Identifying Service Items in Travel Mobile Applications Suitable for Senior Tourists to Improve Traveling Experience

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Abstract
Mobile applications (apps) are becoming a necessary product in tourism, changing service delivery, and traveling experience. With the accelerating global aging, tourism industry and product systems need to understand the requirements of seniors as a heterogeneous group and provide related services to ensure their traveling experience. Previous research has mainly focused on examining the attributes of technology products and customer engagement or acceptance through modifying models. However, the literature is insufficient in researching specific service items of apps suitable for senior tourists. Therefore, this study adopts qualitative and quantitative methods to propose five service items (healthcare service, dietary service, transportation service, reservation service, culture, and humanistic service) in travel apps that can help seniors blend into travel environment. Then we collected data (N=386) to study which service items determine traveling experience of seniors. The results show that all five-service presented in travel apps will benefit to traveling experience. Furthermore, correlations are revealed between healthcare, dietary, and transportation services. Therefore, we suggest how travel apps should be adjusted and what stakeholders can join in this field to offer services for senior tourists. The findings also enrich understandings of seniors' outdoor requirements and provide a theoretical basis for developing future aging studies.

Keywords: travel mobile applications, traveling experience, senior tourists, product service, outdoor requirements.

Introduction:
Aging has become an accentuated problem worldwide because of increasing life expectancy and declining fertility rates. China is one of the fastest-growing aging populations in the world and the population of people over 60 years old is projected to reach 28% by 2040 (WHO, 2018). Senior tourists are the most important segment of the hospitality and tourism market (Wang et al., 2013; Bai et al., 2001). Moreover, the seniors have loose conditions with more discretionary time and little

economic pressures compared with the other aged groups (Alén et al., 2017;Santos et al., 2016) and previous studies also have proved travel experience has positive effects on the self-health report and extending longevity (Gu et al., 2016; Zhou et al., 2018). As a result, senior tourists are a worthy subject of study, both commercially and academically (Shoemaker, 2000).

The new term "Gerontechnology" is defined as technology can assist seniors with ensuring good health, full social participation, and independent living. (Plaza et al., 2011). ICT (information and communication technology) has been considered a vital tool to help in creating a cohesive and inclusive society as through touch screens shorten the distance between users and products, getting a sense of reality and enriching the usability topics of products (Hsiao et al., 2017; Kalimullah&Sushmitha, 2017). Travel mobile applications, as one kinds of ICT products, are multifunctional with influencing traveling experience of users, customer engagement, and changing service operations and delivery methods in tourism industry (Fang et al., 2017; Ramos-Soler et al., 2019). The study of technological products in tourism is far-reaching because senior tourists are a heterogeneous group with deteriorating physical and psychological (Alén et al., 2017). In addition, seniors are known as digital immigrants, main reasons are the characteristics and contents of technology products are clearly more oriented to the experience and behaviors of young generations (Prensky, 2010; Castilla et al., 2013; Hsiao et al.,2017). However, it does not represent that the elderlyrejects all technologies, on the contrary, the number of people over 60 years old interacted with computers, Internet, and mobile phones is dramatically increasing（Plaza et al., 2011; Alpay et al., 2004). Therefore, some scholars pointed travel apps need to know the capabilities and behaviors of seniors to adapting and improving the system interaction with them (Casas et al., 2008).

Suitable mobile applications can enhance traveling experience and engagement of tourists (Fang et al., 2017; Ramos-Soler et al., 2019). Many academic discussions have also been conducted on how mobile applications can be effectively accepted in the tourism context (Fang et al.,2017; Yong Im and Hancer, 2014; Ismail et al, 2016; Tian et al., 2021). However, there are several issues in the current research. First, a large number of existing studies do not divide user groups, as senior tourists are more concerned about personal safety and health problems due to their deteriorating cognition, physical abilities (Wang et al., 2013; Hsiao et al.,2017; Cao et al., 2020); secondly, most existing studies discuss the relationship between technology products and user acceptance by modifying models such as TAM (technology accept model), SOR(stimuli-organism-response), and UTAUT(unified theory of acceptance and use of technology), but few research touches upon the idiosyncratic or guaranteed services provided by travel apps for seniors in unfamiliar environments (Escobar-Rodríguez and Carvajal-Trujillo, 2014; Fang et al.,2017; Tian et al., 2021); thirdly, users were not involved in the process of research and design (Plaza et al.,2011), so previous findings are too general to be explained in any scenario.

