

Effects of Age on End Users' Usage of Mobile Social Network Applications

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Abstract—In recent years, the world is transforming to aging society. Mobile social network application is an important technology that may help improve social interaction in the older adults, which will lead to better life satisfaction and better health. However, a number of researchers suggest that most of the older adults are refuse to adopt new technology, including mobile social network applications. Although some research have been carried out to study on the adoption of online social networks in the older adults. However, there is still a lag of empirical studies in the adoption of mobile social network applications in the older adults. In this paper, we investigated the effects of age on end users' usage of mobile social network applications. A quantitative study was carried out to end users in Thailand. The study got a total of 533 subjects. The one-way analysis of variance was used to test the mean difference between age groups. Only 3 mobile social network applications showed statistically significant differences between age groups, including Facebook, Twitter and YouTube. Moreover, the mean of features usage of each mobile social network application was used to compare between age groups. The result reveals that end users used less of features, as they get older. The study provides suggestions for developers and information providers in order to develop mobile social network applications and communicate with the older adults.

Keywords—Age; Mobile Social Network; Mobile Social Network Application; Mobile Application; End User; Elderly; Older Adult

I. INTRODUCTION

Today, the world is transforming to aging society [1]. In 2013, United Nation [2] reported that the numbers of the older adults who aged more than 60 years are approximately 837 million, accounting for 11.7 percent of the total population in the world (7.16 billion) In Thailand, the proportion of the older adults is 14.5 percent in 2013 (9.7 million of 67 million) [2]. Thus, Thailand is now also transforming to aging society.

The older adults could have more problems with mental health than younger adults. Holmen et al [3] explained that social relationships are one of the predictors of life satisfaction among the older adults. Even so, the older adults become lack of social network; have limited close friends and social contacts, as they get older. Moreover, they may incapability or unwillingness to create new social contacts, poor self-awareness, feeling insecurity which possible lead to loneliness. As a consequence, loneliness frequently results in decrease of

healthy. For example, insomnia, depression, anorexia and etc. [3]. On the other hand, some studies shown that the older adults who have better social interaction with friends are tend to live longer. Thus, the strategies to promote the establishment and maintenance of such relationships in later life deserve further understanding [5]. From this perspective, the usage of Online Social Networks (OSNs) could be improving the level of social network interactions in older adults (e.g., Facebook, Line, Twitter...). The older adults can be connected and socializing with friends in long distance. Furthermore, Most of OSNs offered mobile version of their services, which is known as Mobile Social Networks (MSNs) allowing end users to access their services regardless of place.

However, previous literatures suggest that the older adults are lack of adoption in technology. They are afraid or unwilling to use new technology. For example, Fisky, et al. [4] suggest that the older adults were less likely to use technology than younger adults (e.g., computers, the Internet, cellular phone). Barnard, et al. [5] show that older people have less positive attitude towards learning new things because of perceived difficult and perceived self efficacy. In contrast, they can be influence by having enough facilitating conditions such as availability of support, Handbook. On the other hand, perception of an individual is not only an obstacle of learning a new technology but also the characteristics of the technology itself. This indicates that the older adults may need a customized version of MSN applications in order to increase the adoption level.

In this study, we focus on the effects of age on the usage of mobile social network applications on smart devices, including smartphones and tablets that are currently broadly used and adopted by subjects regardless of hardware specification and brands. A quantitative empirically study was carried out. The population of this study was MSN applications end users in Thailand.

The following parts of this paper are organized as follows. The next section reviews the related literatures (Section II). Then, we propose our hypotheses and describe the collected data set and the data acquisition (section III). Section IV shows the results from a one-way analysis of variance (ANOVA) and compare mean analysis. Finally, we discuss the results, implications and future work of our study (section V).

II. LITERATURES REVIEW

A. Mobile Technology

In the last decade, mobile phone penetration rates have dramatically increased since 2005. International Telecommunication Union [6] estimated the number of world wide mobile cellular telephone subscribers in 2014 would reach 6,915 million. In Thailand, ITU (2013) also reports that there are 92.4 million mobile phone subscribers. Mobile technologies also have developed for both software and hardware. Mobile phone could be used as multi-purpose communication device. They are called smartphones. End users can customize their smartphones as needed by install mobile applications. Furthermore, the price of smartphones has become lower and more affordable for average end-users.

