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Factors Impacting Older Adults' Adoption of Mobile Technology in Emergency Communications

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Walden University
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Abstract

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Doctoral Study Submitted in Partial Fulfillment

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Abstract

An increasing number of older adults must continue working, which requires that they maintain their competencies and work skills, including use of mobile technology (MT). However, little is known about older adult adoption of MT in relation to work. This study used Rogers's diffusion of innovation theory and Davis's technology acceptance model as a framework. The purpose of this exploratory sequential mixed methods study was to examine the experiences of older adults' who adopted MT in the emergency communications (EC) field. Participants came from an emergency services LinkedIn group. Data sources included surveys completed by 85 respondents and interviews of a subset of 10 of the respondents. Phase 1 included survey analysis to develop descriptive statistics on the participants' placement in Rogers's stages of adoption, their perceptions of the usefulness, and the ease of use. Phase 2 included analysis of in-depth interviews, coding for themes and patterns. Survey results indicated that both perceived usefulness and ease of use affect the adoption of MT by older adult users in the EC field. The results of the interviews identified the usefulness and ease of use as factors for the participants. The social implications for employers include a deeper understanding of the specific factors that impact the adoption of MT by older adults. This study provides employers with a deeper understanding of the adoption of MT by older adults so they can develop stronger plans to help their older adults adopt mobile technology.

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Dedication

I would like to give thanks to God and to Jesus Christ, my lord and savior, for making this work possible.

I dedicate this dissertation to my wife, Mary. I needed her support, prayers, and patience during this journey.

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The support of my committee chair, Dr. William Sugar and Dr. Abbie Brown, my second committee member was very valuable. They offered criticism, suggestions, and clarifications that allowed me to make progress and strengthen my dissertation.

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Chapter 1: Introduction to the Study

The increasing population of older adults in the workforce is a growing issue in the United States due to its impact on society, the workplace, and the economy. In *The Health and Retirement Study*, the National Institute on Aging (2007) declared that the rising numbers of the older adult population might be one of the "most transformative demographic changes" (p. 87) that the United States will face. The declaration was based on National Institute of Health research on the impacts of growth in this population on health care, delayed retirement, the labor force, and the U.S. economy.

One problem that the increased older adult population will face due to the economy is the need to continue working (Cutler, 2011). Older adults' ability and willingness to keep up with technology changes in the workplace and the economy will affect their ability to continue working (Lisican, 2013). Corporations often prefer to hire younger workers with more state-of-the art skills and lay off older workers (Dingle & Voutsas, 2010). One key to older adults' maintenance of state-of-the-art skills is e-learning. In the last 10 years, e-learning use in corporate training has grown significantly (Batalla-Busquets & Pacheco-Bernal, 2013). Rashid (2013) specifically focused on the role of mobile technology in promoting learning and continued employment. The merging trends of a growing older work force and increasing need for new technology in the workplace constitute a current phenomenon.

Background

Mobile technology was defined by Advanced Distributed Learning Initiative (2013) as technology based on digital cellular telephone service. Services include Global

System for Mobile Communications and Long Term Evolution (LTE) or 4G. There are a variety of devices that can utilize mobile technology. Mobile devices include smart phones, pads, netbooks, cameras, and GPS devices (Franklin, 2011). The focus for this study was on hand-held devices, including smart phones, mobile phones, and tablets. Mobile technology has also been growing in use for corporate applications. Darstow and Listwan (2011) described how the "convenience, immediacy, and accessibility" of mobile technology have led corporations to increase its use. Darstow and Listwan identified these factors as leading to a need for workers to be able to use mobile technology for their work. Tan, Ooi, Sim, and Phusavat (2012) researched mobile adoption factors based on students' perception of the technology's ease of use and usefulness. The factors found by Tan et al. that affected ease of use were physical factors such as screen and resolution. *Usefulness* covers the factors that drive the value of using the technology.

Mobile technology is an especially critical technology (Eriksson, 2010; Rhodes, 2008) in the emergency communications (EC) industry. Portable computing and communication tools are essential for field-based EC personnel. Yet the extent of adoption of mobile technology by older adults in this industry remains unexplored.

Although there are studies on mobile technology use among adolescents, college students, and young to middle-aged adults, there are few studies on older adults' usage and attitudes toward the adoption of mobile technology (Hamilton, 2011). As an example, only 3.49% of the respondents in the Tan et al. (2012) study were over 40 years of age. Which factors facilitate or hinder the adoption of mobile technology by older

adults in the field of EC and why these factors influence older adults' adoption are the issues that this dissertation addresses.

