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The Relationship between National Culture and the Usability of an E-learning System

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ABSTRACT *The purpose of this study was to investigate possible relationships between national culture and the usability of an e-learning system. The theoretical frameworks that were used to guide this study were Hofstede's cultural dimensions and Nielsen's usability attributes. The sample for this study was composed of the twenty-four attendees in an international workshop on training improvement held in Penang, Malaysia. This population was selected for this study because of the attendees' diverse cultural backgrounds and their underlying interest in all forms of training and instructional delivery. Three instruments were used in this study and each instrument assisted in collecting information regarding unique aspects of the research study. The study revealed that high uncertainty avoidance cultures found the e-learning system most frustrating to use. The study also found 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 power distance indicator cultures.*

KEY WORDS: E-learning, national culture, usability

Social, technological, and economic drivers are transforming education around the world. As globalization encompasses local economies as never before, the development of a skilled workforce becomes a genuinely international concern. As human capital becomes the chief source of economic value, education and training become lifelong endeavors for the vast majority of workers (Stokes, 2003; Urdan and Weggen, 2000). Corporations now view learning increasingly as a competitive weapon rather than an annoying cost factor. 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

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technology to train employees more rapidly, more effectively, and at less expense than in the past (Berg, 1998; Urdan and 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 (Berge, 1998). Today's corporations 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 (Brake *et al.*, 1995). Corporations worldwide are now seeking more innovative and efficient ways to deliver training to their geographically dispersed workforce (Hill, 1997; Hites, 1996; Urdan and Weggen, 2000). A growing technology-based training solution that addresses the expanding global training needs of corporations is e-learning.

The term e-learning covers a wide set of applications and processes, including computer-based learning, web-based learning, virtual classrooms, and digital collaboration. E-learning is defined as the delivery of content via all electronic media, including the Internet, intranets, extranets, satellite broadcast, audio/video tape, interactive TV, and CD-ROM (Wentling *et al.*, 2000). E-learning solutions facilitate the delivery of the right information and skills to the right people at the right time (Ruttenbur *et al.*, 2000). This form of learning currently depends on networks and computers, but will likely evolve into systems consisting of a variety of channels (e.g. wireless, satellite) and technologies (e.g. cellular phones, PDAs) as they are developed and adopted.

E-learning is one of the fastest growing and most promising markets in the education industry. The online training market is expected to nearly double in size every year, reaching approximately $11.5 billion by 2005 (Urdan and Weggen, 2000). The flexibility of e-learning systems allows individuals to be trained at a variety of locations, and often at their own convenience and pace, therefore avoiding the time and expenses associated with traditional training methods (Rosenberg, 2001; Urdan and Weggen, 2000). However, without an effective interface an e-learning system cannot 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 learning goals without confusion and fatigue (Faiola, 1989; Galitz, 1989; Jacques *et al.*, 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 *et al.*, 1999). Usability is the measure of the quality of the user experience of 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 *et al.*, 2000). Users from different cultures may understand the same web sites in totally different ways. Some metaphors, navigation,

interaction, or the web-site appearance might be misunderstood and confuse, or even offend, the users (Evers and Day, 1997; Marcus & Gould, 2000; Mahemoff and Johnson, 1998).

Culture is the fundamental values, beliefs, attitudes, patterns of thinking that are embedded in a society's or region's view of how the world works and of how individuals and groups can and should operate in that world (Brake *et al*., 1995). Many scholars are becoming increasingly concerned with the cultural differences among technology users, because of the greater amount of business interaction in the global arena (Branch, 1997; Henderson, 1996; Hites, 1996; Kim, 1996). According to del Galdo and Nielsen (1996), when a new system is developed, consideration of cultural variables benefits the usability and usefulness of the system. Nielsen (1993) indicated that a system must match the user's cultural characteristics. Dunbar (1991) noted that technology is encoded with the characteristics of the culture that developed it. For example, individualistic values are implicit in the systems developed in the United States, whereas these techniques may be totally inappropriate for users from the collectivistic culture. Day (1991) indicated that cultural factors must be taken into account if human interfaces are to be effective, whether in the Third World or in the culturally diverse subcultures of industrialized countries.