B. Mobile Social Network Applications

Boyd et al [7] defined OSNs as “*web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site.*”

Most of OSNs introduced their mobile applications and mobile web sites for the end users. The MSNs enhance user interface of OSNs in mobile devices. It also gains benefit with add-on features from mobile technology such as location-based services. Hence, mobile technology play an important role to facilitate MSNs [7]. On the second quarter of 2014, Facebook has 829 million average daily active users; 654 million users connect through mobile devices [8]. Similarly, According to Electronic Transactions Development Agency Thailand (ETDAT) [9] 77.1 percent and 31.1 percent of Thai end users access the Internet through their mobile phones and tablets respectively. Moreover, 78.2 percent of them use mobile devices for accessing the MSNs. Thus, end users are now using OSNs from their mobile devices more than on desktop pc.

This study selected the most popular OSNs based on the popularity. ETDAT [9] collected the data from 15,265 MSNs end users in Thailand by online questionnaires. They reported percentage of end users of each OSNs as follow: Facebook (93.7%), Line (86.9%), Google Plus (34.5%), Instagram (34%), Twitter (16.1%), and Other (including YouTube) (3.7%). Hence, those MSNs were selected for the empirical study. Furthermore, MSNs were the mobile applications that mobile are used across all age groups [9] which are suitable to study the effects of age.

III. RESEARCH METHODOLOGY

A. Population and Subjects Selections

The population of this study was end users of MSN applications who are Thai. In 2014, the numbers of MSNs account that still active in Thailand are more than 28 million [10]. Hence, the estimated population of this study is more than 28 million. The subjects were selected by the convenience sampling method.

B. Features of Mobile Social Networks Applications

This study selected the list of MSN application features based on the Facebook’s popular features [11] and the observation from real life usage. The most popular features of Facebook were used to compare with other MSN applications. The results used to generate the features of each MSN applications. The list of features is shown in Table I.

TABLE I. FEATURES OF MOBILE SOCIAL NETWORK APPLICATIONS

Features	Mobile Social Network Applications					
	Facebook	Line	Google+	Instagram	Twitter	YouTube
Read news feed	X	X	X	X	X	X
Share status	X	X	X		X	
Share link	X	X	X		X	
Share photos	X	X	X	X	X	
Photo effect	X	X	X	X		
Share videos	X	X	X	X		X
Share location	X	X	X		X	
Check-in	X	X	X			
Tag friends	X		X	X	X	X
Like	X	X	X	X		X
Dislike						X
Share friends status	X		X		X	X
Comment	X	X	X	X	X	X
Create event	X		X			
Join event	X		X			
Send private messages	X	X			X	
Location sharing in private message		X				
Send photos via private messages	X	X				
Send voice message in private message		X				
Photo effect in private message	X	X				
Send videos via private messages	X	X				
Send sticker via private messages	X	X				

C. Data Collections

This study used an online questionnaire to collect the data because it can reach a large number of subjects in a short period of time. The link of the questionnaire was sent by emails and posted as topics to different types of online communities in Thailand. Those online communities were www.pantip.com (life style community), www.pdamobiz.com (mobile technology and business community), www.overclockzone.com (computer hardware community), www.mashup.in.th (variety community), www.thaiseboard.com (web development community) and Facebook pages. The link of the questionnaire was clicked 1,571 times. There were 761 subjects voluntarily responded to the questionnaire. However, only 533 ($N=533$) subjects were passed the data screen process. The total number of subjects conforms to Yamane's finite population sampling formula [12].

The questionnaire had 3 parts. The first part asked the demographic information of the subjects. The second part collected the time that subjects spend with MSN applications in a day. Subjects answered each MSN applications with 5 options, never use, 1-30 minutes, 31-60 minutes, 61-90 minutes, and more than 90 minutes. The last part selected the MSN applications that subjects did not answer as "never use" from the second part. The questionnaire then generated new questions (list of features) for each selected MSN application. Subjects selected the features of MSN applications that they were used before as the answers.

D. Data Analysis

In order to study the effects of age on MSN applications, this study classified age of subjects into 7 groups based on the methods from United Nations [13] (Table II). A one-way analysis of variance was used to test the mean difference between age groups and features used. Furthermore, the mean of features for each age group was calculated and compared to see the trend of different age groups. The hypotheses of this study are shown below:

- H1: Age of end users have an effect on the number of features used in Facebook's mobile social network applications.*
- H2: Age of end users have an effect on the number of features used in Line's mobile social network applications.*
- H3: Age of end users have an effect on the number of features used in Google Plus's mobile social network applications.*
- H4: Age of end users have an effect on the number of features used in Instagram's mobile social network applications.*

H5: Age of end users have an effect on the number of features used in Twitter's mobile social network applications.

