CROSS-CULTURAL INTERFACE DESIGN AND THE CLASSROOM-LEARNING ENVIRONMENT IN TAIWAN

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ABSTRACT
This study examined whether using localized interface designs would make a difference in users' learning results and their perceptions of the interface design in a classroom learning environment. This study also sought to learn more about users' attitudes toward the localized interface features. To assess the impact of using localized interfaces on students' academic achievements, a 2 x 2 two-way factorial ANCOVA was used to evaluate whether there was a significant difference in students' post-test scores between students in a control group and experiment groups. A two-way MANOVA was applied to examine whether localized icons and layout would bring changes in users' perceptions of interface design. Descriptive statistics were used to evaluate the participants' reaction to localized user interface features. Findings indicated that applying a localized user interface improved neither software usability and adaptability nor the cultural representations and conveyance although culture could affect Human-Computer Interaction (HCI) and software usability.

INTRODUCTION
Through the globalization process, global software, with its standardized interface, is used around the world by users with diverse cultural backgrounds. Realizing that culture is a crucial factor in intercultural human-computer interaction and user interface design, there are many studies investigating intercultural interface design. The available studies show that culture does have a great impact on the usability of interface design and that globally marketed software should accommodate the cultural differences of the target end users (Evers & Sudweeks, 1998). Internationalization and localization are the commonly adopted processes to deal with culturally diverse end users in the industry (Bourges-Waldegg & Scrivener, 2000).

STATEMENT OF PROBLEMS
Internationalization is the process of developing software so that it can be used effectively by users of heterogeneous cultural backgrounds while localization is the process of adding culture-specific components to the software package to adapt to a specific region, language, or culture (Purvis et al., 2001). Localization is one of the commonly used approaches to design cross-cultural, Human-Computer Interaction (HCI). Literature and studies are available on software localization. However, HCI research is western-dominated. The dramatic differences in the social context of the studies and of the international end users could raise questions as to their findings (Day, 1998). Also, there is a lack of literature on the effects of localized versus non-localized interfaces on target culture users (Evers & Sudweeks, 1998). Moreover, there is a lack of studies exploring the effects of localized versus non-localized interface on users' perception and understanding of a given interface (Evers & Sudweeks, 1998).

PURPOSE OF THE STUDY
This study sought to understand to what extent cultural issues could affect system usability and acceptability. This study examined whether using localized interface designs would make a difference compared to a non-localized interface in terms of users' learning results. This study also examined whether the use of localized interfaces would make a difference in users' perceptions of interface design in terms of efficiency and in user satisfaction in the learning environment. Finally, this study sought more understanding of how users perceived the localized interface features.

RESEARCH QUESTIONS
Three research questions framed this study:
1. Does using localized interfaces, instead of a non-localized interface, make a difference in users' learning achievements in a classroom-learning environment?
2. Does using localized interfaces, instead of a non-localized interface, make a difference in users' perceptions of interface design in terms of efficiency and satisfaction in a classroom-learning environment?

3. What are learners' perceptions of the localized interface layout and/or icons?

Hofstede's dimension of culture (1997)

Hofstede's dimension of culture is the most quoted theory in relation to cross-cultural usability (Smith et al., 2004). He argued that there are five cultural dimensions to define all cultures: power distance, collectivism/individualism, masculinity/femininity, uncertainty avoidance, and long-term Confucian orientation (Hofstede, 1997). According to Hofstede, the power distance index is the dimension measuring the degree of inequality in society. It is "the extent to which the less powerful members of institutions and organization within a country expect and accept that power is distributed unequally" (Hofstede, 1997, p. 28). Collectivism/individualism measures the degree of individualism in a society. Individualism refers to the loose ties between individuals in societies: the extent to which individuals are expected to look after themselves. In collectivist societies, people are integrated into cohesive groups. Masculinity/femininity is a dimension of a given societal culture. Masculinity refers to societies with clearly distinct social gender roles. Femininity refers to societies with overlapping social gender roles. Uncertainty avoidance measures the tolerance of ambiguity in a society. It is "the extent to which the members of a culture feel threatened by uncertain or unknown situations" (Hofstede, 1997, p. 113). This variable measures the need for predictability – whether there is a strong need for written or unwritten rules. Long-term Confucian orientation measures the culture's long-term versus short-term orientation toward life's objectives. The values of cultures with long-term orientation include persistence and perseverance, respect for hierarchy of the status of relationships, thrift, and having a sense of shame. The values of cultures with short-term orientation include sense of security and stability, protecting your reputation, respect for tradition, and reciprocation of greetings, favors, and gifts.

