

Nam, Jinyoung; Kim, Seongcheol

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Why do elderly people feel negative about the use of self-service technology and how do they cope with the negative emotions?

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Why do elderly people feel negative about the use of self-service technology and how do they cope with the negative emotions?

Jinyoung Nam¹, Seongcheol Kim²

Abstract

While Covid-19 has accelerated the digital transformation, increasing labour costs and 52-hour workweek rules are replacing human labor with self-service technologies (SSTs). Self-service technology is increasingly implemented and is expected to become a usual phenomenon in restaurant settings. However, the elderly who have relatively lower levels of digital literacy are being excluded from the services which can alleviate the economic and social difficulties of their daily lives. This study thus aims to explain how elderly users feel about and react to the self-service technology in fast-food restaurants. We conducted an off-site survey with individuals who have experience in using self-service technology, and we analyzed the model using the PLS-SEM method by SmartPLS 3.0. The results showed that reduction, perceived ease of use of SST, and perceived time pressure were crucial predictors of viewers' emotions toward the self-service technology. Perceived physical condition and perceived crowding, however, did not have significant effects on users' emotional responses. This study empirically investigates individuals' negative feelings toward and coping strategies for the difficulties of the SST. It highlights the necessity of collaboration among government, industry, and academia for the development of a nationwide digital inclusion policy that can address the digital divide.

Keywords: Self-service technology, Restaurants, Elderly users, Negative emotions, Coping behavior

¹ First author. Ph.D. student, School of Media and Communication, Korea University. E-mail address: skalara@korea.ac.kr

² Corresponding author. Professor, School of Media and Communication, Korea University. E-mail address: hiddentrees@korea.ac.kr

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1. Introduction

The advancement in information and communication technology (ICT) has played a crucial role in enhancing service models by transforming the interactions between service firms and customers. Covid-19 with no contact and no gathering has become the norm of Covid-19 which has accelerated the digital transformation, changing the service models in diverse industries. Specifically, the changes regarding labour environment such as an increase in the labour costs (Jeon et al., 2020) and the 52-hour workweek rules are replacing human labor with the employment of self-service technologies (SSTs). Many service providers introduced technology-enabled mechanism self-service technologies to provide convenient services to the customers in achieving better productivity and increased satisfaction (Gounaris et al., 2010). Self-service technologies have been implemented in various sectors such as banks, civil services, hospitals, cafes, and restaurants, becoming a part of people's everyday lives. However, elderly people are particularly excluded from the services as they have little experience with new technology and the lack the digital skills to process it. Although SSTs have posed challenges in many sectors, it is important to examine the use of SSTs in the restaurant sector, which is closely related to individuals' everyday lives. The self-service technologies rely on interaction through touch screen displays, with the prevalence of self-order kiosks or interactive restaurant self-service technology (IRSST) in restaurants, especially fast-food restaurants.

In the meantime, South Korea is experiencing a rapid demographic shift toward an aging society. By 2040, the elderly aged over 65 years will account for 33% of the population (Lee & Song, 2020). In 2020, elderly households accounted for 4.732 million households (Statistics Korea, 2021). In the year 2021, the elderly aged over 65 accounted for approximately 16.5% of the total population in South Korea, increasing continuously since the year 2010 (Statista, 2021). As digital transformation accelerates with the impact of Covid-19, as one of the socially vulnerable groups, older people with relatively lower levels of digital literacy have become more vulnerable to the use of digital technology (GRI, 2021). The digital information level of the elderly was approximately 68.6% in 2020, while their digital information usage level was approximately 71.4%, still indicating a relatively lower level regarding digital skills they possess (Ministry of Science and ICT, 2020). Particularly, the rate of kiosk implementation in fast-food restaurants such as McDonald's, Lotteria, and Burger King is increasing, reaching over 60% of implementation in 2019 (GRI, 2020). The elderly face challenges in processing the self-service

kiosks that involve touchscreen technology due to a lack of digital literacy skills and the deterioration of cognitive and physical abilities. The prevalence of self-service kiosks intensifies the digital divide, referring to the inequalities people can experience in terms of access to information and communication technologies (ICTs) (Jamil, 2021) which alleviates the economic and social difficulties of their daily lives. This is one of the prominent obstacles for older people, which draws attention from both academia and practitioners.

Self-service technologies are increasingly implemented and are expected to become a usual phenomenon in restaurant settings shortly (Susskind & Curry, 2016). Therefore, digital technology has become prevalent and important in everyday lives, yet too complex, especially for elderly users (Iancu & Iancu, 2020). Despite such ubiquity of SST and the posed challenges to the elderly, there has been limited research on the actual usage of self-service technologies by the elderly. The study utilizes coping behavior as the theoretical framework to explore the relationship between the individual characteristics that leads to the negative emotions evoked by the elderly, and to the coping responses towards the self-service kiosks faced at the restaurants. The research question is as follows: What are the negative emotions of elderly people against the use of self-service technology (SST) and their coping strategies? Overall, this study aims to identify the elderly's emotional and behavioral responses toward the self-service kiosks in restaurants to understand the older consumers' perspective. It specifically examines the individual variables in terms of elderly, technical, and situational factors, the relationship with the emotions, and how it influences their various coping behaviors.

2. Literature review

2.1. Self-service technology (SST) in South Korea

The concept of technology-based self-service has been developed by (Dabholkar, 1996). Self-service technology (SST) is defined as the “technological interfaces that enable customers to produce a service independent of direct service employee involvement” Meuter et al. (2000, p. 50). SST is a service that is provided by customers at the service encounter through the use of any technology facility without direct contact with frontline employees (Fan et al., 2020; Meuter et al., 2000). Current self-service technologies commonly rely on interaction with the customers through touch-sensitive displays, with the use of touch screen technology that is widespread in public (e.g., ATMs and kiosks, vending machines), work (e.g., manufacturing control), and

personal environments (e.g., touch desktops, smart appliances) (Gao & Sun, 2015). The various types of self-service technologies operate across various sectors including restaurant, retail, banking, travel, healthcare, hospitality, education, and government sectors (Acumen Research, 2021). Meuter et al. (2000) classified SST into ten categories from two dimensions which comprise the enterprise technical interface that enables communication with customers and the tasks that are completed by the interface. The enterprise technical interface comprises the sub-categories of telephone or interactive voice response, online or Internet, interactive kiosks, and video, while the purposes are classified into customer service, transactions, and self-help services. With regards to SSTs employed in restaurants, interactive restaurant self-service technology (IRRSST) refers to tablet-based services that involve in-store iPads, tableside electronic monitors, and tabletop multi-touch screens (Ahn & Seo, 2018). However, in this study, the self-service technology refers to self-service kiosks that are prevalent in fast-food restaurants.