The literature reveals that a few researchers have focused on different aspects of culture and technology. For example, Barrett (1996) and DeVos (1995) focused on ethnicity and instructional software and systems. Kedia and Bhagat (1988) investigated the importance of societal culture, organizational culture, and management processes in the transfer of technologies between industrialized, moderately industrialized, and developing nations. Evers and Day (1997) examined users' culturally specific interface design preferences, and evaluated the attitudinal and behavioral consequences of satisfying or not satisfying such preferences. Lee (2000) explored the role culture plays in how peoples interact with product and online systems. Vöhringer-Kuhnt (2001) investigated the cultural influences on the usability of globally used software products. Although some research has been conducted related to different aspects of culture and technology, not enough is known about the ramifications of cultural inclusivity of cognitive design of on-line learning systems and further research is needed (Reeves, 2000). Since e-learning is a relatively new medium of learning delivery, it is not clear what the relationship is between users' cultural backgrounds and usability of e-learning systems.

McLoughlin (1999) reported that e-learning systems often appear to be tailored to the needs of a particular cultural group, recognizing the specific learning needs, preferences and styles of a single, perhaps homogeneous, group of learners. However, in designing e-learning programs, there is a need to ensure flexibility and access to learners of 'multiple cultures', because culture and learning are interwoven and inseparable. When users from different cultures interact with an e-learning system it can result in harmony or tension. If designers of e-learning systems do not recognize the significant impact that cultural and personal cognitive styles have in learning, the instructional design may be at odds with the learning styles of the learners (Henderson, 1996). According to Collis *et al*. (1996) there is little existing research on instructional design for cross-cultural online 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, focused on the relationship between national culture and the usability of an e-learning system.

Purpose of Study

The purpose of this study was to explore possible relationships 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?

Theoretical Frameworks

The theoretical frameworks that guided this study are Hofstede's cultural dimensions and Nielsen's usability attributes.

Hofstede's Cultural Dimensions

Hofstede (1980) identified cultural dimensions that affected individuals' interactions in established systems, social organizations, and education. It was these factors 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. Later, Hofstede (1997) produced a fifth dimension – long-term versus short-term orientation, which refers to the extent to which a culture programs its members to accept delayed gratification of their material, social, and emotional needs. Only the first four dimensions were used in this study because they were more focused on national culture and therefore more relevant to the study. Each of the first four dimensions is discussed below in more detail.

The *power distance* cultural dimension focuses on the nature of human relationship in terms of hierarchy. This idea is often described in animal culture as a pecking order. Those at the top of the order have limited interaction with those below, and so forth. It is defined as 'the extent to which the less powerful members of institutions and organizations accept that power is distributed unequally' (Hofstede and Bond, 1984, p. 419). In other words, people in high power distance cultures are much more comfortable with a larger status differential than those in low power distance cultures.

The *individualism versus collectivism* cultural dimension focuses on the relationship between individual and the group. 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. Some cultures consider relationships and trust important. Some prefer to work in teams and others prefer to work individually. According to Hofstede (1997), individualism pertains to societies in which the ties between individuals are loose and everyone is expected to look after himself or herself and his or her immediate family. Collectivism, as its opposite, pertains to societies in which people from birth onwards are integrated into strong cohesive in-groups, which, throughout people's lifetimes, continue to protect them in exchange for unquestioning loyalty.

The *masculinity versus femininity* cultural dimension focuses on gender roles. Masculinity is seen as the trait that emphasizes ambition, drive, acquisition of wealth, and differential gender roles. Femininity is seen as the trait that stresses caring and nurturing behaviors, environmental awareness, sexually equality and more fluid gender roles. According to Hofstede (1997), masculine cultures tend to have very distinct expectations of male and female roles in the society. Those with feminine cultures have a greater ambiguity in what is expected of each gender.

