Culturally Appropriate Design of Mobile Learning Applications in the Malaysian Context

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Abstract. Many developing countries lack culturally appropriate design guidelines to inform the development of m-learning applications suitable for local use. This study presents the findings from a heuristic evaluation by academics and students at public universities in Malaysia for three locally produced mobile learning applications. The local cultural content and aesthetic values of the applications found a high level of acceptance with the participants. As a result, four principles were identified to support the design of culturally appropriate interfaces for mobile learning applications for the Malaysian context. These were: suitable local cultural content; aesthetic value according to local culture, including appropriate choice of color, and traditional designs and motifs derived largely from local flora and fauna; local language or bilingual communication; and local philosophical values embedded in the content and design.

Keywords: Culturally appropriate interface design · Mobile learning · Usability

1 Introduction

According to Hussin (2011), students at Malaysian universities are ready for mobile learning (m-learning) due to their high rate of ownership of mobile devices. However, to date, there are no national policies on m-learning in Malaysia (So, 2012). In developing countries, such as Malaysia, there is a lack of local content for use in m-learning and a shortage of local digital multimedia learning resources, including local online resources that students might access from their mobile devices (So, 2012). The dominance of mobile content and applications ("apps") from overseas, particularly from English-speaking countries, such as the USA and the UK, contributes to this situation. Faced with this competition and given the relatively small market in which Malaysian mobile developers are operating, there is little financial incentive for the production of content for mobile use for m-learning, either generally or specifically (Ariffin, 2014). In addition, there is a lack of culturally appropriate design guidelines

to inform developers who might wish to create m-learning content and applications for local use. Meanwhile, Kukulska-Hulme (2008) notes that usability issues have often been ignored in m-learning, while Sharples, Taylor and Vavoula (2007) emphasize the significance of usability in improving m-learning effectiveness. Having user interfaces for m-learning purposes designed with local culture in mind can facilitate learning by representing students' own cultural values and engender a greater sense of belonging (Young, 2008). In the same way that students are more motivated when elements of their own culture are included in traditional learning materials (Abdullah & Chandran, 2009), local culture can motivate students in m-learning. Studies have been conducted for implementing African American and American Indian (Eglash et al., 2006), and Chinese culture (Sun, 2012) for a culturally appropriate technology design. However, this study focuses on a culturally appropriate design that can reduce the usability challenges for students employing new mobile applications in Malaysia with the inclusion of the Malay culture.

This paper reports on an investigation of a culturally appropriate interface design for m-learning applications for use in public educational institutions in Malaysia. Despite the cultural plurality of Malaysia, many aspects of culture are shared by all ethnic groups in the country; for example, everyone learns the national language, Bahasa Malaysia, and Islam is the national religion, and, thus, informs government policy on behavioral norms for digital content (SKMM Guidelines, 2012). In order to develop the principles of culturally appropriate interface designs, academics and students at two public universities were asked to take part in a heuristic evaluation of three Malaysian m-learning applications, during and after which they provided their perspectives on culturally appropriate designs and usability. The tool for obtaining their input and stimulating discussion on this issue was a set of usability principles or heuristics based largely on those of Nielsen (Nielsen, 1993; Nielsen, & Mack, 1994), and the mobile adaptations of Nielsen by Bertini, Gabrielli and Kimani (2006), but with the addition of Malay cultural dimensions.

This research does not focus on classifying cultures using the abstract dimensions that are widely used by Hofstede (1984). Hofstede's dimensions focus on the hidden parts of a culture, and, therefore, are not suitable for cultural analysis or "*the inspection of the tangible artefacts produced by that culture*" (Jones & Marsden, 2006, p. 324). Thus, this research proposes and applies a pragmatic approach (Ariffin, 2011) for evaluating the tangible products, such as the m-learning application's user interface for culturally appropriate design principles for the Malaysian context.