The global self-service technology market reported USD 33.66 billion in 2020 and is expected to reach USD 62.39 billion by 2028, growing at a CAGR of 7.6% between 2021 and 2028. Following the increase in market share, in South Korea, the domestic kiosk market is expected to grow at an average annual rate of 61.5%, reaching USD 17.6 million in 2020 (GRI, 2020). The shipment volume of kiosks from domestic manufacturers is estimated to be 12,915 units which is a 59% increase compared to the previous year (Kim, 2021). Covid-19 has accelerated the usage of self-service technologies in the services sector including coffee shops, convenience stores, and restaurants. The rate of kiosk introduction of burger franchises such as McDonald's, Lotteria, and Burger King has reached over 60% as of the year 2019 (GRI, 2020).

2.2. Literature regarding self-service technology (SST)

Prior research has focused on the elderly and their usage of digital technology from the aging perspective (Köttl et al., 2021), health and mental perspective (Lee et al., 2021), and social policy perspective (Hoffman et al., 2020). With the general self-service technology usage, much research has examined the usage of self-service technology in hospitality (Ahn & Seo, 2018) and services marketing (Gelbrich & Sattler, 2014; Kallweit et al., 2014). For example, a study examined personal values and consumer traits as antecedents of attitudes towards using self-service technologies and the relationship between intention to use (Lee & Lyu, 2016). That is, prior research has focused on the self-service technology and consumers' intention to use it from

a user adoption perspective. A study investigated the determinants that affect the adoption of self-order kiosks in fast-food restaurants (Na et al., 2021). Another study examined the relationship between servicescape and the intention to use self-service technology (SST) using core service and employee service as the moderators and attitude as a mediator (Guan et al., 2021). A study examined how consumers' perceived quality of interactive restaurant self-service technology (IRSST) attributes affects their cognitive and affective states and their subsequent behavioral intentions regarding the approach behavior or the avoidance behavior (Ahn & Seo, 2018).

There has been scant research regarding the examination of negative aspects of the SST, especially the potential challenges that the SST brings to several vulnerable groups such as older people. Concerning the use of SST by elderly people, a study examined the general factors that influence elderly people's intention to adopt self-service technologies (Lee & Lyu, 2019). A study examined the growing importance of self-service and the potential for older consumers for engaging in production and consumption from a service management perspective (Nicholls, 2020). A study examined the evaluation of feasibility and adoption intention for the self-service technology of older consumers with a focus on aging that includes chronological age, subjective age, and future time perspective (Park et al., 2020). In the context of the SST in South Korea, a study investigated the elderly's experiences with kiosks in fast-food restaurants through the in-depth interview (Ha & Kim, 2021). Although there has been attempts to examine the adoption of the SST from the older users' perspective, there have been a lack of research examining the emotional and behavioral responses that the elderly express when using self-service technology. To fill this gap, this study takes into consideration the elderly's usage, in terms of elderly-specific, technological, and situational characteristics and their emotional and subsequent behavioral responses (need for interaction, observing others, behavioral disengagement) corresponding to the SST.

2.3. Negative emotions: Social anxiety and helplessness

According to the cognitive appraisal perspective, emotions refer to the mental states of readiness caused by the evaluation of a situation, relatively intense but short-lived affective states resulting from appraisals (Ben-Ze'ev, 2000; Lazarus & Lazarus, 1991). As elderly customers try out and use self-service technology themselves on their own, they may face difficulties in the

process, leading to elicit negative emotions. Prior studies have examined negative feelings about ongoing technology use triggers emotions and how these emotions influence subsequent user attitudes, beliefs, and intentions (Beaudry & Pinsonneault, 2010; Brown et al., 2004). Negative emotions can be categorized into anxiety, sadness, anger, and guilt, which are responses to (appraised) actual or potential harm (Smith & Lazarus, 1993). The core relational theme for anxiety involves a certain level of threat, and the primary appraisals of motivational relevance and motivational incongruence are combined with secondary appraisals of low emotion-focused coping potential. The emotions of anxiety occur when the event is perceived as a threat and the individual feels that they have some control over its consequence (Beaudry & Pinsonneault, 2010). In contrast, for sadness, the core relational theme is a loss to helplessness, the inability to restore the lost or eliminate the harm. This theme is defined by combining secondary appraisals of low problem-focused coping potential and negative future expectations with primary appraisals of motivational relevance and motivational incongruence.

In the context of elderly users and their usage of SST, the negative experiences with SST may trigger emotional responses (Parasuraman, 2000) in the sense that it evokes a certain level of threat or irrevocable loss. Subsequently, elderly users may experience the negative emotions of social anxiety and helplessness. Social anxiety is defined as the discomfort that is associated with the awareness of other people's perspectives of oneself as a social object (Fenigstein et al., 1975). Specifically, it refers to “a state of anxiety resulting from the prospect or presence of interpersonal evaluation in real or imagined social settings” (Leary, 1983, p. 67). On the other hand, helplessness is another emotion examined in the context of SST usage with the elderly. Helplessness is the negative affective psychological state that occurs when feelings of frustration develop in such a way that, despite desiring a change, the individuals feel unsure whether their actions will make a difference (Frijda et al., 1989). Helpless people perceive that an aversive situation may not be changed in the future, thus feeling desperate (Folkman et al., 1986; Frijda, 1987). Negative experiences in SST usage often trigger emotional responses of helplessness (Krone et al., 2002).

2.4. Coping behavior

Coping behavior is the process of taking action to address stressful situations (Carver et al., 1989). Coping is defined as adaptational acts that an individual performs in response to

disruptive events that occur in his or her environment. Coping is defined as the person's constantly changing cognitive and behavioral efforts to manage specific external and internal demands that are appraised as exceeding the person's resources (Lazarus & Folkman, 1984) (Lazarus & Folkman, 1984). Previous research has identified a combination of cognitive and behavioral efforts in the form of problem-focused coping and emotional-focused coping (Lazarus & Folkman, 1984). Coping is often triggered by negative emotions as people seek to reduce their emotional distress and induce more favorable emotional states (Duhachek, 2005; Lazarus & Lazarus, 1991). Of the various coping responses, we consider problem-based coping and emotional-based coping to deal with the reactions to the elderly's usage of self-service technology. Problem-based coping aims to resolve and change the subject to overcome the stress (Carver et al., 1989). This kind of coping deals with trying to alter the situation by dealing with the cause for displacement or altering the environment or changing itself in terms of willingness to learn new skills (Lazarus and Folkman 1984). On the other hand, emotional-based coping deals with altering the individual perception and aims to reduce or control individuals' stressful emotions (Lazarus & Folkman 1984). Disengagement coping includes responses such as avoidance, denial, or escaping of related emotions, which is often emotion-focused, as it involves an attempt to escape feelings of distress (Moos & Schaefer, 1993; Roth & Cohen, 1986). In this regard, elderly users who cannot complete the transaction of the self-service technology may perform three types of coping behaviors after experiencing negative emotions. When facing difficulty with the completion of the transaction with the SST, it is necessary to examine active coping that involves interacting with an alternative channel of purchase, the human employee. The need for interaction refers to the importance of interpersonal contact with the consumer during a service delivery (Dabholkar, 1996). Moreover, elderly users may imitate, or observe others and learn how to use the SST. On the other hand, in terms of an emotional-based coping strategy, elderly users may disengage from using the SST.