The *uncertainty avoidance* cultural dimension focuses on how cultures adapt to changes and cope with uncertainty. Emphasis is on the extent to which a culture feels threatened or is anxious about ambiguity. Strong or high uncertainty avoidance indicates that a culture tends to perceive unknown situations as threatening and that people will tend to avoid these situations. Weak or low uncertainty avoidance indicates that a culture is less threatened by unknown situations; therefore, people do not try to avoid uncertain situations.

It should be stated that cultural variables as defined by Hofstede (1980) were not designed specifically for usability studies. However, 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; Evers and Day, 1997; Marcus and Gould, 2000). It is because of this research-based validation and the widespread acceptance of these factors in the human resource development (HRD) field that these cultural dimensions were used in this study.

Nielsen's Usability Attributes

Nielsen (1993) measures the usability of a computer system in terms of the following attributes: learnability, efficiency, memorability, errors, and satisfaction. *Learnability* focuses on the ease of learning. To measure learnability, one picks individuals who have had no previous experience with the systems and measures the time it takes them to reach a specified level of proficiency in using the system. *Efficiency* focuses on the high level of productivity or effectiveness of an experienced user. *Memorability* focuses on how easy it is to remember how to use the system. *Errors* focus on the amount of inaccuracy displayed by users while they are using the systems (e.g. the number of incorrect mouse clicks). It also explores the ease with which the users recover from any errors they make. *Satisfaction* focuses on how pleasant the system is to use, so that users are subjectively satisfied when using it. Subjective satisfaction typically is measured by simply asking the users for their

opinions. *Efficiency* and *memorability* were not be used in this study because they deal with a high level of productivity or effectiveness of an experienced user, which is beyond the scope of this study.

Nielsen's usability attributes have been used by many researchers to guide usability studies (Borges *et al.*, 1995; Instone, 1997; Kurosu and Kashimura, 1995; Rajani and Rosenberg, 1999). It is because of their well-researched validation and their universal acceptance in the software engineering domain that they were selected for use in this study.

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

This study required the examination of usability and cultural variables that may influence the relationship between national culture and the usability of an e-learning system.

Usability variables. Learnability (ease of learning), error (rate of errors), and satisfaction (user satisfaction) were the three usability attributes that were used to guide the usability aspect of this study (Nielsen, 1993). In this study, error rate was included in learnability. The three relevant attributes for this study are further explained below.

Learnability 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 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 in the 'Data Analysis Procedure' section.

Error measured the number of errors that occurred while users were engaged in a task. Error was measured by comparing users' actual clicks to the expected clicks required to perform a particular task. Expected clicks were based upon average click rates from expert users of the system.

Satisfaction measured how pleasing the system was for 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 and Straub, 1991). Data regarding user satisfaction were 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) values survey results collected within subsidiaries of one large multinational business organization (IBM) in

seventy-two countries. The survey was conducted twice between 1967 and 1973 and produced answers to more than 116,000 questionnaires. 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.

Power distance is defined 'as the extent to which the less powerful members of institutions and organizations accept and expect that power is distributed unequally' (Hofstede and Bond, 1984, p. 419). The Power Distance Index developed by Hofstede (1980) was used in this study. It has a value between 0 (low power distance, LPD) and 100 (high power distance, HPD), but values below 0 and above 100 are technically possible. Thus a score near 0 reflects the least acceptance of the unequal distribution of power while a score near 100 reflects the greatest acceptance of unequal distribution of power within one's culture. For this study a value less than 50 represented LPD and a value of 50 or more represented HPD. The power distance scores represent the relative, not the absolute, positions of individual members of the countries.

Individualism and collectivism variables focus 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, 1980). The variable's values typically are between 0 (strong collectivist, COLL) and 100 (strong individualist, IND), but values below 0 and above 100 are technically possible. For this study a value less than 50 represented COLL and a value of 50 or more represented IND. The individualism and collectivism values represent the relative, not the absolute, positions of individual members of the countries.

Masculinity and femininity variables represent 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). In contrast, masculine cultures have very distinct expectation of male and female roles in society. The variables values typically are between 0 (strongly feminine, FEM) and 100 (strongly masculine, MAS), but values below 0 and above 100 are technically possible. For this study a value less than 50 represented FEM and a value of 50 or more represented MAS. The femininity and masculinity values represent the relative, not the absolute, positions of individual members of the countries.

