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An Empirical Analysis on Mobile Phone Messaging Satisfaction among Malaysian Youths

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Abstract: Problem statement: The proliferation of mobile phone use among the youths worldwide has sparked the interest of many researchers, especially those related to the mobile phone adoptions and use. However, there is a lack of study in assessing the impact of the mobile design on its users, especially in relation to the Short Messaging Service application. Due to this, an empirical study investigating the influence(s) of the mobile phone design and health effect factors on users' messaging satisfaction was conducted in Malaysia. **Approach:** Structured questionnaire interviews were administered among 110 youths, mostly comprising of university students. Data analyses were performed using factor analysis and descriptive statistics. **Results:** Factor analysis resulted in seven independent variables and one dependent variable, named Users' SMS Satisfaction. Descriptive statistics indicated respondents having varying levels of satisfaction/dissatisfaction for Keypad Design, Text Entry Speed and Health-Lower Extremity. **Conclusion:** Overall results indicate mobile phone users have mixed feelings towards Text Entry Speed, Keypad Design and Health-Lower Extremity and thus, they are unsure about their overall SMS satisfaction. The results and comments provided by the respondents can be used by mobile phone designers to further improve users' satisfaction while messaging by designing customized mobile phones.

Key words: Short Message Service (SMS), screen design, keypad design, empirical analysis, Personal Digital Assistant (PDA), hand anthropometry, menu hierarchies, Standard Deviation (SD), mobile phone design, health-lower extremity

INTRODUCTION

Mobile phones were initially designed for wireless voice communication, however, today they have transformed into mobile computing devices. It is common for mobile phones to have multiple features and functionalities, like web browsing, e-mails and most importantly Short Message Service (SMS). SMS (or colloquially known as mobile texting or messaging) allows the exchange of short messages (160 characters or less) between the mobile phone users (Holloway and Valentine, 2003).

The popularity of SMS is quite significant among the youths worldwide. This huge popularity is mainly attributed to cost (relatively cheaper than making audio calls), convenience, accessibility and speed, among others (Igarashi *et al*., 2005; Leung, 2007).

Many researchers around the world have studied mobile phone usage with regards to SMS application, from various angles. Ling (2005) studied the pattern of mobile phone and SMS adoption in Norway whilst D'Antona *et al*. (2010) and Willard (2010) examined the relationships between texting and sex among the younger users. O'Riordan *et al*. (2005) compared various text input methods while others attempted to determine the important factors affecting users' satisfaction (Han *et al*., 2004; Ling *et al*., 2007). The latter studies, however, focused on the overall mobile phone design regardless of any particular application. Focusing on an application is important, as the effects

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of a particular design may differ amongst the applications. For example, mobile phone screen design may not be an issue when audio calls are made; however, it may be important to read text messages.

Usability is regarded as a critical factor which affects the quality of mobile phones and users' satisfaction. ISO 9241-11 (1998) best defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". In this study, the usability goal would be satisfaction, which will be assessed in terms of users' mobile phone messaging activities based on the mobile phone design and health effect factors. Although there are many mobile phone applications, SMS was chosen due to its overwhelming popularity among its users. It is hoped that the results would prove to be beneficial to those examining mobile phone messaging, especially among the popular group- youth.

MATERIALS AND METHODS

In the present study, we refer mobile phone design factors to all the hardware and software factors that might affect users' satisfaction while using the mobile phone to SMS. The factors related to hardware are Mobile Phone Design, Keypad Design and Screen Design whereas Text Entry is related to software (i.e., SMS application).

Mobile phone design: Issues related to mobile phone design have been highlighted in many studies, especially the mobile phone size. For example, users with larger hands were found to be more dissatisfied with the mobile phone size as opposed to small hand-sized users in a study conducted in Malaysia (Balakrishnan and Yeow, 2007). Kurniawan *et al*. (2006) revealed that older users find holding the small mobile phones to be a major problem based on their focus group study with seven elderly women (median age = 67.5 years). Similar findings were reported by Nizam et al. (2008) who examined the issues related to the design of mobile devices and services among the elderly people in Malaysia. Features such as mobile phone colour, sound, are omitted in the present study since they are not relevant to text messaging. The present study defines mobile phone design as the aspects related to the size, shape, weight and "feel" (the tactual feeling when one holds the mobile phone) of the mobile phone.