Zehrer (2009) concluded four features of services are intangibility, perishability, heterogeneity, and simultaneity. Service patterns in the tourism industry are delivered through a variety of products or institutions to customers, so identified on specific services which required for a group is important. To address this gap, according to exploring the outdoor requirements of senior groups in the tourism, this study proposes how tourism mobile applications can improve traveling experience of seniors by providing thoughtful and appropriate service items. Through qualitative and quantitative methods, we validated the hypotheses derived through the literatures and focus groups firstly. Then a certain amount of data is collected through questionnaires to objectively verify these hypotheses and further understand the relationships among these service items and traveling experience of senior tourists.

Literature Review:
Previous studies on travel apps and users

Tourism is a product of the experience economy and focuses on the feelings andexperience of customers which are co-created by interacting with multiple service elements (Teixeira et al., 2012; Tussyadiah, 2014). Yong Im and Hancer (2014) said travel mobile applications transform service into assisting users with their travel requirements. Suitable travel mobile applications are indispensable tools that can influence positively for overall traveling experience (Fang et al., 2017). Ramos-Soler et al. (2019) pointed travel apps for senior tourists are filled with irrelevant information materials that cause difficulties for seniors to understand and give up interacting travel apps, which is also a main reason why they are reluctant to use existing travel apps. Understanding the services that senior tourists desired are crucial for the design and development of travel apps.

The prerequisites for studying mobile applications depend on scenarios and the subjects of engagement (Plaza et al., 2011). Numerous studies have shown attributes and characteristics of apps vary considerably in contexts and user groups (Kalimullah and Sushmitha, 2017; Mary et al., 2020; Valk et al., 2021). Yong Im and Hancer (2014) adopted TAM to prove that tourists' attitudes and EOU (ease of use) are closely related to all motivations and emphasize that travel apps provide users with information searching. Fang et al. (2017) explored customer engagement of travel mobile applications through adjusting SOR to reveal design features and performance attributes that influence psychological engagement so that users are willing to sustainably interact with the travel apps. Tian et al. (2021) adopted the SOR again, explored the relationship between how the attributes of travel mobile applications will lead to consumption intentions. As Tian (2021) summarized limitations are ignoring personal characteristics and social influences on customer engagement, and also consumer behaviors vary widely across groups.

In summary, most of the existing research explored how travel apps can be more effectively accepted by users through modifying existed models, emphasizing prominent roles of EOU and perceived usefulness for travel apps. However, the previous studies ignored the segments' difference, as seniors' attitudes towards tourism and technologies are unique (Kazeminia et al., 2015; Alén et al., 2017; Huber et al., 2018; Haiso et al., 2017); moreover, providing contents is an important aspect of developing travel apps (Ramos-Soler et al.,2019), and outdoor requirements for older people are key to develop and explore.