Existing Literature about Cross-Cultural User Interface Design

There is a lack of empirical data on the effects of localized interface (Evers & Sudweeks, 1998). Likewise, no solid theory or model exists to build cross-cultural user interface design (Evers & Sudweeks, 1998; Kersten et al., 2000; Smith et al., 2004). There are, however, studies available which provide empirical evidence of the effects of cultural elements on user interface usability in cross-cultural user interface design.

Barber and Badre (1998) examined the usability of several hundred websites using different languages from different countries. The results indicated that website design is influenced by both genre and cultural preference and practices. They suggested that some cultural markers could be particular to given countries and regions, or applied across genres. The study also suggested an interplay between culture and genre. Based on these results, Barber and Badre (1998) argued that cultural elements can affect user performance directly. They proposed the merging of culture and usability in international website design.

Smith et al. (2004) conducted a number of studies in China (Beijing, Dalian, and Kunming) to verify the extent to which Hosfstede's cultural dimension theory could apply to Chinese users in terms of overall website acceptance. The research results showed that the most important cultural dimension is power distance (PD). The research also showed that, in addition to PD, individualism/collectivism (IC) and uncertainty avoidance (UA) each affect acceptability of the website significantly. In contrast to the researchers' expectations, Chinese users showed marginal preference to individualistic websites.

Marcus and Baumgartner (2004) applied Hofstede's (1997) five cultural dimensions to explore and analyze the cultural differences and similarities of several international corporate website designs in terms of user interface components. They found that the corporate websites varied significantly from culture to culture, especially from western and oriental cultures, despite those corporations' standardized interface design specifications.

Marcus (2001) conducted a case study on the user interface design of planet SABTRE™ Travel Information Network, which is one of the largest private online networks used exclusively by travel agents. Planet SABTRE™ interface design focused on fitting the needs of international users. It supports multiple languages and enables icon switching to create a more customized and culturally appropriate interface for global users. The user evaluations of this software interface showed that users from other countries have significant difficulties in recognizing some standardized icons that U.S. users would recognize immediately.

According to Marcus (2003), Point Forward and Sony-Ericsson developed a prototype personal digital assistant based on Hofstede's cultural model. This prototype was developed based on fundamental Chinese concepts for information, organization, and communication. The interface design focused on concepts of people, relationships, and wisdom instead of applications and documents. The usability study showed an acceptance rate of over 80 percent.

THEORETIC FRAMEWORK

Based on the existing literature and research of cross-cultural user interface design, Shen et al. (2006) proposed a culture-centered design (CCD) model to guide the design process. The CCD model is a holistic design approach which addresses "…the conveyance of cultural identity, language, visual communication, and research on target users group related to cognition and usability" (Shen et al., 2006). The CCD model focuses on understanding the social and cultural background of the target users and iteration and evaluation at every stage of the design process. The CCD model argues that users' perceptions about, and interactions with, the user interface are significantly affected by their socio-cultural experience and background. Successful cross-cultural interface design requires the understanding and acknowledgement of differing cultural perspectives.

The CCD model applies a two-level cultural filter to achieve this cultural understanding. The CCD cultural filter is composed of two filter planes: the designers' filter and the end users' filter. The two filters project in parallel towards the user interface design. The upper level of the cultural filter is the designers' filter. Designers formulate their point of view about interface design based on their personal experience and on knowledge from their own social-cultural context and background. Through the cultural filter, designers' perspectives are projected onto the user interface design. There are two levels of the designers' filter. On the first level, designers collect relevant cultural data and check the usability and evaluation tools, as well as other available technical tools.
On the second level, designers collect cultural information about the target culture in terms of language, logical thinking patterns, and social taboos, in order to build a culturally appropriate user interface.

The lower level of the cultural filter is the end users' filter. The end users' filter represents the users' perspectives about the interface based on their social and cultural background. Users formulate their understanding about the interface and behave accordingly through their own cultural filter.