H6: Age of end users have an effect on the number of features used in YouTube's mobile social network applications.

IV. RESULTS

A. Descriptive Summaries of Subjects

Table II shows the descriptive summaries of the subjects in this study.

TABLE II. DESCRIPTIVE SUMMARIES OF THE SUBJECTS

Variables	Options	Frequency	Percentage
Age	< 16 years	10	1.9
	16-25 years	147	27.6
	26-35 years	179	33.6
	36-45 years	119	22.3
	46-55 years	44	8.3
	56-65 years	15	2.8
	> 65 years	19	3.6
	Total	533	100.0
Gender	Male	313	58.7
	Female	211	41.3
	Total	533	100.0

B. Descriptive Statistics of End Users on each MSN Application

Table III show the numbers of end users for each MSN applications in this study. Facebook and Line were the most popular MSN applications for the subjects in this study.

TABLE III. DESCRIPTIVE STATISTICS OF END USERS ON EACH MSN APPLICATIONS

MSNs	Number of End Users (Total = 533)	Percentage	Min	Max	Mean
Facebook	492	92	1	20	10.27
Google Plus	125	23	1	15	4.97
Twitter	170	32	1	9	4.09
Line	499	94	1	21	8.79
Instagram	262	49	1	7	4.39
YouTube	442	83	1	8	3.67

C. Test of Mean Difference (ANOVA)

Table IV showed the results from ANOVA analysis. These results suggest that there were statistically significant

differences between age groups in Facebook ($F(6, 485) = 4.273, p = .000$), Twitter ($F(3, 166) = 5.661, p = .001$) and YouTube ($F(6, 435) = 2.58, p = .018$). However, the others MSN applications did not show statistically significant differences between age groups including Google Plus ($F(6, 118) = 0.73, p = .627$), Instagram ($F(6, 255) = 2.048, p = .006$) and Line ($F(6, 492) = 1.46, p = .191$).

TABLE IV. RESULTS FROM ONE-WAY ANALYSIS OF VARIANCE (ANOVA)

MSNs		Sum of Squares	df	Mean Square	F	Sig.
Google Plus	Between Groups	101.966	6	16.994	0.73	0.627
	Within Groups	2747.906	118	23.287		
	Total	2849.872	124			
Facebook	Between Groups	913.104	6	152.184	4.273	0.000
	Within Groups	17273.481	485	35.615		
	Total	18186.585	491			
Twitter	Between Groups	145.026	3	48.342	5.661	0.001
	Within Groups	1417.468	166	8.539		
	Total	1562.494	169			
Line	Between Groups	316.392	6	52.732	1.458	0.191
	Within Groups	17791.933	492	36.162		
	Total	18108.325	498			
Instagram	Between Groups	50.102	6	8.35	2.048	0.06
	Within Groups	1039.963	255	4.078		
	Total	1090.065	261			
YouTube	Between Groups	90.789	6	15.132	2.58	0.018
	Within Groups	2550.985	435	5.864		
	Total	2641.774	441			

$P < 0.05$

D. Trends of Features Used of MSN Applications in Different Age Groups

In order to find the effects of age on usage of MSN applications, this study compare the mean of features used between age groups for each MSN applications. The line charts were plotting in order to show the trends between age groups. The X-axis values represent age groups of the subjects. Y-axis values represent mean value of MSN applications usage. The classifications of age groups are shown in Table II. The age group less than 16 was ignored and did not show in the chart.

Facebook

Figure 1 shows the trends of features (\bar{x}) that were used by different age group of Facebook mobile applications. The results showed that end users of all age groups used Facebook mobile applications. The age group of 16-25 had the highest mean value ($\bar{x} = 11.65$), followed by age group of 26-35 ($\bar{x} = 11.65$) and 36-45 ($\bar{x} = 10.08$). The mean values start to decrease from the age group of 46-55 ($\bar{x} = 8.21$), 56-65 ($\bar{x} = 6.85$). The age group more than 65 years old had the lowest mean values ($\bar{x} = 6.31$).