Heterogeneities of senior tourists

As a vulnerable group in the whole society, seniors are the objects that need to be cared through various services, especially when they are in tourism. Because of dramatic number growth of seniors and deteriorating physical conditions, those have brought about widespread attention of social healthcare systems. According to statistics, 79.5% of seniors have a chronic disease while 50% have more than two chronic diseases (Cao et al., 2020), those personal physical conditions deter them from accessing to travel and aggravating their psychological burdens. Kalimullah and Sushmith (2017) pointed Mhealth (mobile health) products with providing new interactive health services to seniors have sprung up, also some studies related to senior tourism indicated health conditions are a mainstream concerned factor for seniors when they are outdoors. For example, Wang et al. (2013) created a new scale of evaluating a series service for group tours of seniors and indicated Chinese seniors prefer to have a kind of service that can remember their physical status before the trips, remind them to take their medicine and take timely measures to protect their physical and mental safety in case of accidents. Meanwhile, "Self-assessed health" and "safety and security" are consideration conditions for traveling experience of seniors which are defined by many scholars (Zhou et al., 2018; Alén et al., 2017; Kazeminia et al., 2015; Haiso et al., 2017; Huber et al., 2018), moreover, Chinese

seniors are reluctant to follow tour guides during their travels (Wang et al., 2013). Therefore, the healthcare service as an important function in travel apps should be considered.

Traveling experience consists of user experience of buses and the experience of associated service (Hidén et al., 2016). Due to deficits in sensory function and musculoskeletal strength, as well as beyond driving years and some other unavoidable issues deter seniors from participating in social activities which causes depressions and loneliness (Alsnih and Hensher, 2003; Atkins, 2001). Ritter et al. (2002) concluded that one of the critical reasons that seniors hardly take public transportations is unreliable public transpiration services. Wang et al. (2013) mentioned that most of the senior tourists in China rely on public transportations during trips, including trains and coaches, and drivers' attitudes and speed closely affect their traveling experience. Wong et al. (2017) listed nine transpiration services for seniors, e.g., tardy service, uncomfortable long taking times; meanwhile, they also indicated seniors' preference in transports always ignored by policymakers and failed to provide related services. It is urgent to provide digital public transportation services to retain their traveling experience (Hildén et al., 2016; Feng, 2016).

A significant proportion of seniors have dietary requirements (Hoffman, 1993), so dietary services are necessary when seniors in a new environment (Wang et al., 2013). Liu and Zhan (2014) revealed seniors have declining digestive functions and a smaller selection of food than younger people due to tooth loss or significant wear that affect their abilities to chew food. Different regions in China have their food cultures and unique dietary habits, and this variation breaks up the structure of eating out to enjoying their travels. Thereby, travel apps for senior tourists should consider dietary services.

In addition to the three services mentioned above, basic services of current travel apps, including reserve tickets and hotel services and get culture or humanistic information near traveler's locations (Wang et al., 2013; Ismail et al., 2016; Fang et al., 2017; Mary et al., 2020; Ramos-Soler et al., 2019). Most existing studies have not systematically examined the specific services that seniors need from ICT products when they travel, and users are not involved in the research process and development. (Plaza et al., 2011). Especially traveling experience is full of personal and subjective, hence, focus groups were adopted as exploratory and effective tool to involve seniors by gaining an in-depth insight of their requirements via richness data and information (Heung and Kucukusta, 2013; Hsu and Huang, 2016; Ramos-Soler et al., 2019).

Methodology:
Focus group and hypotheses
This study used qualitative and quantitative methods. We first used focus groups to observe elderly people's views on tourism and products and came up with our hypotheses. To further determine whether the hypotheses are universal and objectively scientific, a questionnaire survey was conducted later. The requirements that respondents participate in our research are 60 or over 60 years old, traveling in the past, and have experience using apps or other ICTs while traveling. We visited senior colleges and senior citizen activity centers, and finally, eighteen qualified seniors (6 people/ per group) were willing to participate. In this research, the institution (Senior Activity Center) and all respondents agreed to participate and signed consent forms. Drawn on Huber et al. (2018), respondents were invited to bring photographs from their journeys, which improved the accuracy of their memories and sparked a desire to share. Aside from the respondents, two professionals are charged by hosting and recording the conversation, one from tourism and another is a service designer. There is also a senior citizen activity center volunteer who assists with sitting and basic care for respondents. The process consisted of a brief introduction by the host to present the significance of the research, with the assurance that the privacy of the respondents would be protected, and they have

the right to withdraw their participation at any time. In the second step, a 5-minute ice-breaking game organized by the service designer helped the respondents establish harmonious relationships and break the deadlock of strangeness, which inspired by the previous research (Hsu and Huang, 2016). Then we conducted the discussions following the predesigned guide, the detail for each step is shown in Figure 1.