Uncertainty avoidance (low and high) variables focus 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, LUA) and 100 (high uncertainty avoidance, HUA), but values below 0 and above 100 are technically possible. For this study a value less than 50 represented LUA and a value of 50 or more represented HUA. The uncertainty avoidance variables represent the relative, not the absolute, positions of individual members of the countries.

Population and Sample

The population for this study was composed of the thirty attendees in an international workshop on training improvement held in Penang, Malaysia. The workshop was sponsored by the World Bank Institute and was designed to enhance attendees' skills in the delivery and management of instruction for their World Bank-sponsored training programs in their respective homelands. This population was selected for this study because of the attendees' diverse cultural backgrounds and their underlying interest in all forms of training and instructional delivery. The sample of this study consisted of the twenty-four attendees who volunteered to participate in the study. The six attendees who did not participate refrained because they were unavailable to complete all stages of the study and thus would not produce usable data sets for analysis. The twenty-four attendees who did participate represented fourteen different countries from Africa, Asia, Europe, and North America. These countries included: Canada, China, Denmark, Ethiopia, France, India, Indonesia, Italy, Libya, Malaysia, Singapore, Thailand, the United States, and Zimbabwe.

The study participants represented all the cultural dimensions of the study. Table 1 shows the distribution of study participants based on their cultural dimensions.

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	Total number of 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

Note
The number of participants is more than twenty-four because every country contains participants that fall into more than one cultural variable.

Profile of Study Participants

Of the twenty-four participants in this study, ten (42 per cent) were female and fourteen (58 per cent) were male. They represented fourteen different countries from Africa, Asia, Europe, and North America. All study participants with the exception of three had spent the first fifteen years of their lives in the country that they were currently living in. Two (8 per cent) participants were in their late 20s, nine (38 per cent) were in their 30s, eleven (46 per cent) were between 40 and 49 years of age, and two (8 per cent) were over 50. Of the twenty-four study participants, six (25 per cent) had a bachelor's degree, ten (42 per cent) had a master's degree, and nine (38 per cent) had a doctorate. Their major areas of study ranged across economics, computer science, curriculum and instruction, physics, educational administration, and so forth. All but two of the participants were academic professionals in the educational arena. Of the two who were not, one was a full-time student studying education and the other was an office administrator for a large university in Southeast Asia. Fifteen (63 per cent) of the participants had eighteen or more years of experience in education, six (25 per cent) had between sixteen and seventeen years, and three (13 per cent) had between ten and fifteen years of experience. All the twenty-four study participants had basic computer skills (e.g. regular use of email and a web browser).

Instrumentation

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

The *User Background Form* was developed by the researchers to capture demographic information regarding each user's nationality, educational level, major area of study, computer experience, and so forth. This questionnaire was piloted with a group of six international students at a large university in the Midwest of the United States.

The *User Tasks & Observation Guide* consisted of ten tasks commonly performed by users of the e-learning system utilized in the study. The e-learning system used in the study was a multi media web-based e-learning system designed for delivery of courses, modules, or workshops. The ten tasks were related to using the e-learning system in general. Therefore, tasks such as logging into the system, locating specific modules within the system, locating the course syllabus, electronically submitting a class assignment, and opening synchronous class archives were used. The ten tasks were purposefully ordered so that processes learned during the completion of one task would not directly impact on the performance of later tasks. Clarity of language used in the task statements was established through a multistage review and testing process utilizing four e-learning system experts and pilot tested with six international students who were representative of some of the fourteen national cultures encountered in this study. As study participants completed each task, trained observers recorded the participants' performances in terms of time required

(total seconds) and number of steps (mouse clicks) required for task completion. Included in the mouse click counts were intentional but errant clicks made by the study participants (e.g. incorrect navigational selection, etc.) This practice of recording errant clicks is consistent with established usability practices in research and industry and forms an integral component of system learnability measures (Nielsen, 1993).