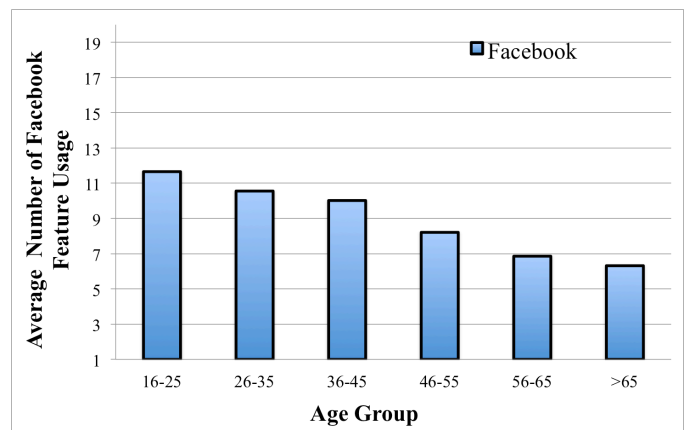


Fig. 1. Average Number of Facebook Feature Usage and Age Groups.

Line

Figure 2 shows the trends of features (\bar{x}) that were used by different age group of Line mobile applications. The results showed that end users of all age groups used Line mobile applications. The age group of 16-25 had the highest mean value ($\bar{x} = 9.65$), followed by age group of 26-35 ($\bar{x} = 8.66$), 36-45 ($\bar{x} = 8.67$) and 46-55 ($\bar{x} = 8.90$). The mean values start to decrease from the age group of 56-65 ($\bar{x} = 6.92$). The age group more than 65 years old had the lowest mean values ($\bar{x} = 5.81$).

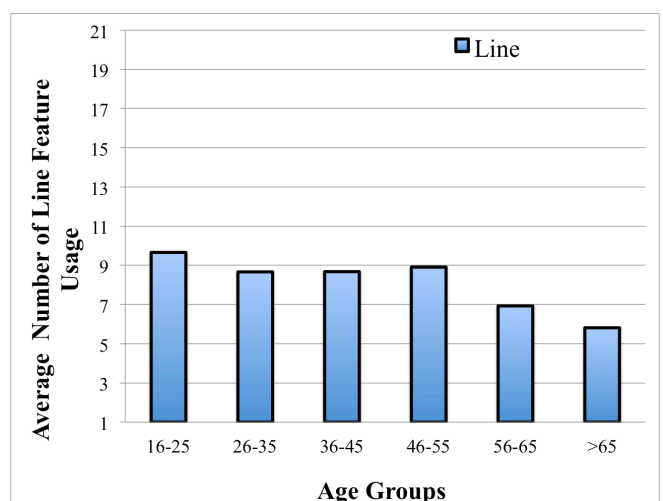


Fig. 2. Average Number of Line Feature Usage and Age Groups.

Google Plus

Figure 3 shows the trends of features (\bar{x}) that were used by different age group of Google Plus mobile applications. The results showed that end users of all age groups used Google Plus mobile applications. The age group of 16-25 had the highest mean value ($\bar{x} = 9.65$), followed by age group of 26-35 ($\bar{x} = 5.10$), 36-45 ($\bar{x} = 4.03$) and 46-55 ($\bar{x} = 4.18$). The age group of 56-65 had the lowest mean values ($\bar{x} = 2.00$). Interestingly, the mean value of features used of age group more than 65 years old ($\bar{x} = 2.5$) is higher than the age group of 56-65.

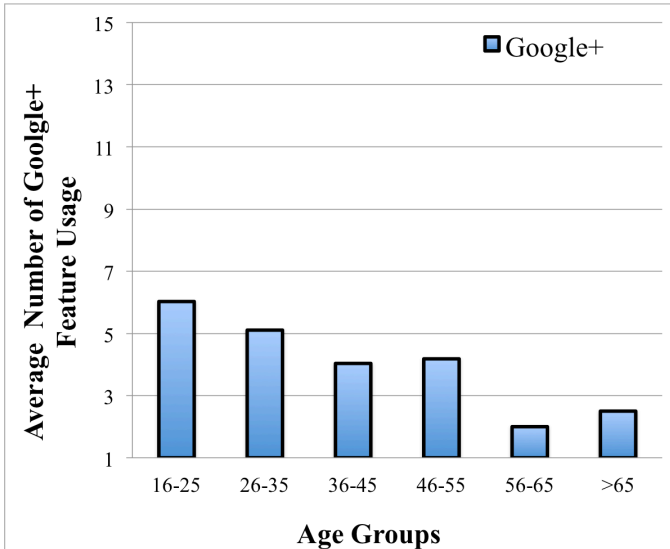


Fig. 3. Average Number of Google Plus Feature Usage and Age Groups.