Steps	Phase	Purpose
1	Introduce our research	To make sure all respondents understand the background and purposes of this study
2	A 5-mins breaking game	To help the respondents have good relationships in the groups and break the strangeness among them
3	Start to discussion	To involve seniors throughout the study and understand their outdoor requirements
4	Ending	For some respondents to communicate at any time later, we left our contact information (Tel No, email)

Figure 1. The phases of focus groups

The first thing worth noting that low usage and frustrations about currently travel digital products which resonated widely among the eighteen respondents. Sixteen respondents stated that they would only use Internet search engines to find answers or contact their family members to ask for remote help, which is in line with Ramos-Sole's findings that seniors do not have appropriate apps, so they often switch between several themes apps to fulfill their service needs. Drawn on Tian et al. (2021) mentioned the popular travel apps in China are Ctrip Travel, Fliggy, Qunar (Figure 2), sixteen respondents responded they roughly knew about, but hese products are too complicated and unable to provide appropriate information or services for them. Under these conditions, Seniors must take strenuous energy to understand and control them. While the other two respondents stated, they had previously booked tickets and accommodations with the assistance of others and were unable to operate these apps independently. It is consistent with scholars have emphasized before complex products only make users have negative emotions and overall dissatisfaction (Fang et al., 2017; Castilla et al., 2013). As Hasan and Ahmed (2007) highlighted perceived usefulness and perceived EOU are essential characteristics of technology products. Thus, developing travel apps for seniors should consider providing services to create an independent and confident using environment (Haiso et al., 2017; Kalimullah and Sushmith, 2017).

Figure 2. Currently occupy a high market rate of travel mobile application products in China

Service items that affect the traveling experience of seniors are diverse. A recurring theme in the discussion was health concerns. Seventeen (17/18) stated they are concerned about their physical status when they are in strange surroundings, which stops them from enjoying pleasant trips. They desire to have a product or institution that will take care of them. The physical status, safety, and privacy of senior tourists have always been the key factors affecting their traveling experience

[…] While traveling in Yunnan, I had no idea that the altitude there would be too much for my heart, which would cause me to be weak and look around for hospitals... how nice it would be if some services could remind me to take some medicine with me... that is why my children disapprove of me traveling anymore... (F, 82 years old)

Furthermore, dietary patterns contribute to health states and moods (Cai et al., 2007; Gao et al., 2013; Locher et al., 2009). Seniors are different from other groups because most of them have chronic diseases (e.g., diabetes, hypertension), reduced immunity, and poor stomach digestion, so it is advisable to have a light diet and pay attention to the intake of trace elements, calories, protein, and vitamins (Xu and Xue, 2017). Fourteen (14/18) respondents stated that traveling would disrupt their household dietary habits and result in negative traveling experiences. They require services or institutions near their locations that can provide healthy dietary according to their physical conditions.

[…] My family doctor told me that as a diabetic, I must strictly follow a sugar-free diet, but most restaurants cannot take my physical status into account..., I do not know where to find services like custom-made meals for me in a new environment ... (M, 62 years old)

Fifteen seniors (15/18) agreed that lack of thoughtful and in-time services make them feel disappointed when taking transportations. Senior tourists should contact crew members in time for psychological counseling and medical kits, such as antihypertensive drugs, oxygen bags, and digestive drugs in every possible contingency. It is in line with Wong et al. (2017) stated that seniors have become a disadvantaged group when taking public transportations and need special attention and services.