Older adults need to continue learning to use new technology to meet their own and society's needs. The current economic conditions in the United States are leading many older adults to postpone retirement and continue working. The rapid change of traditional jobs to new service and technologically based jobs may require relearning of skills and competencies by older adults (Charness & Czaja, 2006).

Longer lifespans and potential quality of life issues for older adults have changed the perception of older adults in the last 30 years. McKay (2008) described a current transition from oppressive viewpoints driven by ageism to a more positive view focused on "re-hirement vs. retirement" (p. 670) in current research. Companies and universities locked into past concepts have fostered an institutionalized ageism that inhibits the growth and development of older adults. The use of technology can be one path away from ageism toward quality of life and value (Longino, 2005). Institutions and corporations must work to reverse the ageism that limits older adults through bias and discrimination (Kidahashi & Manheimer, 2009). Stone, MacMillan, Vance, Satariano, and Bass (2012) recorded Mark Zuckerberg, the founder of Facebook, as stating the ageist view clearly: "If you want to found a successful company, you should only hire young people with technical expertise" (p. 65). Understanding how and why older adults adopt mobile technology could result in positive social change.

For many companies and universities, cost and increasing numbers of learners have led them to offer to distance learning. Tan et al. (2012) described the use of mobile

technology in learning as access to learning management systems, generation of informal learning opportunities, and learning that is not bounded by time or location. Freedom of location involves the ability to easily transport and use mobile devices in situations such as using public transportation, standing in lines, and in areas where no local area networks are available. Adoption of mobile technology by older adults is required for them to take advantage of mobile devices and technology in learning. Research on the impact of new technology on older adults is limited and is reviewed in Chapter 2.

Mobile technology has been found to be critical in EC (Rhodes, 2008). EC personnel need mobile technology to communicate during an emergency. Mobile technology is needed to receive critical alerts (Everbridge, 2013; Federal Communications Commission, 2010). Mobile alerts can come from first responders on the scene, citizens or employees discovering a fire, or victims attacked by a shooter in a building or school. Examining the corporate and personal adoption of mobile technology by older adult workers can help in predicting the possible growth of mobile adoption in the older emergency worker workforce.

Facilitating older adults' usage of mobile technology will strengthen the perception of older adults' technical ability and willingness to adapt. The ability to use mobile technology will allow older adults to enter or remain in the EC field. Aldunate, Schmidt, and Herrera (2012) described the use of mobile technology in the EC field using examples that included first responder communication, instantaneous communications, image transmissions from the scene, and two-way communications between the

operations center and responders. Being unable to adopt and use mobile technology will limit older workers' opportunities in the EC field.

Because the population of older adults is growing, with many older adults remaining in the workforce and in need of training to maintain their positions, corporate and academic institutions need to understand the needs, adoption issues, and factors that drive technology use for older adults. Kidahashi and Manheimer (2009) described the need for greater research and understanding of older adult technology use in corporate and academic institutions. They emphasized that a longer work life has arrived and needs to be handled by lifelong learning institutes. Their study described the *portfolio life* that balances work, family, volunteering, and family time. In the past, family, leisure, and travel were the focus for older adults. Today, lifelong learning institutes need an orientation toward training for work skills, according to Kidahashi and Manheimer.

Lee, Czaja, and Sharit (2009) noted the importance of older adults being able to continue working: "It is generally recognized that the extent to which older people remain productively employed will have a large impact on business/industry, government programs and the economy, and the quality of life of older adults themselves" (p. 16). To prevent career obsolescence, training is required. Timmerman (2011) recommended that older adults learn new skills and job search methods.

The use of mobile technology for work has its own issues for older adults in the EC field. In this dissertation, *older adults* are defined as adults older than 50. The age of 50 years is used by the American Association of Retired People (2013), many libraries (Maher, 2011), and HIV studies (Adhvaryu & Beegle, 2009; Mundell, 2010). Golding

(2011) used 50 years as the base age for his study of older adult learning and well-being. The older-adult Baby Boomer generation, unlike Generation X and Millennials, did not grow up with computers and mobile devices. Baby boomers' computer and mobile technology skills were acquired in adult life. The intersection of the growing older adult population and mobile technology has generated a significant educational technology research area. No articles were found in a search based on the adoption of mobile technology by older adults in the EC field. Researching older adults' experience with mobile technology can help fill this gap. The importance of addressing this gap is based on the growth of older adults at work (Kidhashi & Manheimer, 2009), the retraining requirements to avoid older worker obsolescence (Charness & Czaja, 2006; Ford & Orel, 2005), and the growth of mobile technology as a delivery methodology (Park, 2011). These points are covered in detail in Chapter 2.