We begin by presenting the literature on the role of culture in the usability of m-learning applications, especially in the Malaysian context. A description of our research methods outlines the procedure for the heuristic evaluation by academics and students, and the interviews and focus group discussions that followed. The results of the research include insights into those aspects of Malaysian culture that are perceived by users to be important in the design of m-learning applications, centering around four principles: suitable local cultural content, aesthetic value according to local culture, local language or bilingual communication, and local philosophical values. It is hoped that the understanding developed through this process will lead to the production of

better m-learning resources for Malaysian students and stimulate other countries to develop their own guidelines that are appropriate to their own cultures. Most importantly, we believe that this research will stimulate more discussion of the significant role of culture in human computer interaction, and, specifically, in interface design for m-learning.

1.1 Culture and the Usability of Malaysian M-Learning Applications

Nielsen (1990, p. 39) emphasizes the importance of culture in interface design and the resulting lack of transferability of usability testing from one culture to another. Yeo (1996) stresses the need for cultural considerations of user interfaces for Asian cultures. Specifically, in the Malaysian context, Yeo et al. (2011) indicate that there is a lack of research in the area of interface usability and local culture. Existing usability design guidelines, such as those of Nielsen (1993), do not consider cultural aspects. The importance of culture applies equally to the design of user interfaces for m-learning. Young (2008) highlights one of the important challenges for m-learning as coming from the lack of guidelines for acknowledging local culture in the design of m-learning applications. The inclusion of cultural differences in the design of mobile user interfaces is for the benefit of m-learning application users, such as students and teachers. One of the few studies undertaken in Malaysia is that of Seong (2006), which focuses on the design of a Malaysian m-learning portal. The study proposes usability guidelines for a web portal to facilitate learning using mobile phones. The guidelines cover user analysis, interaction and m-learning interface design. He highlights nationality and language as part of the user analysis but provides no further details on how these might be incorporated. Neither does his study provide information on culturally appropriate design guidelines specifically for the Malay culture. The 1Malaysia studies by Zaibon and Shiratuddin (2010), though culturally focused, dealt with intercultural issues of the Malays, Chinese and Indians rather than Malay cultural appropriateness. In fact, there have been limited qualitative studies of m-learning that focus solely on Malay cultural appropriateness in the Malaysian context.

The cultural design principles are largely inspired by the national cultural policy and Malay cultural literature, which, in the Malaysian context, pertains to Bahasa Malaysia (local language), Malay and Islamic philosophical values, local aesthetic elements (e.g. local motifs from flora and fauna; and local color preferences), and local cultural content (e.g. art and craft traditions).

- **Local Language (Bahasa Malaysia).** Language plays an important role in the Malay society (Mastor, Jin, & Cooper, 2000). Bahasa Malaysia is the official language, and, together with English, is widely spoken, whether in formal educational institutions, such as universities, or outside of these institutions. Therefore, for m-learning applications, Bahasa Malaysia, or bilingual Bahasa Malaysia and English, represent the obvious languages of choice wherever titles, captions, spoken language, etc. are needed. Linked to Bahasa Malaysia is Jawi, an old writing script for the Malay language based on the Arabic script, which dates back to the fifteenth-century (Diah, Ismail, Hami, & Ahmad, 2011). Although it has been

replaced by the Western alphabet in most practical situations, it is still studied and used in Malaysia.

- **Local Philosophy (Malay and Islamic).** The Malay philosophy of life is related to nature and Islamic philosophy (Hussin, 2010; Jamal, 1992; Mastor, Jin, & Cooper, 2000). This includes the Malay attitudes and moral values embedded in m-learning applications. Local moral values are reflected in the Content Code of the Malaysian Communications and Multimedia Commission (SKMM Guidelines, 2012), which specifies the content to be avoided, such as content that is indecent, obscene, violent, menacing, contains offensive language, makes false claims, is unsafe for children, or which neglects family values. The Content Code applies to any digital content developed locally, and thus, includes Malaysian m-learning applications. Thus, m-learning applications need to portray characters in a dignified way, and avoid bad language and violence, which might be imitated by children.