[…] The train was crowded, and the six-hour made me headache... however, I do not know how to contact a steward is familiar with medical knowledge to help me quickly... (M, 72 years old)

Nevertheless, not all the services offered by general travel apps for senior tourists are ineffective. Some essential services, such as reservation services, and cultural and humanistic information of destinations, are also essential for senior tourists.

[…] It is very convenient for me to change my check-in time at any time through the system, because most of the time I cannot communicate effectively with the hotel staff due to the delayed flight... (F, 61 years old)

[…] My wife and I like to check local cultural information through the app when we travel freely, which helps us to quickly integrate into the local folk customs... (M, 68 years old)

To summarize, existing travel-themed mobile applications are not suited for seniors. They cannot improve the traveling experience since they were not created based on the needs and characteristics of seniors. According to the discussions in the focus groups, travel-themed mobile applications provide healthcare service, dietary service, transportation service, reservation service, culture and humanistic service that can positively affect seniors' traveling experience. Therefore, we proposed our hypotheses as follows:

H1: Healthcare service item provided by travel apps positively influences on traveling experience of senior tourists.
H2: Dietary service item provided by travel apps positively influences on traveling experience of senior tourists.

H3: Transportation service item provided by travel apps positively influences on traveling experience of senior tourists.

H4: Reservation service item provided by travel apps positively influences on traveling experience of senior tourists.

H5: Culture and humanistic service item provided by travel apps positively influences traveling experience of senior tourists.

To further determine whether the above hypotheses exist objectively in a larger scale, we conducted a questionnaire to collect data. SPSS (IBM SPSS Statistics, New York, USA) 23.0 and AMOS 23.0 were used for multiple linear regression analysis and confirmatory factor analysis (CFA).

Results and Discussion:

The central purpose of this quantitative research step is to investigate which service items provided in travel apps will determine senior tourists' overall traveling experience and compare the degree of their impacts. We designed the questionnaire's content for the six variables (healthcare service, dietary service, transportation service, reservation service, culture and humanistic, traveling experience). The whole survey is divided into two parts. According to previous studies, the first part is respondents' demographic information, including gender, age, marital status, education level, employment status, and housing situation (Huber et al., 2018). The second part adopts a five-point Likert scale, ranging from 'strongly disagree (1)' to 'strongly agree (5)', to collect seniors' perceptions of each service item and the overall travel experience, some of the questions are adapted from previous literature (Kim and Morrison, 2008; Wang et al., 2013; Yong Im and Hancer, 2014; Kim et al., 2015; Fang, 2016; Pan et al., 2020; Wong et al., 2017; Cao et al., 2020).

Finally, we collected 386 valid samples, and detailed demographic information is shown in Table 1. According to the identification of aging society by WHO, all respondents were all over 60 years old. 50.8% are aged 60 to 69, and 29.5% are aged 70 to 79, 16.8% are aged 80 to 89, and 2.8% over 90. Females made up 57%, and 78.5% of the respondents were retired. Regarding marital status, 66.1% of respondents were married, 21% were divorced, 11.1% were widowed, and 7% were unmarried. 72.8% of respondents live with family members, 6.7% live in nursing homes or with home care workers, and 20.5% live alone. However, most of the respondents' education level stays at middle school and high school, and 17.6% are well educated (above bachelor), which is only 0.8% of the respondents are unable to read or write.

Table 1. Sample description（N=386）

Characteristics		Number	Frequency (%)
Gender	Male	166	43
	Female	220	57
Age	60-69	196	50.8
	70-79	114	29.5
	80-89	65	16.9
	>90	11	2.8
Marital status	Never married	7	1.8
	Married	255	66.1
	Divorced	81	21.0
	Widowed	43	11.1
Employment status	Retired	303	78.5
	Working	83	21.5

Housing situation	Single household	79	20.5
	Living with families	281	72.8
	Assisted living	26	6.7
Education	Illiteracy	3	0.8
	Below middle school	123	31.9
	High school	192	49.7
	Above college	68	17.6