A key aspect of the growth of the older adult workforce is the socioeconomic impact and need for acquiring or maintaining technological expertise. Older adults have grown as a percentage of the population and the workforce (Chen, Kim, Moon, & Merriam, 2008; United Nations Population Division, 2001). Older adults are reentering the workforce due to delayed retirement, longer lifespans, and economic need (National Institute on Aging, 2007). Corporate and academic institutions need to prepare for the rising trend of adults working longer. Weber (2013) found that 62% of workers expected to continue working beyond their retirement. Blau and Goodstein (2010) researched the labor force participation rate (LFPR) to determine if Social Security was causing the

LFPR to rise. Until 1980, older adult men retired at an earlier age, whereas from 1980 to 2005, the LFPR rose, and men retired later (Blau & Goldstein, 2010).

Maestas and Zissimopoulos (2010) began their review of the economic challenges of the aging population by stating that the economic challenges are a current crisis, not a future one. They described the change in the population age distribution as the large number of older adults in the Baby Boomer generation enters the population. The average age of the population has increased. Maestas and Zissimopoulos saw the LFPR of both older men and older women rising. They described the rising LFPR based on the delay in retirement as a positive economic factor. The need to retrain and maintain older workers will be a growing issue (Blau & Goodstein, 2010; Maestas & Zissimopoulos, 2010).

Increased understanding of the factors that enhance and limit older adults' mobile technology use can improve the diffusion of mobile adoption among older adults in EC. The rise in the number of older adults in the workforce and the falling costs and increasing ubiquity of mobile devices indicate the need for a study that helps to fill research gaps concerning the adoption of mobile technology by older adults in EC.

Bollaert, Lourenço, Possemiers, and Trari (2012) identified several reasons that mobile technology is becoming an essential delivery option. Their reasons included the reduced cost of data delivery and increased average revenue per user. In addition, mobile technology provides better user experiences with rich online user interfaces based on touch screen technology and interactivity. Bollaert et al. predicted that these factors would help drive the growth of mobile technology.

In EC, skilled use of mobile technology for crisis and incident management is required (Eriksson, 2010; Hyman, 2014; McGee, Coutière, & Palamara, 2012). Braun, Catalani, Wimbush, and Israelski's (2013) literature review on mobile technology found that workers in health fields used mobile technology for alerts, community health communications, and reception of field information during events. Mobile technology expertise is becoming highly desired for EC workers.

The adoption of mobile technology by older adults is a significant issue for education and society. Brown (2008) defined *research significance* as the reasons a study increases understanding, provides a vehicle for social change, and improves practice in an environment or work area. The adoption of mobile technology is a prerequisite to the utilization of mobile learning. Study of mobile adoption by older adults increases the understanding of older adults' ability to continue working and learning due to the growth of mobile learning, the ubiquitous nature of mobile devices, and the cost advantages of mobile learning options (Hamilton, 2011). Limited aability of older adults to adopt and use mobile technology in general, and specifically for those working in EC, will limit their ability to utilize a critical tool in the current age. *Checkpoint eLearning* ("Positive Attitudes," 2012), a European educational research newsletter, reported that the attitudes of senior educators were beginning a transition from focusing on mobile technology implementation problems to viewing mobile technology as a powerful delivery system. Hamilton (2011) described how older adult students attending Lancaster University began a study due to "the paucity of research into how older people use information and communication technologies" (p. 28). Hamilton concluded that older adults need to be

able to use new technologies such as mobile technology. There is a need for research on the adoption and use of technology by older adults beyond just senior educators. Specifically, there is very little research on the adoption and use of mobile technology by older adults in EC. This study works to help fill this gap.

Problem Statement

The problem addressed in this study is the need for older adults to adopt mobile technology to be able to continue their careers in the EC field and to expand their work opportunities. Older adults in career fields such as EC will be expected to use mobile technology to perform working tasks. The evidence that the problem is significant can be seen in (a) the increasing number of older workers as a percentage of the workforce, (b) the growth of mobile technology, and (c) the scarcity of research in the current literature on older adults and mobile technology adoption in the EC field.