2.5. SST-related coping behaviors mediated by negative emotions

Emotions influence individuals' behavioral responses. Emotions have an adaptive function related to behavioral tendencies (Plutchik, 1980). Prior research has revealed that negative emotions play an important role in determining individuals' coping processes (Monin et al., 2007). Negative emotion, in turn, prompts individuals to interrupt ongoing goal pursuit to

analyze the situation and its implications for their overall status (Ben-Ze'ev, 2000). Negative emotion evokes attempts to cope, and the coping strategies may moderate the effects of negative emotion on performance, with some strategies buffering and some amplifying its effect (Brown et al., 2005). It is important to study how such negative emotions influenced by the individual characteristics affect the coping behaviors in the context of SST usage due to its ubiquitous use in their daily lives and explore the potential consequences it brings to the elderly (Luqman et al., 2021).

Social anxiety can be defined as “the discomfort that is connected with the awareness of other people's evaluation of oneself as a social object” (Fenigstein et al., 1975, p. 522). Social anxiety occurs if someone attributes a negative situation to an external source (Smith & Ellsworth, 1985), and may cause a feeling of lack of control over the SSTs in the presence of other customers (Dabholkar & Bagozzi, 2002; Hui & Bateson, 1991). In a self-service technology context, this type of anxiety can occur when others are watching individuals perform the service or are waiting in line for individuals to finish a task. Consumers are likely to resist using new technology that they are unfamiliar with if social pressures exist (Kumar, 2007). Consequently, social anxiety may disorient customers and make SST usage difficult. Correspondingly, individuals who encounter anxiety will be associated with adaptation behaviors that aim at reducing the risk level of a situation (Han et al., 2007). In this regard, social anxiety will positively affect the problem-focused coping behavior of the need for interaction, as those are likely to seek interaction with the employee to gain assistance instead of using the SST. Moreover, the social learning theory posits that users' behavior can be influenced by observational learning mechanisms through observing others' actions or seeking others' opinions (Cheung et al., 2015). In this context, the elderly may feel the need to control their anxiety about unfavorable situations by observing others and using the SST. On the other hand, users may become anxious when others are watching them, thus reducing their intention to use SSTs (Kinard et al., 2009) in the belief that they are not easy to use. In this sense, elderly users may disengage with the SST, as part of the avoidance behavior. Accordingly, we propose the following hypotheses.

H1a: Elderly users' social anxiety over SSTs is positively related to problem-based coping behavior of need for interaction.

H1b: Elderly users' social anxiety over SSTs is positively related to problem-based coping behavior of observing others.

H1c: Elderly users' social anxiety over SSTs is positively related to emotion-based coping behavior of behavioral disengagement.

The elders often struggle to use information and communication technology, and feelings of helplessness may be intensified due to failed experiences and frustrations (Minge et al., 2014). Helplessness tends to occur when people perceive a low potential to cope with a goal or incongruent event (Lazarus & Lazarus, 1991). Helplessness does not imply a responsibility judgment and therefore does not lead to an aggressive reaction. Instead, helpless customers are assumed to remain inactive (Gelbrich, 2009). Given the perceived lack of control of individuals in situations in which helplessness arises, a helpless user may feel the need for interaction with human assistance, which are the direct behaviors employed to resolve a stressful situation. Moreover, helpless users may feel the need to imitate others to use the SST, which is one observational learning behavior that derives from users' indirect learning experiences by observing the actions of others (Gong et al., 2019). Furthermore, behavioral disengagement is reflected in phenomena that are also identified with terms such as helplessness (Carver et al., 1989). In theory, behavioral disengagement is most likely to occur when people expect poor coping outcomes. The helpless elderly users may be behaviorally disengaged with the SST, avoiding the use of SST. Accordingly, we propose the following hypotheses.

H2a: Elderly users' helplessness over SSTs is positively related to problem-based coping behavior of need for interaction.

H2b: Elderly users' helplessness over SSTs is positively related to problem-based coping behavior of observing others.

H2c: Elderly users' helplessness over SSTs is positively related to emotional-based coping behavior of behavioral disengagement.

2.6. Influences of elderly-specific characteristics on emotion and behavior

2.6.1. Perceived physical condition

Aging is a constant and highly complex process (Mathur & Moschis, 2005). The perceived physical conditions of older people affects their interactions with technology (Lee &

Coughlin, 2015). The physical factor accounts for the age-related declines in their physical abilities, and the physical responses include their speed in responding to the technology (Moschis, 1992). Specifically, the biophysical changes include changes in sensory, and intellectual functioning of the organism, diminished mobility, and decline of physical strength. Therefore, considering the deterioration of physical abilities, the elderly are often perceived as being the laggards of technology. Whether older users can easily utilize a device depends on the extent to which system design can assist the age-related impacts (Gao & Sun, 2015). Aging also has a degenerative effect on hand functions, including declines in manual speed and finger dexterity (Ranganathan et al., 2001), impeding them from making precise choices with the small interface targets (Caprani et al., 2012). The capacity for fine movement control declines with age, as the elderly experience declines in motor control, speed of execution, mobility, and agility (Iancu & Iancu, 2017). Another important physical factor is the reduction in the elderly's eyesight as most interface elements are visual (Caprani et al., 2012). Reduced vision is a common challenge to the elderly, as their eyesight is reduced with age. The information display size is especially relevant when the elderly face decreased eye-sights (Hagen & Sandnes, 2010). It is difficult for older people to easily perform physically demanding tasks, including prolonged standing or slower movement (Chung & Park, 2021). Perceived physical condition (PPC) refers to the beliefs about one's physical difficulties of vision, hearing, and motion that may be faced in everyday life (Ryu et al., 2009). Therefore, the physical condition may be a critical factor that influences experience, especially influencing social anxiety and helplessness with the SST in older people. Accordingly, we propose the following hypotheses.

H3a: Perceived physical condition is positively related to social anxiety over SST.

H3b: Perceived physical condition is positively related to helplessness over SST.