Ideally, according to the CCD, the user interface should represent the target users' cultural values and identities. However, design decisions made based on designers' perspectives might not be appropriate for potential users from different cultures. It is crucial designers be conscious of the possibility that target users might have significantly different cultural backgrounds in terms of language, logic, and taboos. Designers have to be sensitive to the users' culture, whether they share that cultural background or not. Moreover, designers should be able to reflect, and examine their own perspectives through the users' cultural filter plane. CCD cultural filters are not only a tool, but also a "…reflective mental-map between the designer's perception and the end user's perception" (Shen et al., 2006, p. 831).

Using the CCD model, Shen et al. (2006) designed and tested a new computer user interface for a Chinese user group to find out whether the design could really lead to improved conveyance of cultural identity and product usability. Their research showed positive outcomes for the use of the interface and the CCD system. Shen et al. (2006)'s new computer user interface, Garden OS Interface, uses the Chinese garden as its overarching metaphor. It redesigns both interface layout and icons to improve system usability as well as to represent users' cultural identity.

This study employs Shen et al. (2006)'s new computer user interface based on the CCD system to examine how and to what extent cultural issues can affect system usability and acceptability.

RESEARCH DESIGN

In this experimental study, achievement tests and questionnaires were employed to evaluate the effectiveness, efficiency, and satisfaction of the localized interface based on CCD's garden OS interface. To evaluate the effectiveness, a post-test was administered to the users to assess how effectively the localized user interface influenced students' achievement. A survey questionnaire was used to assess the users' subjective opinions about the efficiency and satisfaction rate regarding the courseware user interface.

Design of the research instruments

The instruction topic was intended to teach students some basic knowledge about viruses based on section one, "Viruses," of chapter 20 "Viruses and Bacteria," in the book *Holt Biology*, by Johnson and Raven, published in 2004. All the materials were translated from English into Chinese. The translations were approved by experts in related fields who were fluent in both English and Chinese.

The courseware was designed using Macromedia Flash 8. The reading materials were divided and organized in a way that students could navigate and read through at their own pace within the allocated time. The original interface was designed based on complementary multimedia course materials on the *Holt Biology Texas Visual*

Concept CD-Rom, by Holt, Rinehart, and Winston (Holt, Rinehart, and Winston, 2004). The localized user interfaces in this experiment were designed based on the culture-centered design (CCD) of Shen et al. (2006). Shen et al.'s (2006) garden OS interface design and research was the first attempt to apply a theory of adopting cultural factors into the actual user interface design. According to their research, the garden OS interface—which reflected the Chinese users' cultural background—could have a general positive impact on user satisfaction and learning. In this study, Shen et al.'s garden OS interface was used to test whether it could effectively help students' learning achievements. The garden OS interface tailored the interface to Chinese users by altering layout and icons (see Appendix A).

Pre-test and post-test utilized the same test items to evaluate students' knowledge about the viruses. The only difference between the pre-test and post-test was the order of test items. The tests were translated into Chinese and proof read by experts who were fluent in both English and Chinese to ensure consistency of meaning between the English and Chinese versions. The internal consistency for the pre-test and post-test was proved acceptable and yielded a 0.72 and a 0.76 Cronbach Alpha score respectively.

The questionnaire for the control group and experimental groups were to investigate demographic and computer usage information, students' general opinions about the efficiency and satisfaction of the software interface and to assess users' perceptions about specific localized features of the interface. All questionnaires were translated into Chinese and proof read by several people fluent in both English and Chinese to ensure consistency of meaning. The internal consistency for the two variables, i.e. efficiency and satisfaction, was piloted and yielded a 0.84 for efficiency and satisfaction for 0.83 Cronbach Alpha score.

Procedure

One week before the experiment, the 20-minute online pre-tests were administered to the students in all experimental groups to assess their prior knowledge about the subject matter. During the experiment, students used the pre-installed courseware to self-study the course subject in the computer lab. Instructors assisting in this experiment played only the roles of technology assistant and supervisor. Students in all groups had 40 minutes to self study the material. Course materials for the experimental groups and the control group were exactly the same in content. The only difference was in the courseware interfaces. Students in three treatment groups used courseware with a localized interface tailored for Chinese users: an icon group utilizing localized icons, but with an original layout; a layout group using a localized layout but original icons; and an interface group using both localized icons and layout. Students in the control group used the courseware with an original user interface. After a 10-minute break, students were instructed to take a 20-minute closed book online post-test. After the post-test, all students were instructed to accomplish an online survey to collect demographic and computer usage information, as well as their opinions about the efficiency and satisfaction of the user interface.