Researchers have noted the need of rising numbers of older adults and older adults to maintain their work skills. Chen et al. (2008) identified a revolution in research driven by the increasing number of older adults and need for older adult to maintain competency. Gorard and Selwyn (2008) addressed the need for more research. They focused on older adults and information and communication technology by addressing what older adults are doing with technology, what technology can offer older adults, and why older adults use or do not use technology. Taiwan has demonstrated the impact of the growth of older adult populations and their need for mobile technology (Liang, 2006). Increasing life spans, delay of retirement, and difficult economic conditions have driven many older adults to continue working. Mobile technology will be critical to adults

seeking work opportunities. Miller (2010) noted that workers used their mobile technology devices to communicate with other people, get needed information as soon as possible, and share and post work materials. Mobile phones are outpacing PCs in sales. In early 2013, mobile phones overtook PCs in Internet access (Sterling, 2013) as Darsow and Listwan (2012) predicted. Sterling (2013) announced that mobile technology surpassed PC Internet access based on Internet statistics monitors run by Comscore. Lenovo, one of the largest PC makers in the world, announced that its mobile technology sales had surpassed PC sales in late 2013 (Paul, 2013). This shift from personal computers to mobile devices is one more indicator of the growth of mobile technology. Darsow and Listwan described the growth and transformation that mobile technology is making in the banking industry. In the United States, the percentage of mobile technology workers, "employees who use mobile technology devices in their daily work," is the highest in the world (Darsow & Listwan, 2012, p. 362).

Mobile technology involves personalization of services, widespread access to the Internet, and the ability to provide specific geocoded data that will change business (Rao & Troshani, 2007). Discussing mobile technology commerce, Tripathi (2012) described the key role mobile technology personalization has in commerce. This key role involves mobile technology's widespread use, flexibility, and commercial potential. Mobile technology provides a personalized interface, applications, and information based on the choices and location of the mobile technology user. *Checkpoint eLearning* ("Positive Attitudes," 2012) described a change in European business from viewing mobile

technology as a concept or futuristic innovation to seeing mobile technology as a critical area of application development.

The future growth of mobile technology due to the ubiquitous nature of mobile technology devices and growing applications make it an essential technology for older adults to adopt (Hamilton, 2011; Hwang & Tsai, 2011; Koszalka & Ntloedibe-Kuswani, 2010; Winter, 2000). Mobile learning has made the transition from a future possibility to a mainstream concern (Crescente & Lee, 2011). Crescente and Lee (2011) described mobile learning as a learning delivery methodology that is beneficial to corporate and educational institutions. Yang (2012) reviewed current literature on mobile learning and noted the ubiquitous and personal nature of mobile learning and the current growth of learning programs utilizing mobile technology. Wong, Khong, and Thwaites (2010) described the difficulty of older adults in adopting and using new technologies, particularly mobile technology. They outlined biological difficulties that included vision, hearing, and kinesthetic limitations. Cognitive difficulties included short- and long-term memory loss. The key recommendation was to involve older adult users in the design of mobile technology user interfaces. Wong et al. suggested that studies should go beyond the standard samples from university staff and students. This study looked at older adult workers in the EC workforce. If older adults cannot or will not use mobile technology, they will not be able to access the mobile technology offerings described by Miller (2010).

An initial review of the literature showed that the nature of the adoption and use of technology by older adults, particularly mobile technology, has been unclear

(Hamilton, 2011) due to missing data. Which technologies older adults are using, what would help older adults use mobile technology, and what hinders older adult adoption need further research to inform efforts to improve older adult mobile usage (Gorard & Selwyn, 2008). Gorard and Selwyn (2008) noted that older adults were less likely to talk about career opportunities, were expected to make radical career changes with limited training, and were underrepresented in the adult population and the literature.

Young adults use mobile technology phones almost constantly, making calls, sending texts, and interacting with social networking sites (Thulin & Vilhelmson, 2012). The usage patterns of older adults are not as well researched as those of younger adults. Research to discover which mobile technologies are used by older adults and why they adopt mobile technology in the EC field could help shed light on older adult usage. In addition, an understanding of older adults' experiences and adoption practices for mobile technology may enable older adults to maintain their competency in the coming decades. This understanding may provide benefits not only for older adults working in EC but also for society, business, and learning institutions.