- **Local Aesthetic Values (Flora and Fauna) and local colors (from Nature).** The Malay culture is closely related to nature, in as much as the country has its own distinctive flora and fauna. Most of the environmental elements, even people's lifestyle in the "kampongs" or villages, influence the Malay local art and design. This includes plants and flowers, as well as the philosophy that lies beneath. For example, the motifs and designs in Malay culture are reflected in the design of traditional clothes made from Batik and Songket textiles (Bahauddin & Abdullah, 2003; Hussin, 2010; Ismail, 2010; Jamal, 1992; Jamil, Sembok, & Bakar, 2012). In Malaysian Batik, the motifs and designs are derived from the flora and the universe, instead of from animals and human figures, the representation of which is discouraged by the Islamic religion (Hussin, 2010). On the other hand, colors also influence the life of the Malay people, for example, black represents bad luck, white represents purity and yellow represents royalty. The Malay usage of color is rarely bright unless it is used for festivals, such as "Aidilfitri" at the end of Ramadan or for weddings. Local aesthetic values must fit with local philosophical values (Malay and Islamic).

- **Local Cultural Content.** The Malay culture highlights the importance of art and craft. Typical examples include woodcraft, musical instruments and textiles like Batik (patterned cloth produced by a process of waxing and dying) and Songket (gold and silver hand-woven brocades) (Asiapac Editorial, 2010; Bahauddin & Abdullah, 2003). Malay crafts are inextricably linked to Malay aesthetics and philosophical values, representing the Malay people's attitudes: tolerance of one another, and, despite their differences, respect for everyone living in the community, (Ahmadi, 2004). For example, woodcraft includes concepts, such as "growing from a source", "growing without piercing a friend", "climbing without clinging to a rival", and "intertwining with grace and friendliness" (Ahmadi, 2004, p. 67; Othman, 2005, p. 102). The incorporation of these four elements of local culture into the design of m-learning applications in the Malaysian context would appear to be one way of ensuring culturally appropriate interfaces.

2 Research Methods

The academics and students who took part in this study came from the Faculties of Music and Performing Arts, Art and Design, Technical and Vocational Education, Education and Human Development, Human Sciences, Computing and Creative Industries, Management and Economics, and Science and Mathematics at two public Malaysian universities. Firstly, three Malaysian m-learning applications were chosen for a heuristic evaluation. The applications focused on learning about three of the traditional forms of Malaysian culture described above: Batik, Songket and Jawi. The language used in the applications was mostly English. The number of participants was as follows: 10 academics and 51 students evaluated the Batik application; 10 academics and 46 students evaluated the Songket application; and 9 academics and 39 students evaluated the Jawi application. The applications were evaluated on mobile phones provided by the researchers, which included a variety of devices with large screen formats operating on Windows, Android and Symbian operating systems. The duration of the evaluation lasted about 15 to 30 min for each participant, with academics undertaking their evaluation individually, and two or three students undertaking their evaluations simultaneously, but with one phone per participant. During the evaluations, one of the researchers acted as an observer and assisted the participants if they were having trouble using the mobile applications, for example, if they did not know how to start the application. The participants responded to a series of statements based on heuristic principles, rating each according to a 5-point Likert scale. This provided an overall quantitative measure of how the applications measured up against the usability criteria. In addition, there were two open-ended questions: What are the advantages of the mobile applications? And, what can be improved through these applications? The answers to these two questions provided qualitative data and rich insights into the views of the participants on the usability of the applications, particularly with respect to their cultural appropriateness.

A battery of statements was devised using principles modified from the Nielsen Heuristic Evaluation User Interface Design Guidelines (Nielsen & Mack, 1994), as adapted by Bertini et al. (2006) to mobile applications. A summative evaluation was undertaken since the applications were all finished products (Nielsen, 1993). The statements probed the views of the participants concerning accessibility, consistency, good ergonomic and minimalist user interface design, readability and ease of recall, efficiency and flexibility, and realistic error management. The first heuristic of Nielsen and Mack (1994), and Bertini et al. (2006) – "visibility of system status" – was replaced by accessibility as this was believed to be more important in m-learning: "*Before students can engage in any m-learning activity, they must be able to effectively access and interact*" with the mobile application on the device (Rainger, 2005, p. 58). In addition, the evaluation was extended with heuristics about the Malay culture: suitable local cultural content, and aesthetic value according to the local culture. The heuristic "suitable local cultural content" was adapted from the second heuristic of Nielsen and Mack (1994), and Bertini et al. (2006) – "match between system and the real world" – following the principle that "The system should speak the user's language" (Nielsen & Mack, 1994, p. 13). In the Malaysian context, this was interpreted

to mean that the cultural content should be familiar to students at Malaysian public universities, who are predominantly from a Malay background. The heuristic "aesthetic value according to the local culture" was adapted from Bertini et al.'s (2006) "aesthetics, privacy and social conventions" in which our adaptation takes into account local cultural aesthetic preferences, for example, colors and visual elements.