Keypad design: The keypad design has been often criticized, especially the tiny keys and the limited space between the keys. Balakrishnan and Yeow (2007) measured users hand anthropometry and showed users thumb measurements to be significantly correlated with users' satisfaction towards keypad design, indicating that users with larger thumbs being more dissatisfied with the keypad design. In a study assessing mobile phone games application, McMullan and Richardson (2006) stated that it is difficult to press the correct keys while focusing on the screen using a small keypad where the keys are located close to each other. Researchers like Chang and O'Sullivan (2005) showed that tactile feedback provided when keys are pressed offers a good satisfaction experience among the mobile phone users whilst Lesher *et al*. (1998) and Nesbat (2003) re-designed the keypads to expedite text entry. We define keypad design as all the aspects related to key size, shape, space between keys, tactile feedback (based on texture of the keys, e.g., coarse, hard, soft), simplicity of the keypad design (the ease of using the overall keypad design to message) and keypad layout (e.g., 4 × 3, QWERTY).

Screen design: Studies that have investigated the effects of mobile phone screens and computer displays have highlighted problems related to the size of the screen, brightness, resolution and text legibility, among others (Mizobuchi *et al*., 2005). Studies involving elderly users found them to prefer large, clear and bright screens (Kurniawan *et al*., 2006; Nizam *et al*, 2008). Text or font size is also an important factor that affects text legibility and studies have shown that larger text sizes are more readable as opposed to smaller sizes for both paper based materials (Rudnicky and Kolers, 1984) and computer screen (Bernard *et al*., 2003). It was also reported that errors can be easily corrected with highly legible text and thus resulting in a higher user acceptance and satisfaction Mizobuchi *et al*. (2005). Therefore, the current study defines screen design as all the aspects related to features such as screen size, resolution, brightness, colour, font or text size, screen shape and position.

Text entry: Multitap and predictive text entries are the dominant forms of text input on a standard 12-key mobile phone. Multitap cycles through letters on a key with each press and thus it is often criticized for being slow (Mackenzie, 2002). Alternately, the predictive text entry method predicts the word as it is entered. Usually a next key (e.g., '#') is used to cycle through the potential words. It can be quite frustrating and slow when the phone does not recognize the words that are being entered, especially non-English words (Balakrishnan and Yeow, 2007). Most of the studies related to text entry focused on text entry speed (O'Riordan *et al*., 2005; Oniszczak and Mackenzie, 2004). Some efforts have also been made to move away

from text entry optimization, exploring gestural interactions, such as the use of joysticks (Wobbrock and Myers, 2005) and recently, the possibility of using speech to text (Cox *et al*., 2007). Other studies have highlighted problems related to complex menus (Ziefle and Bay, 2006) and learnability (Friedman *et al*., 2001). Finally, audio feedback has been shown to enhance users' performance when key presses are made; however, this result is based on Personal Digital Assistant (PDA) (Brewster, 2002). We define text entry as all aspects related to features such as the speed or efficiency of the text entry method, learnability, ease of use, menu traversals, special character selections (e.g., symbols to support emoticons, space), case conversions, support for incoming and outgoing messages and audio feedback when key presses are made.

Health effect: Most of the studies assessed the effects of the radiation emitted by mobile phones on user's health. For instance, Usman *et al*. (2009) found the electromagnetic field intensity depends on the mode of operation and proximity of the mobile phones to the end user. The electric field strength emission was found to be higher during outgoing call and lower when receiving SMS. Other similar studies that focused on radiation emission from mobile phones are done by Islam et al. (2006) and Ismail et al. (2010), in Malaysia and by Chiang and Tam (2008) in Macau. Sepehri *et al*. (2009) assessed the contamination rates of mobile phones on health workers in Iran, and found that the mobile phones could be an important source of nosocomial infections and the spread of resistance bacteria in medical healthcare settings. As for SMS, prolonged messaging activity has been reported to be hazardous to the thumb, especially among the younger users. Virgin Mobile revealed that there are about 3.8 million people affected annually by thumb and wrist pains due to high messaging activities (Virgin Mobile, 2006). Though the injuries due to heavy messaging mostly cause pain to the thumb and wrist, there is also a need to investigate if mobile phone users have felt any pain in their neck, shoulder or upper arms. Some studies have reported on this; however they were not related to mobile phones. For example, Karlqvist *et al*. (1996) found spending more than 5.6 hours per week using mouse increased the risk of shoulder injury symptoms. The present study simply defines health effect as any pain or discomfort felt after prolonged mobile messaging.