The *Post-Tasks Questionnaire* consisted of a twenty-one-item, Likert-scale-based survey, which was completed by the study participants immediately upon completion of the ten tasks associated with the *User Tasks & Observation Guide*. The questionnaire targeted the study participants' opinions regarding issues such as satisfaction with navigation schemes, color selections, information presentation, page layout, and overall usability. 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 and pilot tested with six international students who were representative of some of the fourteen national cultures encountered in this study.

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 ten tasks required of the users. The ten tasks were related to the use of an e-learning system developed by staff at the National Center for Supercomputing Applications at the University of Illinois. 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* previously described. The observer handed each participant a printout stating the first of the ten tasks 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 would record the results for that task in the observation guide. This process was repeated until all ten tasks were completed.

Upon completion of the ten tasks, the study participants moved to another table at which time they completed the *Post-tasks Questionnaire* and the *User Background Information Form*. Their responses were recorded on separate forms and stored for future analysis.

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 organized around the four research questions of the study.

There were four cultural variables and three usability variables utilized in this study. The four cultural variables as defined by Hofstede (1980) were: power distance indicator (PDI), individualism vs. collectivism (IDVCOL), masculinity vs. femininity (MASFEM), and uncertainty avoidance indicator (UAI). The three usability variables as defined by Nielsen (1993) were learnability, error, and satisfaction. The relationships between the four cultural variables and two of the usability variables (learnability and satisfaction) were measured through the use of correlational calculations involving each of the four cultural factors and multiple measures for both system learnability and user satisfaction. Error rate was included in learnability. 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 3 reveals that a positive correlation exists between power distance and all three usability variables. However, only one of the relationships is statistically significant. Time on task had a correlation of $r = .248$ and user clicks had a correlation of $r = .42$. Of these, the second one, user clicks, was significant at the .05 level. This means that the higher an individual's power distance score (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 ($r = .19$)

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 (seconds)	456.0	224 – 764	146.5
Error – clicks	36.0	20 – 62	10.0
Satisfaction	77.4	57 – 101	11.6

was also positive but not statistically significant. Table 3 reveals that individuals from cultures with high power distance indicators (e.g. people who are more accepting of uneven power distribution) rated the overall usability higher than individuals from low 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 individuals from cultures with low individualism/collectivism scores (e.g. group is the most important unit) produced higher usability scores. The only statistically significant relationship, however, was between 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.

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 (see Table 5).

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 a statistically significant relationship with any of the three usability variables. However, there

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 error clicks	.420	2.051	.040*	24
Power distance and satisfaction	.191	.884	.376	24

* = statistically significant at $p < .05$

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 error clicks	− .236	1.104	.270	24
Individualism and satisfaction	− .420	− 2.049	.041*	24

* = statistically significant at $p < .05$

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 least likely to accept risk were also the ones who made the most errors in navigating the e-learning system (see Table 6).

Discussion and Implications

Three strong correlations where found among the findings: two of these correlations were statistically significant and the third, PDI, approached the .05 threshold but fell slightly short. Beginning with PDI, 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 represented among the study's participants include China, India, Indonesia, Malaysia, and Singapore, among others. These are cultures in which individuals tend to be more accepting of uneven power distributions (Hofstede, 1980, 1997). 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. Lastly, 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.

The finding of this study, that power distance appeared to have meaningful albeit not statistically significant relations with some of the usability variables, corresponded to Lee's (2000) finding. Lee explored the role culture plays in how people interact with products and online systems through a web site developed for cross-cultural usability testing. Lee's study consisted of demographic, user attitude, cultural variable, population stereotype, subjective preference, and usability testing module. Lee also found some relationships between relating to hierarchical structure of user-interface and cultural dimensions (e.g. power distance culture), although

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 error clicks	−.083	0.381	.703	24
Masculinity and satisfaction	−.113	− 0.520	.603	24

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 error clicks	−.361	−1.734	.0829	24
Uncertainty avoidance and satisfaction	−.030	−0.138	.890	24

none was found to be statistically significantly related to usability attributes (i.e. interaction style, subjective preference).