Effectiveness of the localized interface

To answer research question one, a two-way ANCOVA at .05 probability level was applied and three null hypotheses were tested:

1. Using layout (localized vs. original) in the user interface does not make a difference in students' academic achievements.
2. Using icons (localized vs. original) in the user interface does not make a difference in students' academic achievements.
3. There is no interaction between using icons and layout in students' academic achievements.

Table 1: ***ANCOVA for Students' Posttest Scores***

Source	***SS***	***df***	***MS***	***F***
Pretest	1092.15	1	1092.15	19.88*
Layout	44.27	1	44.27	.37
Icon	67.76	1	67.76	.27
Layout*Icon	68.42	1	68.42	.27
Error	7855.93	143	54.94	
Corrected Total	9304.72	147		

*p <.05

Students' pre-test scores were used as a covariate to control for the influence of prior knowledge of the subject matter on students' post scores. Table 1 above shows that with *FPretest* (1,143) = 19.88, p <.05, the null hypothesis of no relationship between students' pretest scores and posttest scores was rejected. It revealed that there was a statistically significant relationship between the students' prior knowledge and their performance in posttest. The students' pretest scores were appropriately covariate. With *FLayout* (1,143) = .37, *FIcon* (1,143)

= .27 and *FLayout*Icon* (1,143) = .27, we failed to reject the null hypothesis one, two, and three respectively. It seemed that using a localized interface (icons and layout), instead of the original interface, failed to make a difference in terms of users' learning achievements. And surprisingly, even though there was no statistically significant difference detected between groups, users in the control group who used the original user interface had a higher mean score (M=30.6) in the posttest than those in the experimental groups. This study was unable to replicate the localized interfaces' positive effects noted in most of the available usability studies (Marcus, 2001; Marcus, 2003; Shen et al., 2006; Smith et al., 2004). On the contrary, it provided evidence that contradicted the popular perception that a localized interface promotes the effectiveness of international software.

General interface efficiency and user satisfaction

To answer research question two, a two-way between-subjects multivariate analysis of covariance (MANOVA) at .05 probability level was applied. Two independent variables were the interface layout and interface icons. Two dependent variables were students' perceptions about user interface efficiency and students' satisfaction rate toward the user interface. Three null hypotheses were tested:

1. Using layout (localized vs. traditional) in the user interface does not make a difference in students' perceptions toward the user interface efficiency and user satisfaction.
2. Using icons (localized vs. traditional) in the user interface does not make a difference in students' perceptions toward the user interface efficiency and user satisfaction.
3. There is no interaction between using icons and layout in students' perceptions toward the user interface efficiency and user satisfaction.

Table 2: ***MANOVA for Perceptions about User Interface Efficiency and Satisfaction***

Source	Wilks' Lambda	df_1	df_2	F
Layout	.997	2	94	.131
Icon	.987	2	94	.638
Layout*Icon	.993	2	94	.332

*p <.05

With F_{Layout} (2, 94) = .131, F_{Icon} (2, 94) = .638, and $F_{Layout*Icon}$ (2, 94) = .332 in Table 2, we failed to reject the null hypothesis that using localized layouts in the user interface does not make a difference in students' perceptions toward the user interface efficiency and user satisfaction. With F_{Icon} (2, 94) = .638, we failed to reject the null hypothesis one, two, and three respectively. Results indicated that incorporating localized layout and icons into user interface did not significantly affect users' perceptions about interface efficiency and how satisfied they felt about the interface in general. The results of data analysis suggested that applying a localized user interface did not bring changes in users' perceptions about the interface, nor did it make users more satisfied with the interface. The results provided evidence that differed from the commonly accepted notions and results of other usability studies (Marcus, 2001; Marcus, 2003; Shen et al., 2006; Smith et al., 2004).