Users' SMS satisfaction: Literature reviews revealed no studies directly relating user satisfaction and mobile phone messaging has been conducted, especially in terms of the design factors. User preference for specific features on mobile phones was investigated by Ling and Hwang (2005) and they found colour display and Internet browsing features to significantly affect users' overall satisfaction. In Malaysia, Yeow *et al*. (2008) found factors such as peer chatting and family coordination to be crucial factors affecting users' satisfaction in using mobile phones for audio calls and SMS, however, none of the mobile phone design factors were taken into consideration. Therefore, we define users' SMS satisfaction as the subjective impression/emotion/feeling/attitude felt while using SMS with a mobile phone design.

Research design: Five independent variables were identified based on the literature reviews, otherwise collectively known as the Mobile Phone Design and Health Effect factors. Users' SMS Satisfaction was identified as the dependent variable. Figure 1 shows the research framework used in this study.

Respondents: A total of 110 youths aged between 17 to 25 years old (mean = 21.5 years) were recruited using convenience and proportional quota sampling (55 respondents for each gender). All the respondents were Malaysians, comprising the three major ethnicities of the country (Malays, Chinese and Indians). The majority of the respondents (76.3%, 84/110) were college/university students. The majority (80.9%) of the respondents used multitap and only 11.8% used predictive text entry. The rest (7.3%) used both these methods interchangeably. Only six respondents had less than one year of experience in using SMS. The mean years of SMS experience was 3.8 with Standard Deviation (SD) = 1.19. All the respondents used their thumbs to message, single-handedly.

Interviews: Data collection was done using structured questionnaire interviews. The main focus of the questionnaire revolves around the thirty-six questions that were used to measure users' SMS satisfaction/dissatisfaction and/or agreement/disagreement based on the independent and dependent variables (Appendix I).

The interviews were conducted in two states, Melaka and Perak, as they have a high mobile phone penetration rate per 100 inhabitants. All the interviews were conducted face-to-face on a one-to-one basis. The respondents provided comments, opinions and suggestions which were noted by the interviewer. Each interview session consumed approximately 20-30 minutes for a total of eight weeks. The respondents answered the interview questions based on their own mobile phones as they would be very familiar with their mobile phone use and interface.