2.6.2. Losses in cognition

Age affects a decline in working memory, such as the capacity to process the information needed to complete ICT-related tasks (Hauk et al., 2019). Indeed, older adults report greater difficulties in handling technology due to individuals' cognitive abilities that affect the technological demands. The construct of awareness of age-related change (AARC) captures individuals' awareness that their behavior, performance, and life experiences have changed due to their increased age (Diehl & Wahl, 2010). The losses in cognition relate to different aspects of

cognition: gains capture perceived improvements in knowledge, wisdom, and reflexivity, whereas losses capture perceived limitations in processing speed, memory, and mental capacity (Sabatini et al., 2021). We assume that the decline in cognitive function may elicit emotional responses when using the SST. Accordingly, we propose the following hypotheses.

H4a: Losses in cognition is positively related to social anxiety over SST.

H4b: Losses in cognition is positively related to helplessness over SST.

2.7. Influences of technical characteristics on emotion and behavior

2.7.1. Reduction of SST

The technical factors are the design and technical features that affect how older adults interact with technology (Lee & Coughlin, 2015). The technical complexity is applied to the various context of IS when the technology is perceived to be difficult, and users are frightened to learn and use it (Maier, 2014). The difficulty of the user interface hinders how they process the interface, which is customized for younger people. The simplicity facet of reduction refers to the aspect of ensuring that a system is designed in such a manner that only essential steps are required to complete a given task (Maeda, 2006). Especially, reduction refers to the aspect of simplicity in which an application is reduced to its essentials. The reduction can be applied to all aspects of application design that consist of functionality, structural, navigational, and interface complexity (Lee et al., 2015). Particularly, the difficult manipulation of the interface of the SST pertains to the challenge that arises with controlling the touch screen regarding the payment process. The elderly face difficulties not being able to proceed with the next stage while using the kiosk (Korea Consumer Agency, 2020). The manipulation of the kiosk interface may not be reduced to the essentials, making it difficult for the elderly to use it, and amplifying the level of social anxiety. The complexity of the interface can create frustration, reinforcing helplessness feeling for the elderly. Accordingly, we propose the following hypotheses.

H5a: Reduction of SST is negatively related to social anxiety over SST.

H5b: Reduction of SST is negatively related to helplessness over SST.

2.7.2. Perceived ease of use of SST

The perceived ease of use is the degree to which SSTs are regarded as easy to understand and operate, that is, the degree to which a person believes that using particular systems would be

free from the effort (Davis, 1989). When perceptions of usefulness and ease of use increase, a consumer's attitude toward an SST is more positive (Kleijnen et al., 2004). In the study's context, perceived ease of use refers to the hardware aspect of SST, referring to the ease with which users can handle the self-service technology. The problem may arise if the SSTs are not usable nor accessible to the SST (Petrie et al., 2014), inducing negative emotions in elderly people. As a result, we identify ease of use as the key variable affecting the negative emotions of SST. Accordingly, we propose the following hypotheses.

H6a: Perceived ease of use of SST is negatively related to social anxiety over SST.

H6b: Perceived ease of use of SST is negatively related to helplessness over SST.

2.8. Influences of situational characteristics on emotion and behavior

2.8.1. Perceived time pressure

Perceived time pressure refers to how the individual experiences time availability and sacrifice (Kulviwat et al., 2004). It occurs when decisions must be made in a time that is shorter than the period required to complete the task. Perceived time pressure is described as the "degree to which one perceives oneself as lacking time relative to the daily tasks of living" (Alreck et al., 2009, p. 1). The perceived time may be applied when the older people use the self-service technologies as they need to process the technology at their turn on-site. The individuals that perceive that they are pressed for time tend to be stressed when it is their turn to use the technology (Maule et al., 2000). This stress may be intensified in the older people who have relatively lower levels of digital literacy and those with physical and cognitive difficulties, unable to simplify their decision strategies for processing (Svenson & Maule, 1993). This may strengthen the stress and lead to the emotions of social anxiety and helplessness. Accordingly, we propose the following hypotheses.

H7a: Perceived time pressure is positively related to social anxiety over SST.

H7b: Perceived time pressure is positively related to helplessness over SST.

2.8.2. Perceived crowding

In a self-service environment, the presence of many people in a waiting line can exert pressure on the users. The situational variable relevant to the on-site service environment is related to the perceived crowding. Perceived crowding is a subjective unpleasant feeling

(Bateson & Hui, 1992) that occurs when an environment is judged to be dense (Eroglu & Harrell, 1986). The presence and number of other customers may be perceived as negative and can lead to an increased level of social anxiety in people, for example in a crowded retail store (Langer & Saegert, 1977). This is because crowding induces a certain level of stress and a lack of control within the environment, especially in the retail setting (Rapoport, 1975). Therefore, people often change their actions if others are observing them (Kim et al., 2018). The presence of others may lead to older people's emotions of social anxiety and helplessness who may be pressured by the people waiting in line. Accordingly, we propose the following hypotheses.

H8a: Perceived crowding is positively related to social anxiety over SST.

H8b: Perceived crowding is positively related to helplessness over SST.

Figure 1 summarizes our research model.