Localized User Interface Features

To answer research question three, descriptive statistics were applied to analyze data collected from part three of the treatment group questionnaires. 105 out of 148 students filled out the survey after treatment. Results suggested that users in the localized layout, localized icon and localized interface groups had neutral opinions (68%, 62% and 69.6% respectively) toward the most of the localized interface features as well as the "look and feel" of the interface in general. Also, most of them held neutral opinions about whether the localized interface could better convey cultural significance (64%, 50% and 64% respectively). In addition, subjects did not prefer the localized interface to the conventional interface (52%, 58.3% and 52.2% respectively). The results of this study suggested that, contrary to statements based on other usability studies, localized user interface did not necessarily bring target users' acknowledgement in terms of cultural representations, nor did it bring users' preferences over non-localized interface (Marcus, 2003; Shen et al., 2006).

DISCUSSION

The results of this study showed that this localized user interface improved neither software usability and adaptability nor the cultural representations and conveyance. Also, in spite of the fact that this user interface was designed to accommodate the cultural needs of the target users, results showed that users neither held more positive opinions toward it nor preferred it over the standardized interface as expected. It was also very surprising to find out that users even failed to recognize this interface as a better representation of their cultural heritage. Two factors could contribute to this phenomenon.

Changing Chinese culture

According to Hofstede's dimension of culture, Asian and Western cultures have fundamental differences in terms of power distance, individualism/collectivism, masculinity/femininity and uncertainty avoidance (Hofstede, 1997). Traditional Chinese culture differentiates from Western culture profoundly, in that it values group mentality over individuality, harmony over competition, restraint and submission over contention, status over equality, and morality over knowledge (Liu, 1991). However, instead of being "ontologically objective," culture is "continuously interacting and developing" (Bourges-Waldegg & Scrivener, 1998, p. 289).In the era of globalization, global economy brings foreign investments, products, and advanced technologies, which leads to extensive intercultural communications and mergence (Li & Zou, 2004). Globalization creates new forms of cultural and social interactions that inevitably bring changes in every aspect of everyday life and significantly transform traditional Chinese culture (Liu, 2004).

With the development of globalization, western values such as individualism, equality of opportunity and competition, material wealth, and nuclear family have been accepted and adopted by the Chinese (Li & Zou, 2004). And "Western consumer culture, or popular culture, has now found its largest marketplace in the world's most populous country" (Liu, 2004, p. 82). Some argued that, though the variances still remain to some extent, contemporary Chinese culture has been Americanized (Li & Zou, 2004). Nevertheless, it is also not true that Chinese tradition has been lost in the process of globalization. In fact, it is "still alive and vivacious in terms of its forms, structures, and functions" (Liu, 2004, p. 85). It seems current Chinese culture is characterized by both intercultural mergence and contradiction. Contemporary Chinese culture "has become increasingly a site of dialogical contention of a diverse variety of forces, among which the culture industry, or the commercial popular culture, and China's local and national forms and styles … intersect and interpenetrate" (Liu, 2004, p. 85).

The interface applied in this study, the garden OS interface, used the traditional Chinese garden as the overarching metaphor so that the interface could better reflect and represent the culture of target users. It was designed under the assumption that the traditional Chinese garden was still viewed as a microcosm of society and as the representation of the state or well being of China by target Chinese users. This design assumed that modern Chinese still viewed the traditional garden as a reflection of the world around them so that it could "offer insight into cultural specific design principles such as layout, style, and aesthetics" (Shen et al., 2006, p. 833).These assumptions may not be tenable since modern Chinese, particularly younger generation, probably do not view the world in this way due to dramatic cultural changes.

The research subjects of the study were 15 to 19 years old. This generation is frequently referred to as "newer new humanity" by both themselves and society in general. The "newer new humanity" are a new generation of Chinese, pursuing both en vogue and pleasure-seeking lifestyles. They might have more in common with their Western peers in terms of life styles and value systems than with their ancestors (Liu, 2004). In today's China, with the progress of urbanization and modernization, for most urban youths such as the participants in this study, the traditional Chinese garden is not something present in their daily life. Like their western peers, they are mostly exposed to it in classrooms, books, movies, and during tourist trips. However, they can still associate it with Chinese due to their cultural heritage. Probably for them, the traditional Chinese garden is a representation of ancient Chinese culture. It is not a reflection of the contemporary Chinese culture and society they are living in. Hence, even though users could still probably recognize localized interface features' connections to their cultural heritage, they could not acknowledge localized interfaces as a better conveyance of their cultural identities. This might be one of the reasons that most of the participants in treatment groups did not prefer the localized interface to the conventional interface, and had neutral opinions about whether the localized interface could better convey cultural significance.