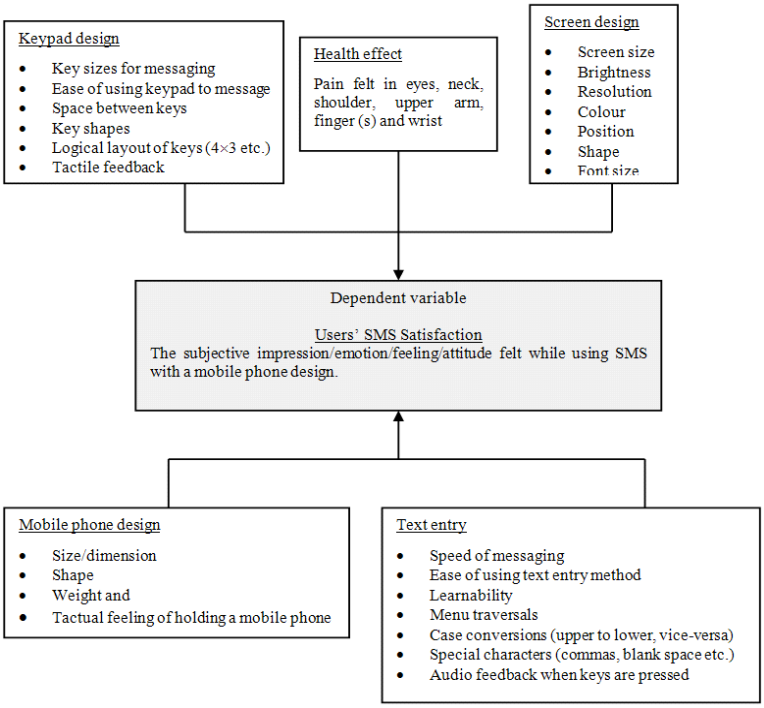

Fig. 1: Research framework

Statistical tests: The collected data were processed and analyzed using Statistical Package for Social Sciences (SPSS) version 13.0. Apart from using descriptive statistics such as mean, frequency and Standard Deviation (SD), factor analyses were also performed on both the independent and dependent variables. Items with similar loadings and/or with loading less than 0.5 were removed in the current study.

RESULTS

Mobile phone design and health effect factors (independent variables): The factor analysis resulted in a total of seven factors with eigenvalues of greater than 1.00 (Table 1). Approximately 74% of the expressed variance was contained in these seven factors (total variance 73.74%, with 29 items included).

Factor one was named Screen Design as it contains all the items used to measure users' satisfaction towards the mobile phone screen design. Similarly, all six items measuring users' keypad design satisfaction loaded into factor two, hence it was named Keypad Design. Text Entry factor was split into two with all but one item loaded together. Items like learnability, ease of use, special character selections and menu traversals clustered together in factor three; therefore this factor was named as Text Entry Usability. Speed of texting loaded separately in factor seven, hence named Text Entry Speed. The support for incoming and outgoing messages and audio support to indicate successful key presses were dropped due to low factor loadings (<0.5).

Factor four contains all the items that measured users' satisfaction towards mobile phone overall physical design and thus it was named Mobile Phone Design. Health Effect factor was also split into two other factors. Four items related to health effects on human body upper dimensions loaded into factor five, thus it was named Health-Upper Extremity. On the other hand, items related to wrist and thumb pain loaded into factor six. Therefore, it was named Health-Lower Extremity.

Factor analysis for users' SMS satisfaction (dependent variable): Table 2 shows the results of the factor analysis performed on Users' SMS Satisfaction. All five items loaded into a single factor, with an eigenvalue of 2.53 and a total variance of 50.58%. The internal consistency of these items was validated with a Cronbach alpha value of 0.745.

This factor was named Users' SMS Satisfaction as all the items measured users' satisfaction towards each of the Mobile Phone Design and Health Effect factors.

The factor analysis resulted in a high variance for both the independent and dependent variables, with 73.74% (Table 1) and 50.58% (Table 2), respectively. Therefore, construct validity has already been

End time

Table 1: Varimax rotated factor loadings matrix for independent variables

Factors	Factor loading
FACTOR 1: SCREEN DESIGN (Cronbach α = 0.896)	
Screen size effect	0.702
Screen brightness effect	0.672
Screen resolution effect	0.809
Screen colour effect	0.780
Screen position effect	0.748
Screen shape	0.803
Font size displayed on the screen	0.632
Eigenvalue (Variance - %)	7.76 (26.76)
FACTOR 2: KEYPAD DESIGN (Cronbach α = 0.891)	
Size of the keys used for messaging	0.802
Ease of use of the keypads and menu items	0.739
Amount of space available between the keys	0.833
The shape of the keys	0.793
The logical layout of the keys on the mobile phone	0.761
The tactile feedback when key presses are made (based on texture)	0.603
Eigenvalue (Variance - %)	5.23 (44.8)
FACTOR 3: TEXT ENTRY USABILITY (Cronbach α = 0.860)	
Ease of converting upper case to lower case letters and vice versa.	0.737
Ease of messaging based on the text entry method used.	0.855
Ease of looking for SMS functions via the menu hierarchies.	0.804
Ease of using special characters like symbols, punctuation marks	0.701
Ease of learning the text entry method by someone who is inexperienced.	0.502
Eigenvalue (Variance - %)	2.64 (53.9)
FACTOR 4: MOBILE PHONE DESIGN (Cronbach α = 0.890)	
Mobile phone weight	0.785
Mobile phone shape	0.854
Mobile phone size/dimension	0.783
Mobile phone feels	0.823
Eigenvalue (Variance-%)	1.95 (60.64)
FACTOR 5: HEALTH-UPPER EXTREMITY (Cronbach α = 0.859)	
Pain felt in the eyes	0.572
Pain felt in the neck	0.808
Pain felt in the upper arm	0.894
Pain felt in the shoulder	0.907
Eigenvalue (Variance - %)	1.57 (66.05)
FACTOR 6: HEALTH-LOWER EXTREMITY (Cronbach α = 0.622)	
Pain felt in the wrist	0.642
Pain felt in the thumb	0.817
Eigenvalue (Variance - %)	1.22 (70.27)
FACTOR 7: TEXT ENTRY SPEED	
Speed of composing SMS based on text entry method used.	0.849
Eigenvalue (Variance - %)	1.01(73.74)