Instagram

Figure 4 shows the trends of features (\bar{x}) that were used by different age group of Instagram mobile applications. The results showed that end users of all age groups used Instagram mobile applications. The age group of 16-25 had the highest mean value ($\bar{x} = 4.80$), followed by age group of 26-35 ($\bar{x} = 4.45$) and 36-45 ($\bar{x} = 4.00$). The mean values start to decrease from the age group of 46-55 ($\bar{x} = 3.84$), 56-65 ($\bar{x} = 3.40$). The age group more than 65 years old had the lowest mean values ($\bar{x} = 2.66$).

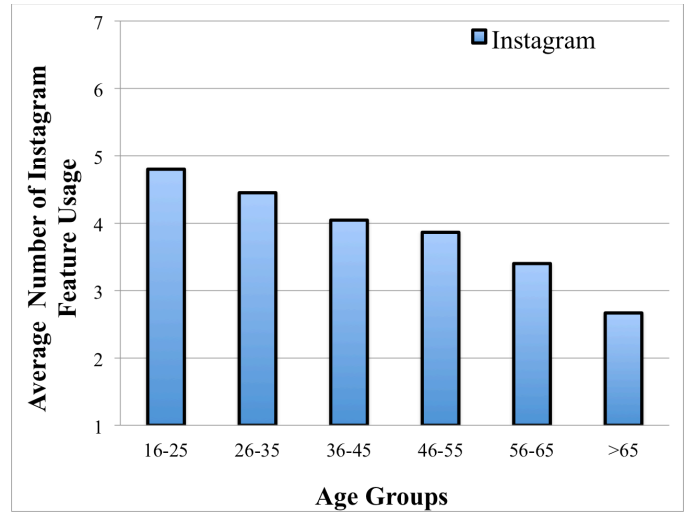


Fig. 4. Average Number of Instagram Feature Usage and Age Groups.

Twitter

Figure 5 shows the trends of features (\bar{x}) that were used by different age group of Twitter mobile applications. The results showed that end users of 4 age groups used Twitter mobile applications. The age group of 16-25 had the highest mean value ($\bar{x} = 5.08$), followed by age group of 26-35 ($\bar{x} = 4.17$), 36-45 ($\bar{x} = 2.93$) and 46-55 ($\bar{x} = 2.43$). The age group of 56-65 ($\bar{x} = 3.40$) and more than 65 years old did not use Twitter mobile applications.

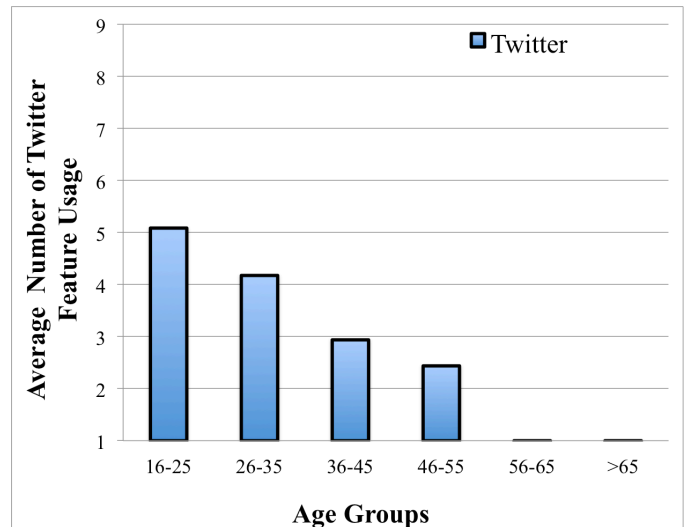


Fig. 5. Average Number of Twitter Feature Usage and Age Groups.

YouTube

Figure 6 shows the trends of features (\bar{x}) that were used by different age group of YouTube mobile applications. The results showed that end users of all age groups used YouTube mobile applications. The age group of 16-25 had the highest mean value ($\bar{x} = 4.24$), followed by age group of 26-35 ($\bar{x} = 3.72$), 36-45 ($\bar{x} = 3.30$), 46-55 ($\bar{x} = 2.97$) and 56-65 ($\bar{x} = 3.16$).