Purpose of the Study

The purpose of this study was to explore the experience of older adults with mobile technology in the EC industry. The phenomenon was explored using a mixed-methods model. There was a survey to gather information on which mobile devices are used and why they are used. The survey was followed by interviews to explore the phenomenon by seeking more detail on the factors that enhance or inhibit older adult mobile technology use in the EC field. The study was phenomenological in nature, and

no hypotheses were made. Many studies in the past focused on the deficiencies that older adults acquire as they age. This study looked at methodologies that can be used with new technologies to help older adults learn to maintain their working skills and quality of life (Chen et al., 2008).

The sample group for this study was drawn from Everbridge LinkedIn Group, Everbridge Incident Management and Emergency Notification. Everbridge is a corporation that provides interactive communications and mass notification solutions for academic institutions, state and local governments, healthcare providers, and corporations. The LinkedIn group is a forum for emergency management personnel to communicate about communication during a crisis or event. Mobile technology is a critical component of EC during a disaster that may disable other forms of communication. Understanding which mobile technologies older adult workers in this group use and assisting in the adoption and use of mobile technology could be important for institutions and older adults.

Research Question and Hypotheses

The research questions for this study were the following:

1. How do older adults in the EC field perceive the usefulness of mobile technology in the EC workplace?

2. How do older adults in the EC field perceive the ease of use of mobile technology in the EC workplace?

3. How do older adults describe the discrete factors that affect their adoption as they relate to ease of use and usefulness of mobile technology in the EC workplace?

4. How do older adults describe the impact of these discrete factors as they relate to ease of use and usefulness on their adoption and use of mobile technology in the EC workplace? Do the interviewed older adults have suggestions to enhance the usefulness or ease of use of mobile technology?

Theoretical Framework for the Study

The theoretical framework of this study is based on the work by Rogers (2003) and Davis (1989). Rogers's diffusion of innovation theory provides a model that can be used to determine the readiness of users to adopt innovations. The stages of adoption that Rogers outlined should provide insight into adopters' attitudes and needs. Mobile technology faces the challenges that every innovation must overcome to become a mainstream technology. The techniques and motivations needed to facilitate the adoption of a new technology were described by Davis, who identified the role of perceived ease of use and perceived usefulness. Ease of use determines how quickly adopters can master an innovation. The more difficult an innovation is perceived to be, the more resistance to adoption must be overcome. The usefulness of an innovation motivates a user to adopt it. Usefulness can be based in the adopter's work, social, or personal life. Davis's two areas of perception were the framework to help answer Research Questions 3 and 4. The theories of Rogers and Davis are reviewed more thoroughly in Chapter 2.

Nature of the Study

This study had an explanatory sequential design (Creswell & Plano Clark, 2007) utilizing surveys and interviews. A mixed-methods approach was appropriate for a review of how older adults interact with mobile devices and their perception of mobile

technology. A mixed-methods study provides both quantitative gathering of data and qualitative interpretation of the data with deeper research using interviews (Plowright, 2013).

The first part of the design was a survey of approximately 100 participants to gather quantitative data on adoption and use, factors that hinder older adult adoption of mobile technology, and factors that facilitate older adult adoption of mobile technology. The participants were drawn from the LinkedIn social network group Everbridge Incident Management and Emergency Notification. Everbridge was named by Gartner (2012) as the leader in U.S. emergency/mass notification services. The LinkedIn social network group was the source of the convenience sample that provided older adult participants. There are currently 1,020 members of the group, ranging in role from software engineer to administrative assistant and varying in technical skill. The LinkedIn social group does not store age data on its members. Approximately 90% of the population is from the United States. All members use computers and access this social network. The membership includes approximately 50 Everbridge employees. The other members consist of EC workers in state and local government, healthcare, universities, corporations, and energy providers.

The second part involved interviewing to provide qualitative research data on older adult mobile adoption, an understanding of how and why older adults interact with mobile technology, and identification of the factors that influence adoption acceptance and hindrance (Hatch, 2002). Rao and Troshani (2007) delineated factors that included familiarity, expertise, compatibility, and personal innovativeness. Their research did not

investigate factors that hinder or enhance mobile technology use and adoption by older adults in the EC field. Johnson and Christensen (2008) noted that in areas of limited research, qualitative researchers can use collected research data to build theories. A mixed-methods study can help in collecting research data.

