study because of the attendee's diverse cultural backgrounds and their underlying interest in all forms training and instructional delivery. The sample of this study consisted of the 24 attendees who volunteered to participate in the study. Those who did not volunteer to participate in the study were unavailable to complete all stages of the study and therefore could not produce useable data sets for analysis. Of the 24 attendees who did participate, they represented 14 different countries from Africa, Asia, Europe, and North America. These countries included: Canada, China, Denmark, Ethiopia, France, India, Indonesia, Italy, Libya, Malaysia, Singapore, Thailand, United States, and Zimbabwe. Table 1 shows the distribution of study participants among the cultural variables by nationality. Nationality was determined by greatest length of time a given participant lived in single national; it is not necessarily the country in which s/he was born.

Of the 24 participants in this study, 10 (42%) were female and 14 (58%) were male. They represented 14 different countries from Africa, Asia, Europe, and North America. All study participants with the exception of three had spent the first 15 years of their lives in the country that they were currently living in. Two (8%) participants were in their late 20s, nine (38%) were in their 30s, 11 (46%) were between 40-49 years of age, and two (8%) were over 50. Of the 24 study participants, 6 (25%) had a Bachelors Degree, 10 (42%) had a Masters Degree, and 8 (33%) had a Doctorate Degree. Their major areas of study varied from Economic, Computer Science, Curriculum and Instruction, Physics, Educational Administration, and so forth. All but two of the participants were academic professional in the educational arena. The two who were not were a full time student studying education and an office administrator for a large university in Southeast Asia. Fifteen (63%) of the participants had 18 or more years

of experience in education; six (25%) had between 16 and 17 years, and three (13%) had between 10 and 15 years of experience. All of the 24 study participants had basic computer skills (e.g., regular use email and a web browser).

Table 1. *Distribution of Participants Based on Their Cultural Dimensions (n=24)*

Cultural Variables	Countries Represented in the Study and Number of Participants Representing Each Cultural Variable	Participants Representing Each Cultural Variable
LPD	Canada(1), Denmark(1), USA(1), Zimbabwe(1)	4
HPD	China(1), Ethiopia(1), France(1), India(2), Indonesia(2), Italy(2), Libya(1), Malaysia(7), Pakistan(1), Singapore(1), Thailand(1)	20
IND	Canada(1), Denmark(1), France(1), Italy(2), USA(1), Zimbabwe(1)	7
COLL	China(1), Ethiopia(1), India(2), Indonesia(2), Libya(1) Malaysia(7), Pakistan(1), Singapore(1), Thailand(1)	17
MAS	Canada(1), China(1), India(2), Italy(2), Libya(1), Malaysia(7), Pakistan(1), USA(1), Zimbabwe(1)	17
FEM	Denmark(1), Ethiopia(1), France(1), Indonesia(2), Singapore(1), Thailand(1)	7
LUA	Canada(1), China(1), Denmark(1), India(2), Indonesia(2), Malaysia(7), Singapore(1), USA(1), Zimbabwe(1)	17
HUA	Ethiopia(1), France(1), Italy(2), Libya(1), Pakistan(1), Thailand(1)	7

Instrumentation

Three instruments were used in this study with each instrument collecting information regarding unique aspects of the study. Separate descriptions are provided for each of the instruments which include: User Background Form, User Tasks & Observation Guide, and the Post-Tasks Questionnaire.

The User Background Form captured demographic information regarding each user's nationality, educational level, major area of study, and computer experience. This questionnaire was piloted and used in previous research, including a study on e-Learning and national culture.

The User Tasks & Observation Guide consisted of ten tasks commonly performed by users of the e-Learning system utilized in the study. They included such tasks as logging into the system, locating specific instructional modules within the system, locating the course syllabus, and electronically submitting a class assignment. The 10 tasks purposefully were ordered so that processes learned during one task would not directly impact the performance of later tasks. Clarity of language used in the task statements was established through a multistage review process utilizing international students representing of many of the 14 national cultures encountered in this study.

The Post-Tasks Questionnaire consisted of a 21 item, Likert-scale based, survey that was completed by the study participants immediately upon completion of the 10 aforementioned tasks. The questionnaire targeted the study participants' opinions regarding issues such as satisfaction with navigation schemes, color selections, information presentation, page layout and overall usability. Essentially, this instrument measured the usability attribute of satisfaction. The instrument, itself, was generated through a multiple expert review process to ensure validity, clarity of language, and usability of data captured.