performed on the measurement method. The high variances indicate that the measurement method (i.e. interview questionnaire) to a high extent accurately represents the research design and provides an observation distinct from that produced by a measure of another construct.

Mean scores for mobile phone design and health effect factors: Table 3 depicts the results of the mean factor scores calculated using the descriptive analysis after the independent variables were extracted separately using factor analysis. The average factors' mean and SD for all independent variables is 3.14 and 0.80 respectively. Factors such as Screen Design, Keypad Design, Text Entry Usability, Mobile Phone Design and Text Entry Speed scored above the average mean whereas both Health-Upper Extremity and Health-Lower Extremity scored below the average factors' mean score.

Screen Design, Mobile Phone Design, Text Entry Usability and Health-Upper Extremity have a standard deviation value of below one, indicating that the respondents have consistently rated all these factors. The mean scores for Screen Design, Mobile Phone Design and Text Entry Usability were close to 3.00, indicating that majority of the respondents are almost neutral about these factors. Health-Upper Extremity has a mean score lesser than 3.00, indicating that most respondents have not experienced health discomfort in their upper body dimensions due to prolonged messaging. Keypad Design, Health-Lower Extremity and Text Entry Speed factors have standard deviation values which are equal or above one, indicating

differing opinions among the respondents about these three factors.

None of the factor scores are above 4.00 on a five-point Likert scale, indicating that only a minority of the respondents are satisfied with the Mobile Phone Design and Health Effect factors.

Mean scores for keypad design and health-lower extremity: Standard deviations of above 1.00 for item (i), (iii), (i v) and (v i) for Keypad Design satisfaction in Table 4 indicate the respondents having different levels of satisfaction.

Table 2: Varimax rotated factor loadings matrix for dependent variable

Items	Factor loading
1. Health effect on SMS satisfaction	0.540
2. The overall mobile phone design effect on SMS satisfaction	0.788
3. The mobile phone screen design effect on SMS satisfaction	0.782
4. The physical aspects of the keypad and the keys effect on SMS satisfaction	0.675
5. The overall text entry aspects' effect on SMS satisfaction.	0.742
Eigenvalue	2.530
Variance (%)	50.580
Coefficient α	0.745

Table 3: Mean values for mobile phone design and health effect factors

Factors	Mean	SD
Screen design	3.54	0.61
Keypad design	3.44	1.07
Text entry usability	3.46	0.68
Mobile phone design	3.69	0.71
Health-upper extremity	2.10	0.51
Health-lower extremity	2.55	1.04
Text entry speed	3.25	1.00
Average mean factor scores	3.14	0.80

Table 4: Mean values for keypad design and health-lower extremity items

Factors	Mean	SD
Keypad design		
The size of the keys used for messaging.	3.32	1.029
The ease in which you can compose a message based on the keypad design.	3.76	0.965
The amount of space available between the keys.	3.17	1.124
The shape of the keys used to SMS.	3.35	1.126
The way the keys are arranged on your mobile phone.	3.41	0.997
The tactile feedback felt when key presses are made on your mobile phone.	3.28	1.158
Health-lower extremity		
You have felt pain in your wrist.	2.39	1.041
You have felt pain in the finger used to SMS	2.70	1.043

Table 5: Mean value for users' SMS satisfaction

Mean	SD
3.35	0.622

The mean value for item (iii) seems to be the lowest indicating the respondents being more dissatisfied with this particular item as opposed to the others. Similarly, the standard deviations of more than 1.00 for Health-Lower Extremity also show differing opinions among the respondents for having felt pain in the thumb and wrist. The higher mean value for pain felt in the finger indicates that some of the respondents have experienced more pain to their fingers than their wrists.