Following the heuristic evaluation, the opinions of the participants concerning culturally appropriate user interface design for m-learning applications were collected via interviews and focus groups. Fifteen academics were involved in individual semi-structured interviews, and 127, mostly Malay students, took part in 15 focus groups. Focus group discussions were selected as an appropriate method for data collection from the students, as Malaysian students are more responsive when they discuss in groups, rather than being asked questions individually. The interviews and focus groups were part of a wider study to gain an understanding of academic and student perspectives towards m-learning, particularly in the context of local culture. The researcher's methodology in examining the data from the interviews and focus groups discussions was through thematic analysis (Braun & Clarke 2006). The researcher handled, gathered and arranged the data by utilizing NVivo.

2.1   Results of the Heuristic Evaluation

We present the participants' responses to all the user interface design principles since they have a bearing on how Malaysian m-learning applications should be designed. However, the two principles that focus on local cultural content and aesthetic values are the most interesting from a cultural point of view. The rankings for each statement for both academics and students have been averaged to provide an overall evaluation of whether or not the participants agree with the statements. It can be seen that, on average, the participants ranked the three applications highly, including the cultural heuristics regarding local content and local aesthetic value. The greatest problems were experienced with touch screen interaction, navigation and error management, nevertheless, even these scored only slightly below 4.0 on the Likert scale of 1-5. The aesthetics of the audio files associated with the applications received the lowest ranking of the cultural heuristics, scoring 3.92 for the Batik and 3.89 for the Songket applications (Ariffin, 2014).

Good Ergonomic and Minimalist User Interface Design. Apart from some issues with the design of the mobile phones on which the applications were being tested, the participants responded well to the applications from the point of view of ergonomic and minimalist design. The interface of the Batik application, in particular, was viewed as simple, easy to understand, and brief but informative.

Readability and Ease of Recall. The participants wanted a readable user interface, but, by contrast, most encountered difficulties. However, one academic noted that "*The Batik pictures look real. The interface is readable*", all other academics concurred with "*a need to enlarge the size of the visual, which is small and it needs to be clearer.*" Likewise, students requested "*that the text be enlarged for Batik and Songket local mobile applications … The Jawi mobile application needs to increase the size of the*

text … The buttons and hyperlinks should be more visible." From this evaluation, the importance of the readability of m-learning applications is emphasized.

Efficiency and Flexibility. Academics indicated that they wanted efficiency when using the m-learning applications. They wanted a mobile application that was fast to access for immediate use. However, most academics commented on having difficulty with slow speeds using the applications: comments included "*The application should be faster for the Batik and Songket applications*"; "*The Songket application has problems with exiting because it is very slow*." Students also had issues with the speed of using the m-learning applications.

Realistic Error Management. Both academics and students voiced their concerns over the lack of a 'Help' function for providing users with instructions on how to utilize the applications. Students noted that the Batik application "*can be improved by having clear information with pictures as instructions*." In addition, the greatest impact on usability was with the Jawi application: "*With the Jawi mobile application, the only drawback is that there is no help or instruction on how to play the games*". Because of the lack of a Help function, or, as one academic suggested "*the use of icons and symbols embedded into the Jawi application*", most users did not know how to use it properly.

Suitable Local Cultural Content. The academics and students agreed that the m-learning application content was mostly suitable to the local culture. In addition, they found that the local content was useful and informative for learning about the Malay culture. On the other hand, both groups demanded greater availability of mobile applications with local content, and greater and more detailed cultural content in the three applications that were tested. One issue noted by a number of students, but overlooked by the academics, was the issue of the Malay language. All three applications were in the English language, apart from odd words like 'batik' and some terms for particular motifs or patterns. Students expressed a wish for the applications to be created "*in our local Malay language too*." However, one academic noted how the Jawi application answered a need for representation of the local language, not so much as a means of communication, but as an icon of Malay culture: "*For me Jawi portrays an example of Islam identity*".