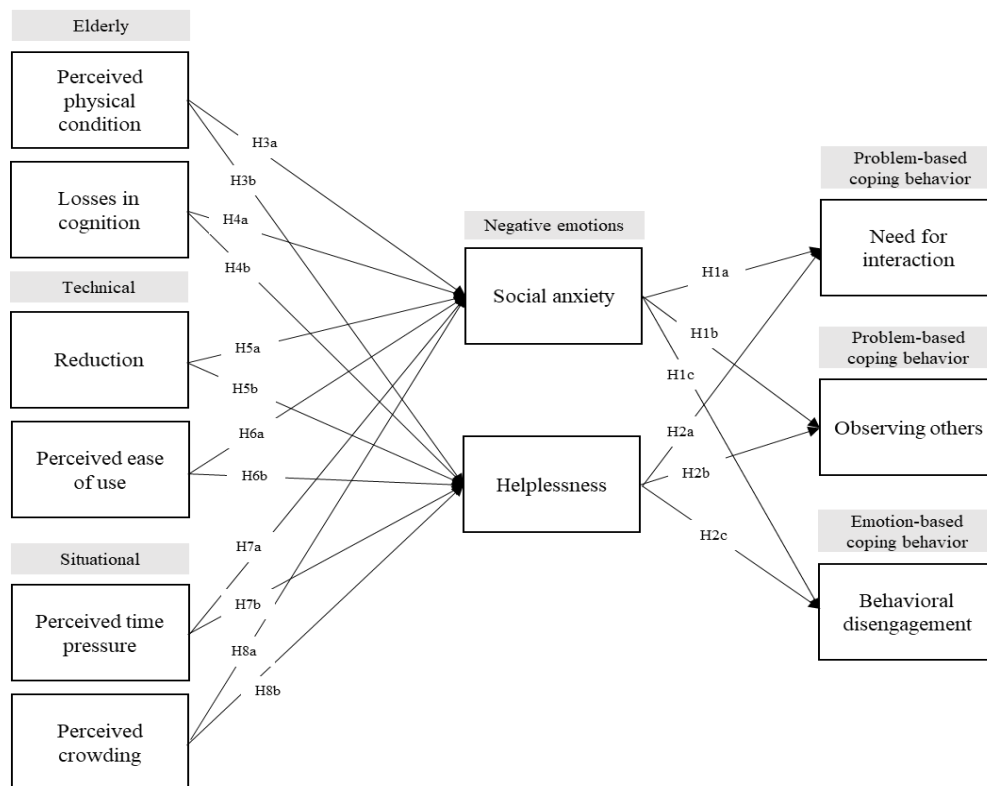


Figure 1. Research model

3. Methodology

3.1. Data collection

Prior to the actual survey, a pilot study was conducted from December 5 to December 10, 2022, to explore and identify elderly users' emotions towards self-service technology. The pilot survey included open-ended questions about the emotions or responses felt after using the SST, and further thoughts about the use of SST in general. We aimed to identify the negative emotions that may be associated with users' coping responses. Based on the results of the pilot study and our prior literature review on negative emotions, we selected social anxiety and helplessness in the actual survey.

We collected data for the actual off-site survey from May 1 to May 24, 2022, under the context of elderly South Korean users in their 60s to 70s who have experience in using self-service technology in fast-food restaurants. Most prior studies consider people aged above 60 years as elderly people (Narushima et al., 2018; Peek et al., 2019). We did not conduct an online survey because elderly online users who can utilize online resources can elicit biased results. Instead, we aimed to obtain direct and accurate responses from the elderly. Convenient sampling is appropriate in this context in the case of selecting a sample with certain characteristics that are typically used in broader social and behavioral research on aging (Hultsch et al., 2002; Pruchno et al., 2008) and several prior studies have successfully employed the convenient sampling for elderly respondents (Lee et al., 2006; Maly et al., 1998). The off-site survey was conducted by visiting places where the elderly users are present, including elderly communities, senior centers, and care worker facilities. We did not conduct the off-site survey in the fast-food restaurants because it was not allowed to collect data in the restaurants during Covid-19 situation. The contents of the printed survey were written in Korean and we first checked the respondents' age and their experience with SST in fast-food restaurants. Participants read text scenarios portraying the SST implemented in the fast-food restaurants and encountered relevant pictures of SST. Then, we measured their emotional and behavioral responses to the SST. After excluding unreliable responses, we used a total of 100 valid questionnaires in the final data analysis. As our sample is the elderly people within the specific age range 60s to 70s that are difficult to reach, 100 respondents would be sufficient. The sample size of 100 is also considered adequate for PLS-SEM analysis (Anderson & Gerbing, 1984). Table 1 reveals the respondents' demographic characteristics.

Table 1. Demographic information

Measures		Frequency	Percent
Gender	Male	52	46.4
	Female	48	42.9
Age	60-64	39	34.8
	65-69	42	37.5
	70-74	13	11.6
	75-79	6	5.4
Education	Elementary school	1	1.0
	Middle school	3	3.0
	High school	17	17.0
	College	19	19.0
	University	40	40.0
Kiosk usage in fast food restaurants	Graduate school	20	20.0
	1-2 times in a month	72	64.3
	3-4 times in a month	15	13.4
	5-6 times in a month	3	2.7
	>7 times in a month	2	1.8
	Once in a 2-3 month	3	2.7
Time spent for kiosk completion	Once in 6 months	5	4.5
	1-3 minutes	57	50.9
	4-6 minutes	36	32.1
	7-9 minutes	2	1.8
	10-15 minutes	5	4.5

3.3. Measures

The survey contained three main parts, measuring the elderly, technical, and situational factors, negative emotions, subsequent coping behaviors, as well as demographic factors. We derived all measures from prior literature, with some modifications to fit our specific research context. All items utilized 5-point Likert response scales ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). The constructs of physical condition and losses in cognition were adopted from prior studies (Ryu et al., 2009; Sabatini et al., 2021). We adopted measures of reduction (Lee et al., 2015), modifying the variable to fit the SST context, with the name reduction of SST. We adopted the perceived ease of use construct from prior studies (Davis, 1989; Venkatesh & Davis, 2000). Perceived time pressure and social pressure were adapted from prior research (Gelbrich & Sattler, 2014; Kim et al., 2018). The problem-based coping of the need for interaction was adapted from the study (Carver et al., 1989). The construct of observing others

was adapted from the study (Gong et al., 2019), but the constructs were constructed by the researcher. The emotional-based coping of behavioral disengagement was employed (Carver et al., 1989). We also included questions on personnel responsiveness, frequency of using a credit card, and familiarity with digital payment.

3.4. Measurement model

We employed partial least squares structural equation modeling (PLS-SEM), using Smart PLS 2.0 as the analytic tool to test the hypotheses. PLS-SEM is an appropriate method when dealing with a small sample size (Hair et al., 2011). This analysis simultaneously estimates the structural model with high predictive accuracy, although typically in situations where applications have little available theoretical background (Wong, 2013). We adopted PLS-SEM given our small sample size and the relative deficiency of existing theory, as discussions on the SST-specific or elderly-specific factors have not been employed in prior research, which may influence the individuals' responses to the SSTs.

In the measurement model estimation, the research model needs to satisfy the guidelines for reliability and validity. The reliability of each item is acceptable because the factor loading of every item exceeds 0.7 (Barclay, Higgins, & Thompson, 1995). The general criteria for the reliability of constructs include a Cronbach's α exceeding 0.7 as well as composite reliability (CR) exceeding 0.8 (Henseler et al., 2016). Through the factor loadings, composite reliability (CR), and average variance extracted (AVE), the reliability and validity of the measurement model were assessed. Additionally, the value of average variance extracted (AVE) for every construct exceeded the threshold value, 0.5 (Henseler et al., 2016), displaying sufficient convergent validity (see Table 2). To establish discriminant validity, we used the square root of AVE for each latent variable (Fornell and Larcker, 1981). The obtained values were higher than those for other correlations among the latent variables (see Table 3). Therefore, we established discriminant validity in our dataset. However, as we used PLS-SEM to perform the analysis, we report the results of the heterotrait–monotrait ratio (HTMT), which is an alternative approach to establishing discriminant validity. All values were below the recommended value of 0.85 (see Table 4).