Confirmatory factor analysis (CFA) was adopted to assess the scales and examine validity and reliability (Yong Im and Hancer, 2014; Kim et al., 2015). The Cronbach's alpha of the whole questionnaire is 0.843 (> 0.7), as Table 2 shown, for each dimension is from 0.828 to 0.868(> 0.7), indicating internal consistency (Pan et al., 2020). Factor loading falls between 0.727 to 0.873 (p< .001), which can be proved that adequate convergent validity for all the indicators. Average variance extracted (AVE) and composite reliability (CR) for all items exceed 0.5 and 0.7 respectively, indicating high construct reliability (Zhou et al., 2019; Fang et al., 2017; Tian et al. 2021). AVE of each structure is from 0,6139 to 0.6579, and CR is from 0. 8272 to 0.8709, all the indexes higher than recommend threshold. Hence, all indices are meet the requirements, data of this study have good reliability, validity, and scientific nature.

Table 2. Item and reliability analysis

Construct/Item			Factor Loading	α
Healthcare service		0.868	0.8709	0.6283
HS1	0.791			
HS2	0.783			
HS3	0.744			
HS4	0.849			
Diet service		0.863	0.8640	0.6139
DS1	0,760			
DS2	0.774			
DS3	0.766			
DS4	0.832			
Transportation service		0.841	0.8446	0.6455
TS1	0.732			
TS2	0.799			
TS3	0.873			
Reservation service		0.850	0.8526	0.6597
RS1	0.869			
RS2	0.727			
RS3	0.834			
Culture and humanistic service		0.828	0.8272	0.6154
CHS1	0.750			
CHS2	0.757			
CHS3	0.843			

		0.836	0.8387	0.6350
Traveling experience				
TE1	0.728			
TE2	0.843			
TE3	0.815			

α= Cronbach's alpha; CR= composite reliability; AVE= average variance extracted

Multiple fitting indices were used to evaluate the fitting of the measurement structure in Table 3. All these indices are in acceptable, X²/df =231.999/155=1.497<3, CFI=0.979, GFI=0.944, AGFI=0.924, NFI=0.941, RMSEA=0.036, which meet cutoff values suggested by many scholars (Wang et al., 2013; Fang et al., 2017; Pan et al., 2020; Tian et al., 2021). Therefore, these criteria shown the model fit the data adequately.

Table 3. Fit indices of the measurement model and structure model

Fit Index	Saturated Model	Recommended Cutoff Value
X²/df	1.497	<3
GFI	0.944	>0.9
AGFI	0.924	>0.9
RMSEA	0.036	<0.06
NFI	0.941	>0.9
CFI	0.979	>0.9

GFI= goodness-of- fit index; AGFI= adjusted goodness-of-fit index; RMSEA= root mean squared error of approximation; NFI= normed fit index; CFI= comparative fit index.

Pearson correlation was employed to explore the correlations between variables (healthcare service, dietary service, transportation service, reservation service, culture and humanistic service, traveling experience). As shown in Table 4, Pearson indices of variables are positive for all significant P values. Most importantly, there are also significant positive correlations among HS (healthcare service), DS (dietary service), and TS (transportation service). However, neither is related to the first three nor each other for RS (reservation service) and CHS (culture and humanistic service).

Table 4. Pearson Correlation analysis

	HS	DS	TS	RS	CHS	TE
HS	1					
DS	0.341**	1				
TS	0.324**	0.312**	1			
RS	0.028	0.096	0.048	1		
CHS	0.006	0.057	0.061	0.053	1	
TE	0.473**	0.458**	0.439**	0.147**	0.268**	1

HS= healthcare service; DT=dietary service; TS= transportation service; RS=reservation service; CHS=culture and humanistic service; TE= traveling experience.
**. Correlation is significant at the 0.01 level (2-tailed).