Mean score for users' SMS satisfaction: Table 5 shows the mean value for Users' SMS Satisfaction to be 3.35 (lesser than 4.0 out of a five-point Likert scale), indicating that respondents are almost neutral about this factor. Moreover, a standard deviation of 0.622 reflects a high degree of consensus on all the items by the respondents.

DISCUSSION

Factor analysis: Screen Design factor comprises items that measured users' satisfaction towards mobile phone screen design. This confirms the findings of previous literature that identified problems related to mobile phone screen design. Mobile phones tend to have small, low resolution screens that allow only a few lines of text to be displayed at a time. Moreover, the limited size of the screen makes it easily cluttered with icons and menus which eventually make the menu hierarchy complicated and the small screen to be crowded. Apart from screen size, studies have also identified users' preference for larger texts and brighter screen, though these findings were based on older users (Kurniawan *et al*., 2006; Nizam *et al*, 2008)). As shown in Table 1, items such as screen size, brightness, resolution, colour, position and shape loaded into a single factor with a high reliability of 0.896.

All six items measuring keypad design satisfaction were found to load together as Keypad Design. The most common issues related to keypad design were the limited space between the keys and the size of the keys itself (Balakrishnan and Yeow, 2007). In Ling *et al*. (2007), it was revealed that all items measuring aspects of the keypad design loaded into a single factor, which includes key size, shape, feel and key arrangement; however, all the items were investigated in terms of the overall use of mobile phone, without emphasizing on a particular application such as SMS.

The Text Entry Usability factor comprises items that measured learnability, simplicity of using the text entry method, conversion between upper and lower cases, selection of special characters and the use of menus related to SMS. This is in accordance with some of the studies that have highlighted problems related to

the slow text entry methods and complicated menu traversals (Bay and Ziefle, 2005). In addition, mobile phone users also tend to get confused as only single word or abbreviations are used for menu labels due to the limited display size and overloaded keys (Lindholm and Keinonen, 2003).

One of the items that measured the speed of texting loaded separately into a single factor named Text Entry Speed, confirming the findings from studies focusing on texting speed. For example, some researchers worked on improving the predictive method (Gong and-Tarasewich, 2005), reducing the number of keystrokes needed to enter a word (Levine and Goodenough-Trepagnier, 1990) and exploring other ways to enter text that does not include key presses (Cox *et al*., 2007).

All the items measuring users' satisfaction towards mobile phone overall physical design loaded into Mobile Phone Design. Mobile phones are often criticized as being too small to be held and handled (Balakrishnan and Yeow, 2007). The colour, shape, brightness and size of all the components on mobile phones were found to load together in a study investigating the overall user satisfaction of using the mobile phones (Ling *et al*., 2007). Similarly, items such as size and shape that are related to SMS also loaded together, as shown in the present study.

Health-Upper Extremity comprises all items related to pain felt in the eyes, neck, shoulder and upper arms. Karlqvist *et al*. (1996) reported the effect on these bodily dimensions based on the use of mouse. These health effects were often attributed to poor posture and long period of using a particular device. Another factor related to health was named Health-Lower Extremity. Two items, namely pain in the wrist and finger loaded into this factor. This is consonant with some studies that have reported muscular strain to the wrist and fingers to be high due to a prolonged use of button clicking operations or the use of fingers to grip and maneuver a device (Lalumandier and McPhee, 2001).

Users' SMS Satisfaction comprises all the items that measured users' satisfaction towards the five factors related to Mobile Phone Design and Health Effect. This compliments findings from previous literature which identified some of the problems related to users' satisfaction in using the mobile phones (Han *et al*., 2004; Yun *et al*., 2003), however, these studies focused on the overall use of the mobile phone. On the contrary, the findings depicted in Table 2 are specifically based on the mobile phone and SMS application only. Mean scores for independent variables: Table 3 shows factors such as Screen Design, Mobile Phone Design and Text Entry Usability scored close to 3.00 out of a five-point Likert scale, indicating that the majority of the respondents are neutral about these factors. This shows that the respondents are unsure about the effects of these factors on their messaging satisfaction.