Table 2. Construct reliability results

Construct	No. of items	Item loading	Cronbach's alpha	CR	AVE
Perceived physical condition	4	0.894-0.945	0.940	0.957	0.848
Losses in cognition	4	0.826-0.916	0.910	0.937	0.789
Reduction	4	0.911-0.947	0.953	0.966	0.876
Perceived ease of use	4	0.839-0.897	0.894	0.927	0.760
Perceived time pressure	4	0.801-0.895	0.880	0.917	0.736
Perceived crowding	4	0.909-0.953	0.948	0.962	0.864
Social anxiety	4	0.901-0.957	0.945	0.960	0.859
Helplessness	4	0.939-0.970	0.972	0.979	0.921
Need for interaction	4	0.655-0.803	0.753	0.826	0.544
Observing others	4	0.838-0.970	0.942	0.958	0.851
Behavioral disengagement	4	0.816-0.889	0.871	0.911	0.718

Table 3. Discriminant validity (Fornell and Larcker, 2015)

Constructs	PPC	LIC	R	PEOU	PTP	PC	SA	H	NI	OO	BD
Perceived physical condition	0.921										
Losses in cognition	0.663	0.888									
Reduction	-0.096	-0.055	0.936								
Perceived ease of use	-0.214	-0.200	0.457	0.872							
Perceived time pressure	0.307	0.199	-0.357	-0.464	0.858						
Perceived crowding	0.181	0.232	-0.372	-0.168	0.461	0.930					
Social anxiety	0.390	0.390	-0.486	-0.536	0.621	0.469	0.927				
Helplessness	0.244	0.170	-0.477	-0.646	0.649	0.253	0.586	0.960			
Need for interaction	0.138	0.134	-0.358	-0.460	0.327	0.273	0.517	0.396	0.738		
Observing others	0.219	0.270	-0.130	-0.219	0.236	0.114	0.356	0.124	0.375	0.922	
Behavioral disengagement	0.195	0.269	-0.294	-0.480	0.460	0.210	0.520	0.388	0.332	0.171	0.847

Table 4. Discriminant validity: Heterotrait-monotrait (HTMT)

Constructs	PPC	LIC	R	PEOU	PTP	PC	SA	H	NI	OO	BD
Perceived physical condition											
Losses in cognition	0.218										
Reduction	0.100	0.072									
Perceived ease of use	0.233	0.218	0.490								
Perceived time pressure	0.334	0.218	0.386	0.518							
Perceived crowding	0.192	0.248	0.388	0.179	0.497						
Social anxiety	0.410	0.418	0.508	0.584	0.677	0.493					
Helplessness	0.254	0.179	0.492	0.690	0.704	0.260	0.612				
Need for interaction	0.137	0.139	0.387	0.509	0.342	0.252	0.499	0.446			
Observing others	0.230	0.298	0.130	0.227	0.243	0.120	0.358	0.120	0.435		
Behavioral disengagement	0.215	0.286	0.309	0.540	0.504	0.229	0.558	0.402	0.327	0.175	

4. Results

We used 5000 bootstrap subsamples to test the structural path's significance with respect to the measured variables (Wong, 2013). In terms of the relationship between negative emotions and coping behavior, social anxiety was significantly related to need for interaction ($\beta = 0.437^{***}$, $t = 3.496$, $p < .001$), observing others ($\beta = 0.457^{***}$, $t = 4.507$, $p < .001$), and behavioral disengagement ($\beta = 0.448^{***}$, $t = 4.505$, $p < .001$). However, helplessness was not significantly related to the three types of coping behavior. While H1a, H1b, and H1c were supported, H2, H2b, and H2c were not (see Table 5). Furthermore, this study aimed to examine the determinants of elderly users' negative emotions toward self-service technology and subsequent coping behaviors. The results showed that for elderly-user-specific variables, the perceived physical condition had no significant relationships on social anxiety and helplessness. H3a and H3b were not supported. However, losses in cognition had a significant relationship with social anxiety ($\beta = 0.187^*$, $t = 2.003$, $p < .05$), and no significant relationship on helplessness. H4a was supported while H4b was not supported. Moreover, technical factors of reduction and perceived ease of use was significantly related to the negative emotions in response to SST. Particularly, H5 predicted that reduction would be negatively related to the two negative emotions. We found statistically significant negative relationships between levels of reduction and social anxiety ($\beta = -0.196$, $t = 2.390$, $p < .01$) as well as between reduction and helplessness ($\beta = -0.181$, $t = 2.164$, $p < .01$). H6 predicted that perceived ease of use would be negatively related to the two negative emotions. We found statistically significant negative relationships between perceived ease of use and social anxiety ($\beta = -0.220$, $t = 2.287$, $p < .01$) as well as between perceived ease of use and helplessness ($\beta = -0.365$, $t = 3.722$, $p < .001$). H5 and H6 were supported. Moreover, H7 and H8 predicted that situational factors of perceived time pressure and perceived crowding would be significantly related to users' socially anxious and helpless reactions. The results showed that perceived time pressure had a significant relationship with social anxiety ($\beta = 0.318$, $t = 3.815$, $p < .001$), and helplessness ($\beta = 0.447$, $t = 4.031$, $p < .001$), supporting both H7a and H7b. On the other hand, perceived crowding did not have a significant relationship on social anxiety or helplessness. Thus, H8a and H8b were not supported. Table 5 and Figure 2 summarize the hypothesis testing results.

Table 5. Results of hypothesis testing.

Hypothesis	β	t-value	Results
H1a: Social anxiety → Need for interaction	0.437***	3.496	Supported
H1b: Social anxiety → Observing others	0.457***	4.507	Supported
H1c: Social anxiety → Behavioral disengagement	0.448***	4.505	Supported
H2a: Helplessness → Need for interaction	0.129	0.861	Not supported
H2b: Helplessness → Observing others	-0.169	1.350	Not supported
H2c: Helplessness → Behavioral disengagement	0.122	0.890	Not supported
H3a: Perceived physical condition → Social anxiety	0.074	0.793	Not supported
H3b: Perceived physical condition → Helplessness	0.026	0.257	Not supported
H4a: Losses in cognition → Social anxiety	0.187*	2.003	Supported
H4b: Losses in cognition → Helplessness	0.001	0.014	Not supported
H5a: Reduction → Social anxiety	-0.196**	2.390	Supported
H5b: Reduction → Helplessness	-0.181**	2.164	Supported
H6a: Perceived ease of use → Social anxiety	-0.22**	2.287	Supported
H6b: Perceived ease of use → Helplessness	-0.365***	3.722	Supported
H7a: Perceived time pressure → Social anxiety	0.318***	3.815	Supported
H7b: Perceived time pressure → Helplessness	0.447***	4.031	Supported
H8a: Perceived crowding → Social anxiety	0.156	1.858	Not supported
H8b: Perceived crowding → Helplessness	-0.087	0.851	Not supported

Note: *p < .05, **p < .01, ***p < .001.