Aesthetic Value according to the Local Culture. The participants responded fairly positively to the aesthetic values of the m-learning application interfaces, particularly with respect to the Batik application and Jawi software, which were seen to be in accord with local culture: "*… beautiful graphics design color*." These findings indicate the importance for the user interface of the m-learning applications used in Malaysia to comply with the aesthetic values that have their roots in local culture.

2.2   Results of the Academic Interviews and Student Focus Groups

Following the heuristic evaluation, academics were interviewed and focus groups conducted to gain their perspectives on an appropriate user interface design for m-learning applications. Many academics cited general usability principles that had

nothing to do with culture. For example, ease of use, speed and efficiency were all priorities, with some academics quoting their BlackBerry, iPhone or tablet PC as being efficient for achieving their tasks or for their students to use. For several academics, the simplicity of presentation of local content was important, as mobile content that was dense with images could be difficult to view. The themes generated are: Need more local content, help to facilitate learning local culture better, mobile application limitations, potential for incorporating local philosophical values, local aesthetic values in design, and fusion of new ideas.

Need More Local Content. Academics worry about how 'overseas' cultures, such as the USA, have influenced the minds of the younger generation, such as students. One of them pointed out that the younger generation idolized overseas content, such as from 'Disney' cartoons compared to their own local cultural heritage icon story: "*There is so much Western content, such as embedded characters of 'Snow White' and all other sorts of Disney cartoons.*" Students expressed a desire for applications that conveyed their own culture, complaining about the predominance of applications from overseas:"*… Why do we not have an application for our own culture on mobile phones?*"

Help to Facilitate Learning Local Culture Better. However, there were also academics who valued the fact that the cultural content from the mobile applications could improve the learning of their students: *"From the mobile application we can study the relation between motifs in Batik now with motifs from crafts in the Stone Age…"* The m-learning applications were rated very highly. Typical comments from academics include: *"I like the Batik and Songket applications for learning. The Jawi application also facilitates the learning process and is a fun learning culture source."* Students noted that m-learning was an ideal way of learning about their culture, including the diverse cultures that make up the states of Malaysia: *"We hope there will be mobile application software available for other states."* The students also rated the applications very highly from an educational and usability point of view and obviously found them very engaging: "*The Batik application is interesting and easy to understand for the students. The Songket application can introduce the motifs that are rarely seen.*"

Mobile Application Limitations. On the other hand, one academic noted the limitations of conveying local content via mobile applications: "*It is a good start for learners*." One student suggested that the applications should be brief with simple information and interactivity, such as a combination of information and games: *"combine the concept of Jawi games, and information of the Batik apps…"*

Local Philosophical Values. A number of academics also appreciated the potential for Malay philosophical values to be embedded with local design motifs in mobile application interfaces. They saw this as adding local aesthetic value and reflecting the local cultural identity. One interviewee highlighted that Japanese people are proud of their own local design motifs that are widely utilized in their lives, including mobile applications. Another academic preferred local colors, which reflected the Malay culture instead of adopting those from other cultures, and saw the possibility of transferring local design elements used on local artefacts to the mobile application user interface: *"…promote our own Batik".*

Local Aesthetic Values in Design. In addition, academics noted the relation between learning content and the aesthetic design in which that content was embedded, and that learning is much more interesting using a mobile application because of this: *"The visuals in Batik and Songket applications are very beautiful."* However, there were many negative comments about color from both academics and students. Although some liked the Songket application and found its interface aesthetically pleasing, it also incurred the most negative comments: "*...looks dull ...has less of a chance to attract the kids... orange looks 'Indianish'.*" Many students in the focus groups expressed a desire for the use of local motifs, designs and colors in the user interfaces of mobile applications. Batik motifs were specifically mentioned. In addition, designs derived from local flora and fauna were particularly popular, and brown and green were seen as culturally appropriate colors because they were linked to the flora and fauna.