Culture is multi-layered

Interface localization is based on the idea that designers should study and understand the "target culture" so that they can identify and localize the cultural attractors to accommodate users' cultural differences. Culture is a value system that is usually thought to be shared by people with the same race/ethnicity/nationality, in the same region, or using the same language. At the same time, culture is also a multi-layered entity. It is "an orientation system provid[ing] a structure for the field of action of an individual belonging to the society, organization or group" (Beu, Honold, & Yuan, 2000, p. 349).

Despite the fact that people may have dramatic differences in their main value systems, they can share the same group culture under certain contexts. For example, an Asian internet user may have more in common with an American internet user than with an Asian non-internet user in the context of internet usage. Cultures are not mutually exclusive either (Yeo, 1996). One can belong to numerous cultures at the same time. A Chinese individual working for an international company belongs to both Chinese culture and the international company

culture. In different contexts, people could react and behave differently based on the specific culture that related to a certain context. Hence, we should not assume a particular target culture based simply on the target users' nationality, race, ethnicity, and language. Context is a crucial factor that should be taken into consideration.

Today's personal computing paradigm and most international software originated from North American. Their design and development are deeply rooted in Western culture and language (Sacher, Tng, & Loudon, 2001). When they were first introduced in the international market, most of them used a standardized, non-localized interface with translations. Even though they assumed and represented American values, behaviors, and goals, they distributed rapidly and found huge success in the global market. Most culturally diverse users, such as Asian users, were exposed to computers and the internet through these products. For those users, though they belonged to different cultures, the learning and frequent usage of new technology subdued their cultural differences to a large extent when they used computers (Onibere, E., Morgan, S., Busang, E. & Mpoeleng, D., 2001). For them, in the context of computers and software usage, these products came to represent their native computer culture. In this sense, new localized software that tries to represent and accommodate their national culture might actually be an alien cultural impostor for them instead (Bourges-Waldegg & Scrivener, 1998). One example was the success of word processing software in Japan. When word processing software programs were introduced to Japan, it was designed based on western typewriter metaphors. Japanese had a very different writing style than Western countries. They used to write from top to bottom and from right to left on rule-lined writing pads. Western typewriters were seldom used in Japan at that time. Nevertheless, it was not only that the Japanese accepted Western word processing software. They also got so accustomed to it that using localized world processing software programs was awkward (Ito, M. & Nakakoji, K., 1996).

The participants in this study were a younger generation of Chinese, "born at the age of globalization and technology innovations" and were "the generation of information technology and the internet" (Liu, 2004, p. 150). Ninety-three percent of participants in this study have computers at home. Sixty-four percent of them use computers frequently/very frequently. Seventy-three percent of them rated their computer skills as fair or better. They were not novice users of the computer and the internet. Like the Japanese word processing software users, they've become accustomed to westernized metaphors and interface. For them, in the context of computer usage, the garden OS interface might be foreign, rather than an interface that better represented their cultural identities. In this sense, it was no wonder that using the garden OS interface failed to lead to the improvement of usability in this study.

CONCLUSIONS AND IMPLICATIONS

The results of this study suggest that applying a localized user interface did not always lead to improved software usability as previous studies indicated. However, the results did not imply that cultural factors were not crucial in the cross-cultural HCI design process. Rather, this study provided empirical evidence and offered more insights on how significantly culture could affect HCI and software usability. It demonstrated that culture is a sophisticated and constantly changing entity. For educators and researchers, when it comes time to evaluate and choose cross-cultural software programs, it is vital to keep in mind that looking for localized features that seem to symbolize the "target culture" is not enough, and could be misleading. Instead, one should look for culturally appropriate features within the specific context. More importantly, one should look for features that address culturally relative representations to facilitate effective human computer communication and interaction in a diverse cultural environment, and within a specific context.