Data Collection Procedures

Each study participant spent approximately one hour completing the data collection process for this study. To begin the process, participants sat at a workstation equipped with the necessary software and hardware to complete each of the 10 tasks required of the users. At the workstation along with the participant was an observer who instructed the participants on their task and monitored their performances using the User Tasks & Observation Guide described above. The observer handed each participant a printout stating task to be completed. Together, the participant and observer read the printout to ensure proper understanding of the task statement. Once the participant understood what was being asked of him/her, the observer would say "begin" and start monitoring the participants' performance. Upon completion of the task, the observer recorded the results for that task in the observation guide.

Upon completion of the 10 tasks, the study participants moved to another table at which time they completed the Post-tasks Questionnaire and the User Background Information Form.

Data Analysis

Data gathered via the above instrumentation were analyzed using several techniques. Demographic information collected using the User Background Information Form was reviewed and categorized using simple frequency counts and statistical means. The remaining data from the User Tasks & Observation Guide and Post-tasks Questionnaire were utilized in a series of correlational calculations necessary to measure the relationships between participants' usability performances and their cultural dimensions.

Findings

The following section describes the key findings emerging from this study. This section presents the findings or results of the study by organizing them around the four research questions of the study.

There were four cultural variables and two usability variables (Error Rate is a Learnability measure) utilized in this study. The relationships between the cultural variables and the usability variables were measured through the use of correlational calculations involving each of the cultural factors and multiple measures for both system learnability and user satisfaction. In addition, supplementary calculations were conducted in order to investigate underlying factors that may influence each of the above variables.

Question 1: What is the Relationship Between Power Distance and the Usability of an E-Learning System?

Question one was answered by computing the correlation between participants country scores for PDI and the learnability and satisfaction usability scores. The learnability variable was comprised of two measures: total time taken to complete the tasks and number of clicks made (an indication of error). Table 2 presents descriptive statistics for the six variables. Table 3 presents correlational results that are associated with research question one.

Table 2. *Descriptive Statistics*

Variable	Mean	Range	sd
Culture Variables			
Power Distance	73.0	18 – 104	25.0
Individualism/Collectivism	40.3	14 – 91	25.2
Masculinity/femininity	50.4	16 – 70	11.6
Uncertainty Avoidance	46.1	8 – 86	17.8
Usability Variables			
Learnability- Time	456.0	224 – 764	146.5
Learnability- Clicks/Error	35.6	20 – 62	10.0
Satisfaction	77.4	57 - 101	11.6

Table 3. *Correlation of Power Distance and Usability Variables*

	r	Z-Value	Probability	n
Power Distance and learnability Time	.248	1.16	.246	24
Power Distance and Learnability Clicks	.420	2.051	.040*	24
Power Distance and Satisfaction	.191	.884	.376	24

* = statistical significance at $p<.05$

Table 3 reveals that a positive correlation exists between power distance and all three usability variables. However, only one of the relationships are statistically significant. Of the two learnability sub-variables, time on task had a correlation of r=.248 and clicks made had a correlation of r=.42 with PDI. The second one, clicks, was significant at the .05 level. This means that the higher the power distance score for an individual's culture (e.g., greatest acceptance of unequal distribution of power), the higher their time and clicks in the e-Learning tasks. The correlation between satisfaction and power distance (r=.19) was also positive but not statistically significant. Table

3 also reveals that individuals from cultures with low power distance indicators (e.g., people who are more accepting of uneven power distribution) rated the overall usability higher than individuals from high PDI cultures.

Question 2: What is the Relationship Between Individualism and Collectivism and Usability of an E-Learning System?

Question two was answered by computing the correlation between the Individualism/Collectivism variable and the two usability variables; learnability and satisfaction. Table 4 reveals that the only statistically significant relationship was with the individualism/collectivism scores and Satisfaction. Individuals from collectivist societies found the system more satisfying to use versus those from individualistic societies, r = -0.420.

Table 4. *Correlation of Power Distance and Usability Variables*

	r	Z-Value	Probability	n
Individualism and learnability Time	-.016	0.73	.942	24
Individualism and Learnability Clicks	-.236	1.104	.270	24
Individualism and Satisfaction	-.420	-2.049	.041*	24

* = statistical significance at p<.05

Question 3: What is the Relationship Between Femininity/Masculinity and the Usability of an E-Learning System?