Fusion of New Ideas. An academic preferred more vibrant colours, as this could attract learners to use the mobile application: "*Use brighter colour, such as red, black and orange for Islamic applications.*" However, some students preferred more vibrant colours, and saw these as a way of enhancing local cultural elements by creating a fusion of new ideas with traditional design: "*User Interface must be vibrant to attract the attention.*"

3   Discussion

This exploration of a culturally appropriate interface design for m-learning in Malaysia has demonstrated that in the opinion of our participants, culture is a consideration that must be taken into account when designing m-learning applications. Both academics and students responded very positively to the inclusion of local cultural content and to the Malay aesthetic values used on the application interfaces, such as color and traditional designs and motifs. This was seen as motivating for students' learning and a way of engaging them in their studies. Malay and Islamic philosophical values, on the other hand, were seen as being embedded in the local content and aesthetic values, and were less often mentioned as a separate entity. However, they are part of the Content Code to which all mobile developers in Malaysia must adhere (SKMM Guidelines, 2012).

Language was one aspect of the interface design that students emphasized but which our heuristics failed to highlight, despite its importance in Malaysian culture. It is curious that all three applications, despite being developed in Malaysia, chose English as their mode of communication, perhaps following the convention established by the mobile content imported from overseas, which dominates the market. In addition, the use of a Jawi transcript, without having a Bahasa Malaysia translation in the user interface instructions, could discourage novices who did not know how to read Jawi. This study shows that language needs to be defined by a separate heuristic in order to encourage developers to choose either the local language, Bahasa Malaysia, or a bilingual interface. As a result of the findings of this research, we propose four principles for a culturally appropriate interface design for m-learning applications for the Malaysian context, in no specific order of importance: Suitable local cultural content; Aesthetic value according to local culture; Local language or bilingual communication; and local philosophical values embedded in content and design.

We note that keeping to traditional cultural norms may not always be appropriate as some participants expressed a desire for a fusion of the traditional with the modern, which may be a way of attracting young people to m-learning. Further research is needed on this point. However, our research also shows that it is insufficient to focus solely on culture. General usability principles are also viewed as important, for example, consistency, minimalist design, efficiency, flexibility and error management. Failure with respect to these heuristics in the trial of the m-learning applications evoked criticism from both academics and students. For example, the lack of a help function to provide users with instructions on how to utilize the applications was of concern to most participants, particularly with the Jawi game. The slow speed of the applications also resulted in negative feedback with respect to the heuristic of efficiency. The evaluation further shows that m-learning applications need to consider the smaller size of the interface, particularly when mobile phones are the device being used. Thus, the heuristic of readability included in the model by Bertini et al. (2006) has been demonstrated to be extremely important; most academics and students voiced their concern over the small size of text, images, buttons or hyperlinks for all three applications. There is possibly a higher level of difficulty in achieving this with interfaces that include Malay cultural content and aesthetics since many of the traditional designs and motifs are highly intricate. This requires further investigation, which is beyond the current study.

4   Conclusion

Overall, the m-learning applications were rated very highly by the academics and students who took part in this study, as measured quantitatively by means of a Likert scale as well as qualitatively by analyzing the comments of the participants. Moreover, the cultural content and local aesthetics were widely appreciated. Even participants who were not associated with cultural studies courses valued the way in which the applications reflected local culture. M-learning applications that acknowledge local culture may be a way of improving usability and keeping the Malaysian culture alive and thus avoiding the pressure of the globalizing forces of overseas mobile content.

The study resulted in the identification of four principles for a culturally appropriate design for m-learning applications in the Malaysian context: suitable local cultural content; aesthetic value according to local culture, including appropriate choice of color, and traditional designs and motifs; local language or bilingual communication; and local philosophical values embedded in content and design. Further research is needed to order the principles in this list according to their importance, and to validate their impact on usability, even though the literature supports the view that culture has a role in improving usability (Young, 2008). In addition, there is a need to investigate further the interplay between the cultural factors and the more general usability principles that this research confirms must be satisfied in order to produce application interfaces that users find acceptable. It would also be of benefit to extend this work to m-learning applications that incorporate cultural aspects but for which the main purpose is not cultural learning. While acknowledging the limitations of the research, it is expected that these findings will lead to a more culturally appropriate interface design

for m-learning applications in Malaysia. It is also hoped that the principles put forward here will form the basis for other countries, especially those in the developing world, to develop guidelines to satisfy the requirements of their own cultural traditions.

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