The age group more than 65 years old had the lowest mean values ($\bar{x} = 2.72$).

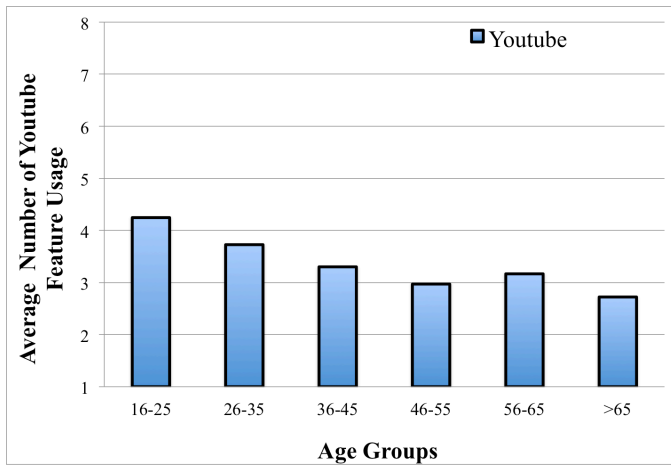


Fig. 6. Average Number of YouTube Feature Usage and Age Groups.

V. DISSCUSSION AND CONCLUSION

A. Hypothese Testing Results

According to the results from ANOVA analysis, the test of hypotheses can be summarized as in Table V. The MSN applications that did not show statistically significant differences between age groups in the ANOVA test were considered as rejected in the hypotheses testing (H2, H3, H4).

TABLE V. SUMMARY OF HYPOTHESE RESULTS

Hypotheses	Results
H1: Age of end users have an effect on the number of features used in Facebook's mobile social network applications.	Accepted
H2: Age of end users have an effect on the number of features used in Line's mobile social network applications.	Rejected
H3: Age of end users have an effect on the number of features used in Google Plus's mobile social network applications.	Rejected
H4: Age of end users have an effect on the number of features used in Instagram's mobile social network applications.	Rejected
H5: Age of end users have an effect on the number of features used in Twitter's mobile social network applications.	Accepted
H6: Age of end users have an effect on the number of features used in YouTube's mobile social network applications.	Accepted

B. The Number of Features in MSN applications

The results from Table III showed that Facebook and Line were used by most of the subjects (more than 90%). Facebook, Line and Google Plus have the top 3 highest numbers of features. However, Google Plus was used by only 23% of the

subjects. This finding suggests that the higher number of features in MSN applications may not always attract more end users.

C. Effects of Age on End users' Usage of MSN applications

The results from Figure 1-6 show the trends that the older adults preferred to use less of features in most of MSN applications. For Facebook, Line, Instagram, Twitter and YouTube, the number of MSN applications feature usage start to drop in the age group 46-55 years and become the lowest on the age group more than 65 years. However, Google Plus shows a different result. End users in the age group more than 65 years used higher number of features than the age group of 56-65 years. Hence, the usage of Google plus should be considered in future research.

D. Implementations

The combination of findings was used to generate recommendations for developers and information provider of MSN applications especially for the older adults.

a) Developers of MSN Applications for the Older Adults.

Firstly, MSN applications for the older adults may be included only some features. This result are in agreement with those obtained by Pfeil, et al [14]. They suggested that older adults used less of media and features of MySpace OSN. Those features need to be carefully selected for the older adults. The results show that older adults choose to use different features among MSN applications. Any complicated features may not be required and can be ignore. Secondly, when implementing new features, developer should design new features based on the characteristics of existing features that the older adults already adopted. These suggestion was support by Barnard, et al. [5]. They also suggest that the older adults have negative attitude toward new technology.

b) Information Providers for the Older Adults

Information providers should make the information for the older adults as simple as possible, if their target were the older adult. The result shows that the older adults mostly share and read texts and pictures. Hence, the information should be sent as texts or pictures only without any video or audio.

E. Limitation and Future Research

- The older adults of this study were born from 1940 to 1960, which were known as the "Baby Boomers" age cohort. The results may be different if apply the method in this study with the older adults in the future. For example, the older adults from the generation X or Y.
- The subjects of this study were from Thailand. However, the results may be generalized to other countries with the same cultural dimensions.
- This study was designed for study the features usage in MSN applications context. However, the future research may apply this method with other categories of mobile applications. Each category of mobile applications has different distinctive common features.

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