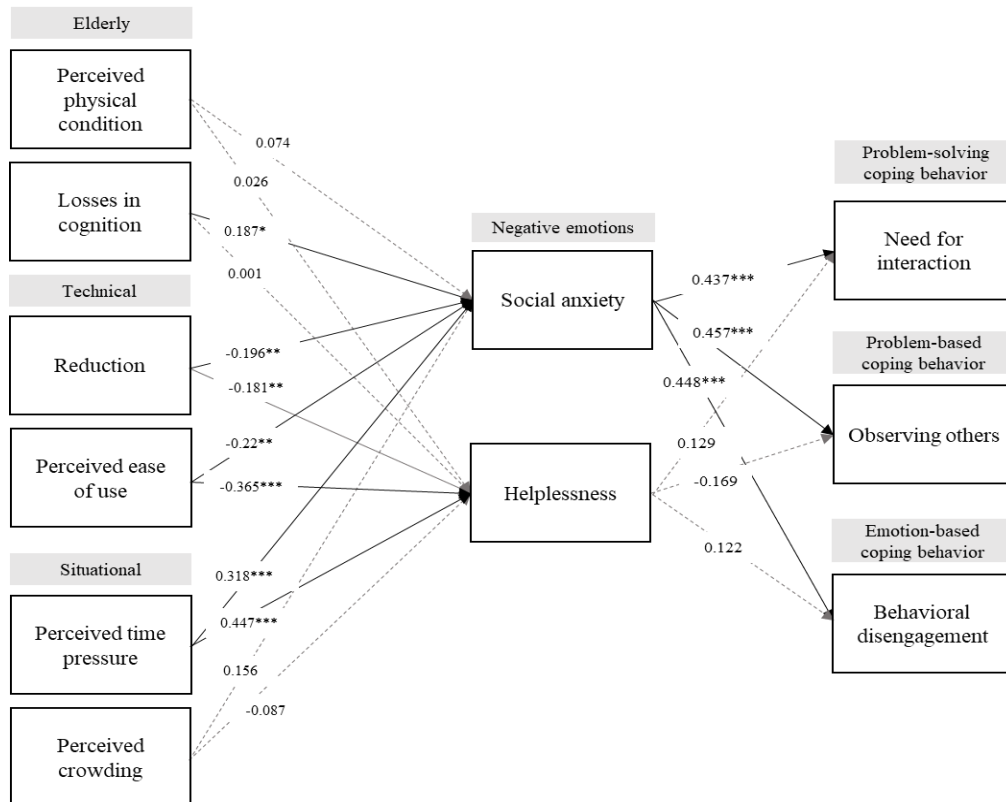


Figure 2. Results of the research model

5. Discussion and conclusion

5.1. Key findings

This study uncovers the recent phenomenon of the implementation of self-service technology in the context of fast-food restaurants and elderly users' responses to the usage. With the ongoing Covid-19, digital transformation will continue to be a huge part of our lives. It has been shown that elderly people are the most disadvantaged group from the use of technology, alleviating the digital divide. Despite such problems, most prior research has explored the general factors that drive users or elderly users to use self-service technology. To address the research gap, this study investigated elderly users' emotional and behavioral responses to self-service technology by examining the relationship between elderly, technical, situational factors, negative emotions, and subsequent coping behaviors. Therefore, it is crucial to understand the relationship between the individual factors, negative emotions, and the coping behavior of elderly users and find the most effective approach to address them.

Several key findings can be driven from this study. The results of the PLS-SEM analysis revealed that social anxiety is a strong predictor of users' problem-solving coping strategies that include the need for interaction with the human employee as well as observing others use the SST. Users that feel socially anxious experience fear or discomfort in specific social situations in which they may be scrutinized by others. To cope with such discomfort situations, users tend to go and seek help from the employees. Social anxiety is also associated with users' observational learning, where they indirectly observe others to complete the transaction using the SST. The findings align with the studies that showed that a positive coping response may be a protective factor for social anxiety (Yang et al., 2021). The results show that social anxiety also is related to users' emotional coping response of behavioral disengagement. Consequently, as suggested by prior research, social anxiety appears to elicit the types of adaptation behavior to reduce the risk level of a situation (Han et al., 2007). With social pressures that exist, users are likely to resist using new technology that they are unfamiliar with (Kumar, 2007), leading to disengaging with and giving up using the SST. These findings are relevant to how elderly people, in particular, tend to be more responsive to the presentation of self, where social status, honor, and the presentation of oneself are considered important (Choi & Kim, 2000). The emphasis on one's self-presentation in the eye of others is well-reflected in Asian culture (Brown et al., 1987). The findings further explain how social anxiety is associated with cultural norms and values across

countries. South Korea is considered one of the collectivistic countries, and prior research revealed higher social anxiety and more positive attitudes toward socially avoidant behaviors in collectivistic countries (Heinrichs et al., 2006).

Furthermore, contradicting prior research that helplessness may elicit emotional-based coping (Gelbrich, 2010), helplessness is not significantly related to either type of coping behavior. These results may indicate that helpless individuals, experience a high level of lack of control which may not be sufficiently significant to induce coping behavior, and are frequently reinforced by the failed experiences which induce frustrations (Minge et al., 2014). Moreover, empirical results support that helplessness alone may not be adequate to lead individuals to actively cope with the situation, as helplessness does not imply a responsibility judgment which therefore does not lead to aggressive reactions (Gelbrich, 2009). The non-significant results found between helplessness and coping behavior may be plausible.

Regarding the relationship between elderly-specific characteristics and negative emotions, while perceived physical conditions do not influence social anxiety or helplessness over SST, losses in cognition positively influence social anxiety among elderly users. Despite prior research that examined that deterioration of physical abilities of the elderly that impedes them from making precise choices with the technology (Caprani et al., 2012), the findings reveal that physiological conditions do not affect negative emotions. One possible explanation is that the elderly people do not experience such intense physical difficulties. On the other hand, losses in cognition are positively associated with social anxiety only, but not helplessness. The findings suggest that users that face difficulties with reduced cognitive abilities that signify loss in processing speed, memory, and mental capacity are more likely to elicit social anxiety when facing social pressures. The elderly may feel more socially anxious due to may lead to the feeling of embarrassment associated with a lack of cognitive abilities and short-term memory loss (Timmermann, 1998).

Regarding technical factors, the reduction is negatively related to social anxiety and helplessness. The findings show that the higher the reduction component of the self-service technology interface, the lower the social anxiety individuals feel. The simplicity facet of reduction of the SST interface with minimum and essential steps required to complete a given task (Maeda, 2006) tends to respond less emotionally. A simple self-service technology user interface is likely to make individuals feel that the users can have control over the technology

use, which may lead them to feel less helpless. Moreover, perceived ease of use is negatively related to social anxiety and helplessness. SST which is perceived as easy to use may lower the negative emotional response. Consequently, users are likely to be more frustrated with such a system as they find it difficult to use, which has a significant influence on their perception of the system's ease of use (Choi & Lee, 2012).