LIMITATIONS AND RECOMMENDATIONS

Firstly, this study was conducted using middle school students in one middle school in Taiwan and further studies should include subjects of more diverse demographic backgrounds to better represent the target population. Secondly, participants had very limited time to get familiar with and use the software interface before taking the posttest and complete the questionnaire. It was possible that this limited treatment time contributed to the results that this study failed to replicated the localized interface's positive effects in previous studies. Future studies should allow more adequate time for treatment to eliminate this possible confounding variable. Thirdly, this study evaluated the short-term effects of different cross-cultural software interfaces only. Future studies could seek to evaluate long-term effects of different interface designs. Fourthly, quantitative data were analyzed for this study only. Observations, case studies, and interviews can be used for further study to provide more sophisticated and comprehensive data for further understanding about cross-cultural interface designs.

Globalized markets bring the need for localized and software packages tailored to target cultures and markets (Evers & Sudweeks, 1998). Further research studies are needed to shed more light on effective cross-cultural interface design. Moreover, further research and studies are needed to deepen and extend our understanding

about the relationship between culture and software usability, and to find more productive and effective approaches for software localization.

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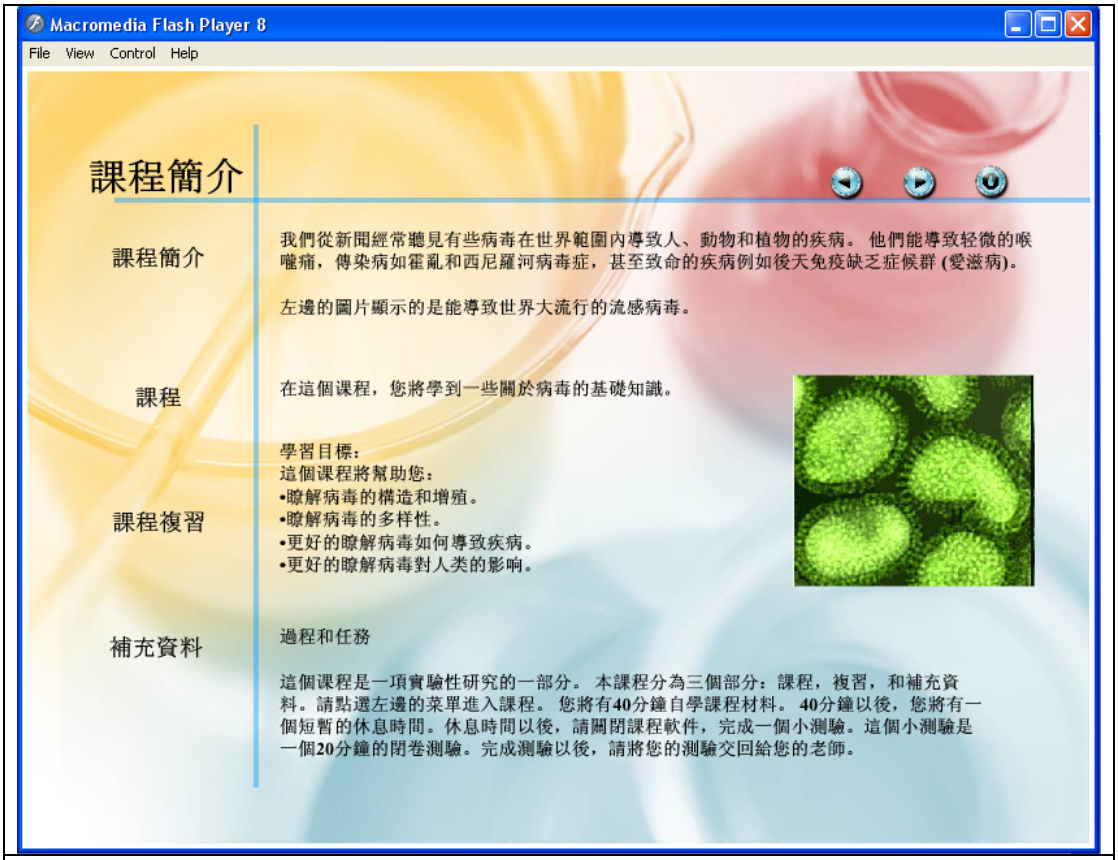
Appendix A

Screen shots of user interface design in control and experimental groups



Screen Shots for Non-localized User Interface Design (Control Group)

Screen Shots for Localized Layout User Interface Design (Localized Layout Group)

Screen Shots for Localized Icon User Interface Design (Localized Icon Group)

Screen Shots for Localized User Interface Design (Localized Interface Group)