Keypad Design scored a mean value of 3.44 out of a five-point Likert scale. A standard deviation value of 1.07 indicates that the respondents have varying satisfaction or dissatisfaction levels. It was found that the respondents' satisfaction levels differed for key size, space between keys, shape and tactile feedback (Table 4). This is in accordance with several studies that have reported keypad design to be inappropriate for messaging activities. Balakrishnan and Yeow (2007) measured users hand measurements and found users with larger hands and thumbs to have difficulty messaging due to tiny key sizes and limited space between the keys. Tiny keys were shown to cause more text entry errors, especially when the users are walking, in a study that explored the relationship of various key sizes on PDAs and walking speed (Mizobuchi *et al*., 2005). During the interviews, 29 respondents in this study specifically mentioned that larger keys or additional space between the keys would improve their SMS satisfaction. They also stated their preferences for slightly larger mobile phones with these characteristics. Twelve of them mentioned that the main reason for owning the conventional small mobile phones is budget, followed closely by trend. The majority of the respondents are students (84/110), therefore, owning larger mobile phones (especially with QWERTY keyboards) are not possible due to tight budgets.

Respondents have also commented on the key shape and tactile feedback when key presses are made. Twenty three respondents specifically mentioned that mobile phones should have a proper tactile feedback mechanism so that the users know when a key press is made. It was recommended that keys that are rectangular or square in shape and "raised" provide a better tactile feedback than keys that are oval or "flat". The respondents also believed that keys that are rectangular or square in shape are easier to be pressed.

Text Entry Speed also has a mean score close to 3.00; however, a standard deviation value of 1.00 indicates that the respondents have differing levels of satisfaction for this factor (Table 3).

This is in line with some studies that have predicted text entry speed to be at varying levels for users with various messaging skills (Friedman *et al*., 2001; Oniszczak and Mackenzie, 2004). The majority of the respondents (80.9%, 89/110) in this study used the multitap technique for text entry, however, most of them (61.8%, 68/110) claimed that multitap technique is time consuming as every character needs to be

entered compared to predictive text entry where the words are guessed by the software as the characters are entered. This finding concurs with other studies that have reported multitap as being slow and inefficient (Mackenzie, 2002). Six respondents who used the predictive method stated that texting activity becomes tedious when the words entered are not recognized by the predictive text entry software. This especially happens when they attempt to message using abbreviations (e.g., "2day" for today). Moreover, the predictive software also fails when local dialects and languages other than English are used. Even though predictive text entry method is faster, but mobile phone users have to learn to use the technique before being able to use it properly.

Table 3 indicates that respondents have different opinions on the Health-Lower Extremity factor. A standard deviation score of above one indicates that some respondents have experienced health effects in their wrists or fingers due to prolonged messaging. Three of the respondents in the present study who used Samsung ×430, Motorola E398 and Sony Ericsson T630 stated that thumb pain was felt due to the keys that are "flat", as making continuous key presses were difficult. They commented that the pain was felt, especially after messaging continuously for a prolonged period, indicating that poor keypad design is a factor that contributes to thumb pains among these active SMS users. These three respondents felt that "raised" keys are better; especially those made from soft materials as making key presses would be gentler to the thumbs. The recommendations given by the three respondents in the present study need to be further investigated, that is, to see if "raised" and soft keys reduce the pain felt in the thumbs due to continuous messaging.

CONCLUSION

It is believed that the present study is the first ever conducted in Malaysia and also worldwide studying the influence(s) of Mobile Phone Design and Health Effect factors on Users' SMS Satisfaction. Factor analysis resulted in high variance explanations by the independent (73.74%) and dependent (50.58%) variables, proving that the instrument used in the present study (i.e. interview questionnaire) has a high degree of validity. The interview questionnaire therefore, can be used by researchers in other countries to replicate this study. Results indicate mixed feelings towards Text Entry Speed, Keypad Design and Health-Lower Extremity which resulted in the respondents being unsure about their overall SMS or mobile phone messaging satisfaction.

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