Surveys are used to obtain the characteristics of a population, attitudes, and opinions (Johnson & Christensen, 2008). This study employed opportunistic sampling within LinkedIn (Johnson & Christensen, 2008). There is a diversity of older adults within the LinkedIn group, although all use computers and social networks.

Interviews can be used to gather information that is "local, temporal, and in flux" (Hatch, 2002, p. 24). The study used 10 interviews drawn from the survey respondents. The interviews focused on older adults' experience of the factors that impact their acceptance or rejection of mobile technology.

Definitions

4G: A fourth generation wireless technology that is the standard for wireless networks (Verizon, 2012).

Ageism: A primarily negative stereotypical view, prejudice, or discrimination based on chronological age or cultural perceptions of age limitations in cognitive, affective, and behavioral areas (Iversen, Larsen, & Solem, 2009).

Cell phone: A phone that uses cellular communication systems such as global systems for mobile technology (Advanced Distributed Learning Initiative, 2013).

Ease of use: How strongly a user believes that a system or device will be simple to adopt and utilize (Davis, 1989).

e-learning: e-learning is the use of information systems and communication technology to build, distribute, and administer learning activities (Punnoose, 2012).

Geolocation: The capability of mobile technology devices to determine a user's location using GPS. It can also be referred to as *geocoded location data* (Advanced Distributed Learning Initiative, 2013).

Global System for Mobile Communications: A second generation (2G) wireless technology for network technologies (Verizon, 2012).

LTE: A 4G wireless technology that offers higher speeds and wider availability than other 4G technologies (Verizon, 2012).

Mobile learning: Learning developed and delivered by mobile technology (Koszalka & Ntloedibe-Kuswani, 2010).

Mobile technology: Technology based on the mobile technologies of digital cellular telephone service. Services include Global System for Mobile Communications and Long Term Evolution (LTE) or 4G (Advanced Distributed Learning Initiative, 2013).

Short message service (SMS): (SMS) allows short text communications between mobile technology devices using digital communications over a cellular network. Unlike instant messaging, it is not proprietary (Yunos, Gao, & Shim, 2003).

Smartphone: A smartphone is a mobile technology phone that can provide functionality available on a personal computer such as a laptop or workstation (Advanced Distributed Learning Initiative, 2013).

Software as a service (SAAS): Cloud-based rather than onsite software. All services and upgrades are maintained and distributed by the SAAS provider (Advanced Distributed Learning Initiative, 2013).

Ubiquitous: Ubiquitous describes a technology that is so common that it is viewed as universally used and available. The term is often associated with mobile technology due to the proliferation of mobile technology phones (Advanced Distributed Learning Initiative, 2013).

Usefulness: How strongly users believe that a system or device will help them in their job or life (Davis, 1989).

Wi-Fi: Wi-Fi is an abbreviation for Wireless-Fidelity. Wireless-Fidelity refers to the technology standard for wireless networks. Wi-Fi is a registered trademark owned by the Wi-Fi Alliance and was devised to provide a more expressive term than *IEEE 802.11* (Pogue, 2012).

Assumptions

In this study, I assumed that older adult workers desire to maintain their quality of life, economic security, and career opportunities. I assumed that seniors (a) could be accessed through social networks and (b) possess the cognitive ability, memory, and motivation to learn to use mobile technology. I assumed that participants in the survey and interviews provided truthful and reflective responses.

Scope and Delimitations

The research was limited to the experiences and case histories of older adults who have access to personal computers and social networks. I sought to draw at least 100

survey participants from a LinkedIn social network group, Everbridge Incident Management and Emergency Notification. Approximately 90% of the population reside in the United States. All members use computers and access this social network. The 10 interview participants were drawn from the survey participants.

The diverse nature of the membership increases the transferability of the results to other older adult populations. The career areas and technical expertise levels of the sample population were varied. At least 25% were senior members of their workplaces. The industries represented were as follows: information technology (14%), hospital and health (10%), public safety (8%), and government (8%). The sampled adult population was composed of (a) older adults 50 to 70 years in age who were (b) participants in a specific social network and (c) in a corporate, governmental, health, or academic environment.