Multiple regression is appropriate for inferring causal relationships between multiple dependent variables and independent variables, particularly in the study of service quality (Fick and Brent Ritchie, 1991; Weng et al., 2018). About the regression model of this study, we first need to confirm the excellent fit and validity of the model through ANOVA, R², and some other indicators. According to the model fitting results, adjusted R² is 0.443, which means five dependent variables have the

capability of 44.3% explaining one independent variable. About ANOVA, p is 0.00 (<0.005), which means at least one of the service items (dependent variables) can result in traveling experience (independent variable) changing (Hasan and Ahmed, 2007). Later, Durbin-Watson (DW), VIF, and residual distribution need to be noticed (Jang and Wu, 2006; Lin and Ho, 2020). In this multiple regression model, DW is 2.016(recommended value1.9-2.1), VIF range is from 1.008 - 1.204(recommended value <10), and residuals are normally distributed. Therefore, all values of this multiple linear regression indicate that the model can explain the causal relationship between variables scientifically and reasonably.

As shown in Table5, all the five independent variables had a significant positive correlation with traveling experience (p<0.05, B>0), which also examine all the hypotheses proposed in this study are support. By comparing β-value, the ranking of services that affect the traveling experience of the seniors is as follows: healthcare service (0.303)> diet service (0.257)> transportation service (0.241)> culture and human service (0.232)> reservation service (0.090).

Therefore, for senior tourists，traveling experience and the service items offered from mobile applications can be summarized in the following equation：

$TE = -0.504 + 0.316 * HS + 0.250 * DS + 0.232 * TS + 0.085 * RS + 0.221 * CHS$

Table5. Coefficient of five independent variables and one dependent variables

Model	Unstandardized Coefficient		Standardized Coefficients	t	Sig.
	B	Std. Error	β		
Constant	-0.504	0.276		-1.825	0.069
HS	0.316	0.44	0.303	7.271	0.000
DS	0.250	0.41	0,257	6.127	0.000
TS	0.232	0.40	0.241	5.800	0.000
RS	0.085	0.37	0.090	2.333	0.020
CHS	0.221	0.37	0.232	6.034	0.000

HS= healthcare service; DT=dietary service; TS= transportation service; RS=reservation service; CHS=culture and humanistic service; TE= traveling experience. Dependent Variable= Traveling experience

Conclusion:

The study identified the most influential service item that results in good traveling experience of seniors is healthcare services (β =0.303, P=0.000), which is relevant to the findings of many previous studies (Wang et al., 2013; Gu et al., 2016; Zhou et al., 2018), but we revealed more deeply information and causalities for traveling experience through travel apps provided services. Seniors have chronic diseases and various potential physical impairments, such as muscular weakness, slowed movement, reduced perception and cognition, and other inevitable issues (Lin and Ho, 2020; Valk et al., 2021). When senior tourists are in unfamiliar surroundings, it often aggravates their physical functions or psychological stress, leads them away from tour programs, or they are unable to devote themselves to enjoying the scenery of trips. According to focus groups and data analysis, senior tourists will need travel apps that can help them organize their itineraries based on their health records, remind them to take their prescriptions on time, and inform them in advance to avoid attractions that are not well protected. In emergencies, seniors will be able to contact the nearest professional pharmacy or hospitals via the travel apps dependently. Senior tourists need is an intelligent "private doctor" who can adjust their trips according to their physical functions, provide timely medical information and protect their bodies, minds, and properties from any damage.

Dietary services are the second service item that should be paid attention to (β =0.257, P=0.000). Few previous studies mentioned catering services for senior tourists only pointed visible signs, environmental facilities, and workers' attitudes influence senior tourists (Wang et al., 2011; Marry et al., 2020). However, dietary services in this research refer more keep the household diet structure of seniors and providing chewable and nutritious meals. According to respondents' feedbacks, diabetic patients used to carry prepared food that is easy and stored to help them retain enough energy while traveling; thyroid patients are supposed to be served with non-iodized salt, but almost all Chinese restaurants use iodized salt, which dramatically affects the traveling experience. Thus, calling on more restaurants and organizations to provide scientific and high-quality dietary services through travel apps is necessary and urgent to ensure the traveling experience.