With regard to the femininity/masculinity factor, there was no significant relationship with any of the three usability variables. For all three variables the relationship was negative but very small.

Table 5. *Correlation of Masculinity/Femininity and Usability Variables*

	r	Z-Value	Probability	n
Masculinity and learnability Time	-.037	0.169	.866	24
Masculinity and Learnability Clicks	-.083	0.381	.703	24
Masculinity and Satisfaction	-.113	-0.520	.603	24

Question 4: What is the Relationship Between Uncertainty Avoidance and the Usability of an E-Learning System?

The cultural factor of Uncertainty Avoidance did not produce statistically significant relationship with any of the three usability variables. However, there was a strong correlation between UA and Learnability Clicks (p= .08). Given that UAI measures how willing individuals are to accept risk or change, it is not surprising to find that participants who were from cultures that were least likely to accept risk were also the ones who made the most errors in navigating the e-Learning system.

Table 6. *Correlation of Uncertainty Avoidance and Usability Variables*

	r	Z-Value	Probability	n
Uncertainty Avoidance and Learnability Time	-.324	-1.542	.123	24
Uncertainty Avoidance and Learnability Clicks	-.361	-1.734	.0829	24
Uncertainty Avoidance and Satisfaction	-.030	-0.138	.890	24

Discussion and Implications

Three strong correlations where found among the findings; two of these correlations were statistically significant and the third approached the .05 threshold but fell slightly short. In the first, individuals from cultures with high Power Distance Indicator scores tended to make more errant mouse clicks while using the system. Cultures with

high Power Distance Indicators, as represented the study's participants, include those from China, India, Indonesia, Malaysia, and Singapore, among others. These are cultures in which individuals tend to be more accepting of uneven power distributions. These same five countries appear again on the list of cultures with low IND/COL scores. That is to say, individuals from these cultures tend to have more collectivist tendencies versus individualistic. Participants from these collectivist cultures showed strong, statistically significant, levels of satisfaction with the system they used. Last, the same five countries showed strong correlations between their low uncertainty avoidance score (e.g., they were less averse to change and taking risks) and their higher errant click rates.

When viewed in a purely statistical light and given the relatively small sample size, these three findings appear to provide little enlightenment with regard to conducting cross-cultural training and e-Learning activities. However, when one considers the nature of the cultures represented by the participants in this study, one gains a greater understanding of how the findings can truly impact an organization's international operations. In each case, participants represented countries and cultures where there are historic precedents and general tendencies for strong centralized authority figures, whether in the form of teachers, office leaders, or governmental regimes. These cultures also were witness to relatively recently (e.g., the last 50 years) and radical changes in their lifestyles due to the influence of these strong authority figures. For example, compared to their immediate neighbors, Singapore, Malaysia, and Indonesia represent the most technology forward countries in Southeast Asia. In fact, Singapore is one of the most technologically connected nations in the world (ITU, 2003). This is due in large part to their government's determined efforts to put Singapore at the forefront of the technology movement. Last, these cultures tend to be very group/social oriented, often doing what is best for the group regardless of how it might impact them as individuals.

Bearing this mind, organizations conducting training or e-Learning operations in cultures where power-centric, collectivist, and change accepting societies exist must give consideration to a few logistics. First, trainers need to consider the level of leadership expected by the learners. Learners from cultures where strong authority figures are common (e.g., those from high power indicator cultures) will expect greater leadership and guidance from their instructors. As a result, training might take on a more traditional teacher-centered approach, whereas individuals from other cultures may desire a more student-centered approach. Another factor to consider is the level of group interaction and support offered to students. Training conducted in strong collectivist cultures might employ strategies where group work, collaboration, and socially oriented approaches are more prevalent. Conversely, training and e-Learning activities in more individualistic societies might give the learners greater freedom in terms of creativity and expression of knowledge gained (e.g., alternative assessments) or possibly employ more competitive learning environments (i.e., normative testing and grading practices).

In today's increasingly global market, many e-Learning systems designers are faced with the task of insuring that their systems are equally as usable in foreign countries as in the United States. Given the impact that culture has on people's behavior, truly functional global e-Learning systems should reflect the cultural orientation of its users and not just be a translation of an American interface.

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