Perceived time pressure turns out to be the strongest predictor of social anxiety and helplessness, while perceived crowding does not influence the two types of negative emotions. When individuals perceive themselves as lacking time relative to the daily tasks of living, it implies that individuals pressed for time tend to be stressed (Maule et al., 2000), which may reinforce the negative impact of social anxiety. Moreover, the individuals that perceive to be pressed for time when completing a transaction may find themselves feeling helpless. This aligns with prior research that suggests that situational factors, such as time pressure may play an important role in the use of SST (Yoon & Choi, 2020). In contrast, perceived crowding does not influence helplessness. A possible explanation is that the stress entailed in perceived crowding is not strong enough to reinforce the negative effect of social anxiety or helplessness on the elderly's use of SST.

5.2. Implications for theory and practice

The study makes several important contributions to theory and practice. Self-service technologies are increasingly implemented and are expected to become a usual phenomenon. As follows, there have been challenges regarding such use of self-service technology from the older people who have relatively lower levels of digital literacy. However, prior studies have concentrated on the general factors that lead to the elderly's usage of self-service technology, with scant research conducted on the actual elderly users' emotional and behavioral responses to the SST. To address this gap, this study focused on the elderly users' responses to the SST by analyzing the relationship between individual characteristics, negative emotions, and coping strategies. Findings from this study contribute to the literature on SSTs in the context of the elderly as little research has explored what responses older consumers elicit with SST. The study's results provide a rich understanding of self-service technologies from the perspectives of the elderly.

This study confirms the significant roles of elderly-specific factors, technical factors, and the situational factors that affect the negative emotions, and the subsequent coping behaviors. This study expands the scope of technology adoption that reflects the context of elderly users. We applied the elderly-specific constructs that could reflect the complex context of online elderly users. Moreover, the study introduced the elderly-specific construct in terms of their physical and cognitive abilities, specifically losses in cognition that are used in cognition research. Moreover, this study factor of reduction extends the concept of simplicity, which is an important concept in human-computer interaction (HCI) research.

The study's findings provide practical implications for the SST service providers, fast-food restaurants, the government, and the academia for a more integrative approach toward the implementation of self-service kiosks. For the service providers, this study suggests that service providers should present a clear and simple kiosk interface that comprises minimum stages of the transaction and clear and simple menu items termed with bigger fonts and accessible color that requires less processing time. The simple and easy-to-use self-service technology can increase the accessibility of using the SST. For the government, the implementation of nationwide digital inclusion policies is critical to protect the interests of elderly people, mitigating seniors' digital exclusion which can alleviate the digital divide. The findings of the research further suggest fostering the digital inclusion of older people. The government needs to focus on the development of 'Digital Inclusion' policies. Currently, the National Assembly is discussing the enactment of the 'Digital Inclusion Act' that focuses on the establishment of a digital inclusion committee, nurturing of professionals, and measures for digital access for the elderly or the disabled (Business Watch, 2022). The efforts for comprehensiveness in the public policy regulations at the national, regional, and local policy levels are necessary that cater to the digital inclusion-related policies that cater towards the elderly people's usage of technology. The formulation of an adequate national policy and the support for its implementation by dedicated programs need to be implemented. Further, a comprehensive approach may be needed for the appropriate e-government policies and e-services tools that can help reduce the digital divide. For example, a nationwide guideline for 'kiosk accessibility standards' that centers around a simple and usable interface should be developed. The self-service technology should be accessible and inclusive to all individuals, without discrimination. The elderly users may think that they have become vulnerable users of ICT which leads to negative emotions and

subsequently, affects their quality of life. It will be important to combat the users from feeling vulnerable to the use of the technology.

For academia, the findings give insights into further examination of the opportunities and challenges for the academic institutions and when resourcing and implementing digital literacy programs. Digital literacy is an important skill and ability needed to use the available digital technology (tools, devices, and software) to meet information needs (Jang et al., 2021). Digital education for elderly people has become a necessity as South Korea continues to accelerate the digitization of various sectors accelerated by the pandemic. Specifically, government-led education programs and digital literacy intervention programs can be coordinated from a community level, bringing together the efforts of diverse organizations. Private and public institutions, community centers, and extension colleges with digital literacy programs for the elderly are appropriate for the elderly to learn how to use the self-service technology. Therefore, the collaboration between relevant stakeholders such as governments, private sectors, academia, and organizations needs to bring inclusive digitalization outcomes at both public and private sectoral levels will be critical to address the digital divide.

Lastly, the study gives insights into the strategies that can address the appropriate measures that can correspond to the alternative coping strategies that elderly users face in the usage of the SST. For the users that need interaction with the employee, the helper, or an employee can stand beside the self-service technology to aid them when the users face difficulties during the process. For the users that learn how to use the service by observing others, it is necessary to implement simple and well-explained usage instructions present on the SST which can aid the users to use it on their own. For the users that disengage from using the SST, further education or promotional programs are needed to reduce such negative emotions. As users have stated that they face unfamiliar kiosks whenever when visit a new place which induces uncomfortable feelings of anxiety and helplessness. Increasing familiarity with the technology and reducing levels of anxiety will be critical to increasing confidence in the use of unfamiliar technology.

5.3. Limitations and future research

This study is not without its limitations. The study identified the antecedent factors with their relation to the elderly's emotional and behavioral responses to SST. This study investigated

the meaningful impacts of elderly-specific, technical, and situational antecedents on negative emotions and behaviors. However, the predictors suggested here may not comprehensively describe users' rich experiences with the SST. In this sense, it would be necessary to investigate how the individuals' digital literacy, psychological, or personality factors may influence the subsequent negative emotions and coping behavior. Future research is required to verify the new constructs that can fully explain the research model in the context of the elderly.

In addition, this research took place in South Korea, a leading country in ICT development, but a country that experiences digital divides in the usage of technology, especially for the elderly. Although the basic process and constructs can also be applied to other countries, it would be difficult to generalize our results to other countries. Furthermore, this study produced meaningful results in the sense that social anxiety was a huge predictor of the coping responses, in the context of South Korean elderly users. As social anxiety is assumed to be related to cultural norms across countries (Schreier et al., 2010), it will be meaningful to conduct cross-cultural by examining the elderly's usage of SST in the context of individualistic versus collectivist cultures.

Lastly, the study considered one specific context of self-service technology usage, which is the fast-food restaurants. As the SST is implemented in various contexts such as hospitals, banks, civil services, bus terminals, and more, becoming a part of people's everyday lives. Accordingly, future study is required to examine if there are significant differences between the individual factors, the emotions, and the coping behaviors in different contexts.

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