Meanwhile, the data analysis that transportation services are second only to the first two in terms of their impact on the traveling experience of senior tourists (β =0.241, P=0.000). It is a scientific consensus that services and transportation patterns for senior tourists should consider the particularities of this group (Feng et al., 2017; Wong et al., 2017). Nevertheless, the breakthrough in this paper regards transportation services as an essential part of travel and explores the causalities which related to traveling experience and other services. Prolonged taking of transports easily can cause physical discomfort and negative emotions (Wong et al., 2017). As Hildén (2016) indicated before, services in transports should be a way to provide various services. It was surprising to find a significant correlation between healthcare services, dietary services, and transportation services (p<0.01), suggesting that seniors who need one of these services will need the other two services presented in travel apps. It supports the findings of previous studies that Chinese seniors have an entrenched concept of maintaining their health through dietary supplements (Liu and Zhan, 2014). However, we further reveal that senior tourists who require dietary services and healthcare services are more sensitive to services when taking transportations.

In addition to the above three services that positively influence traveling experience, there are culture and human services and reservation services. Seniors prefer to immerse themselves in a new environment and savor the surrounding customs (Huber et al., 2018). Therefore, enriching their knowledge and experience through mobile travel applications is also interactive and essential part that digital products should provide. Regarding reservation service, although it also has a significant impact on tourism in this study (β =0.090, p=0.002), its effect on traveling experience is relatively low compared with the first four services. From the recording of focus groups, senior tourists will not change their schedule at will without personal or external emergencies. They are used to planning everything from hotels to scenic spots before departure, which aligns with Wang et al. (2013) research results. But we need to highlight here that all five services can improve the traveling experience of seniors through travel apps; reservation service is only relatively low compared to others; however, it is still a necessary basic function for most tourists.

The main contributions of this study are to distinguish the outdoor requirements of seniors from other age groups in terms of mobile applications and to identify further specific services which should be available in mobile travel applications that can improve the overall traveling experience of seniors. At the same time, this study has some implications for future academic development as follows:

Firstly, most previous research has examined technologies and consumer engagement or acceptance by modifying the S-O-R, TAM, and has derived a positive relationship between some characteristics such as EOU, perceived usefulness, UI attractiveness, and compatibility to consumer engagement or acceptance (Yong Im and Hancer, 2014; Fang et al., 2017; Tian et al., 2021). However, when applied specifically to seniors and the tourism industry, the characteristics are too general and lack of Specific

strategies, as the literature indicated seniors are a heterogeneous group in tourism (Alén et al., 2015; Huber et al., 2018; Lin and Ho, 2020). In this study, the development directions for services in travel apps proposed are ideally suited to the characteristics of this group because seniors participated entirely in our research, both qualitative and qualitative methods. Secondly, the hypotheses for this study concluded from the literature and focus groups. To ensured that results were not too subjective, then we used quantitative methods through the questionnaires. Combining two methods is enlightening for future research into the behaviors and motivations of specific groups. Thirdly, the needs of seniors for mobile applications will be different in different contexts (Kalimullah and Sushmitha, 2017; Cao et al., 2020). Future research on aging can refer to this study to explore how the advantages of ICTs can fully utilize to better suit seniors' lives in different scenarios. Finally, this study has implications about how to provide better tourism services and facilities for seniors from the stakeholders and employees in the tourism business, which enhance their cooperation and long-term mutual benefit.

EthicsApproval

The study has been reviewed and is hereby granted approval for implementation by the JawatankuasaEtikaPenyelidikanManusiaUniversitiSains Malaysia (JEPeM-USM). The study has been assigned study protocol code USM/JEPeM/22010016.

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