In contrast to this study's second finding, some researchers have found relationships between individualism/collectivism and usability variables (Vöhringer-Kuhnt, 2001; Zaharias *et al.*, 2001). Specifically, Vöhringer-Kuhnt (2001) investigated cultural influences on the usability of globally used software products. The survey was conducted online via the Internet. The overall results revealed differences in the attitude towards usability across members of different national groups. The study showed that individualism/collectivism was significantly connected to the attitude towards product usability. Also, Zaharias *et al.* (2001) found a relationship between collectivism and learnability of a web-based testing system. However, it is important to note that the mentioned studies did not focus on an e-learning system, but instead focused on globally used software products and a web-based testing system. Therefore the differences in research methodologies and focus could have contributed to different findings. Also, it is important to note that often different users, even those with the same national cultural background, may have different perspectives, behaviors, and opinions, even perspectives that may be diametrically opposed.

The third finding from this study, which indicated a significant relationship between uncertainty avoidance and learnability time, has been supported in existing literature. For example, Zaharias *et al.* (2001) found a relationship between uncertainty avoidance and learnability of a web-based testing system. Also, Evers and Day (1997) found that some relationships among uncertainty avoidance and usability interface attributes exist. Although Evers and Day's study was not specific to e-learning systems but on interface in general, they found that some relationships exist among uncertainty avoidance and usability of interface systems.

When viewed in a purely statistical light, the major findings of this study appear to provide little enlightenment with regarding 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 on 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, group leaders, or governmental regimes). These cultures also were witness to relatively recent (e.g. in the last fifty 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, with people often doing what is best for the group regardless of how it might impact on them as individuals.

Bearing this in 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). An effective e-learning system needs to be usable: easy to learn and satisfying to use. The findings in this study should help human resource development professionals to design effective and appropriate e-learning systems that will meet the needs of users from various cultural backgrounds. The findings could provide HRD educators with information that could assist them in understanding the cultural implications of using e-learning systems in various cultural settings.

In today's increasingly global market, many US e-learning systems designers are faced with the task of ensuring that their systems are 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. Conceptual localization that fits the user's culturally specific mental model of the e-learning system with functionality, feedback, and support for learning is a much more effective way to design e-learning systems for global use.

It should be noted that this study is subject to some limitations. It used only Hofstede's cultural dimensions to guide the cultural aspect of this study; therefore, the result of this study may be limited by the likelihood of omitting important local facets of culture that were present but not captured by the Hofstede's cultural dimensions. It is also important to note that, if other cultural models (Hall, 1990; Triandis, 1994; Trompenaars, 1993; Victor, 1992) had been used, it is possible that different findings would have resulted from the study. Although these other cultural models have some elements that could have applied to this study, the researchers felt that the most relevant model for this study was the Hofstede's cultural dimensions because Hofstede's model has been used and tested by many researchers (e.g. Bernard, 2000; Dunbar, 1991; Evers and Day, 1997; Fernandez, 1995; Marcus and Gould, 2000) to explore influence on user interface and systems design.

Another limitation of the study is the sample size and the representativeness of the sample of their national cultures. The sample size of twenty-four participants is relatively small and if a greater number of participants had been used this would have increased the generalizability of the study's immediate findings. However, bearing in mind the comparatively small amount of research to date in cross-cultural testing of e-learning systems the researchers chose to utilize a smaller sect of participants in order to gather some basic information that is necessary to control and refine exploratory studies in this emerging area of e-learning.

More importantly, this study established a new foundation for further research. For researchers, this study brings together a range of usability testing methodologies

and provides structure and direction for expanding the scope of inquiry into the usability of other e-learning systems. Although the sample of this study was relatively small, future research could validate this study by researching different types of e-learning systems and with larger sample sizes to make the results more generalizable. Further comparison of the results from this study with results obtained from larger, representative user studies of similar systems will add to the value of this study. Also, further work will validate the tools and the approach used in this study. Further research is needed to determine the impact of culture on interface perception and modeling to assist in setting a standard practice for e-learning system design.

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