Limitations

Limitations describe the generalizability of a study's results across people and situations (Brutus, Gill, & Duniewicz, 2010). Limitations are beyond the researcher's control based on the sample population, methodology, or time (Brutus et al., 2010; Creswell, 2009). The sample group was from the Everbridge Incident Management and Emergency Notification group. The selection of the Everbridge Incident Management and Emergency Notification group restricted the generalizability to that group and not to the larger population of adults over 50. This study was limited by the number of participants who were over 50 years old in the sampled LinkedIn group. The sample members were employed and computer literate. The participants could access a social

networking group and communicate via the Internet. The generalizability of the findings is limited to older adults who share all of these characteristics.

Significance

The adoption of mobile technology by older adults is a significant issue for education and society. Mobile technology adoption by older adults is significant due to the growth of mobile learning, the ubiquitous nature of mobile technology devices, and the cost advantages of mobile technology (Hamilton, 2011). Aubusson, Schuck, and Burden (2009) identified the need for the adoption of mobile technology before the adoption of mobile usage and mobile learning.

The increasing number of older adults in the workforce and the use of mobile technology devices as work-based platforms indicate the need for a study that helps to fill the research gaps regarding the adoption of mobile technology by older adults in the EC field. To maintain their competency and work skills, they need to be able to use mobile devices at work.

The significance of a study based on the converging growth of mobile usage and the need for older adult adoption of mobile technology can be summarized by laying out the following social trends. Older adults are a growing segment of the population and are returning to formal learning due to delayed retirement, longer lifespans, and economic needs (Blau & Goodstein, 2010; Ryan, Sinning, & National Centre for Vocational Education, 2009; Sheppard, Rix, & International Labour Office, 1989).

Mobile technology has the potential to become one of the most critical e-learning delivery methodologies (Liu, 2011). Mobile learning's ubiquitous nature and lower

delivery costs are driving its increasing use in online learning (Hwang & Tsai, 2011; Keskin & Metcalf, 2011; Liu, 2011). Understanding which factors limit mobile adoption by older adults may help older adults adopt mobile technology.

Older adults face ageist stereotypes (Wolfe, 1998) and have been classified as "Silver Surfers or as marooned in a technological 'gray gap'" (Gorard & Selwyn, 2008, p. 1). This study's research could help to reduce the discrimination that ageism can foster by providing information about the ability of older adults to use technology. Studies that document the ability and willingness of older learners to use mobile learning are needed to address the paucity of research on older adults and technology. More studies could help to remedy lack of research and common stereotypes.

This study's survey and interviews may give voice to an older population. The study may provide information to learning providers that enables them to meet the older population's needs. The study could help to reduce the impact of ageism by providing current data. Examining the changing nature of older adults and mobile technology may draw attention to older adults and provide a focus on their particular adoption needs in the area of EC.

Summary

A large percentage of the growing population of older adults needs to maintain expertise and continue working (Chen et al., 2008; Kidahashi & Manheimer, 2009; National Institute on Aging, 2007). The situational and personal factors affecting mobile technology use by older adults need to be understood (Cross, 1981).

The use of technology could be a way to help older adults maintain their skills and improve their quality of life (Longino, 2005). In particular, mobile technology has the potential to become a primary source of learning for older adults due to its lower cost and ubiquitous nature (Hamilton, 2011; Park, 2011). There is a need for more research into the area of older adults' use and adoption of technologies such as mobile technology (Hamilton, 2011). In this mixed-methods study, a survey and interviews were used to gather data on older adults' use and adoption of mobile technology in the EC profession. EC personnel need to be able to use mobile technology to keep their jobs and to receive training that will be mobile based.

In Chapter 1, the need for research to provide an understanding of older adults' experiences with mobile technology is introduced. In Chapter 2, related studies on the nature of the older adult experience, mobile technology, and Everbridge Incident Management and Emergency Notification and technology usage are reviewed. In Chapter 3, the methodology for this study, its research design, and its context are discussed. The results of the data collection and analysis are in Chapter 4. Chapter 5 provides a summary, analysis of results, and recommendations for further study.

Chapter 2: Literature Review

Growing numbers of older adults remaining in the workforce due to increased life spans (U.S. Census Bureau, 2010) constitutes a phenomenon that has social and economic consequences. Members of the older adult population have demonstrated a desire to remain productive in their later years (Timmerman, 2011). This desire, coupled with the pressures of the current economy (Maestas & Zissimopoulos, 2010), has contributed to older adults delaying their retirement (Matz, 2011; Weber, 2013). The desire and need to continue working have contributed to the need for older adults to learn in order to avoid obsolescence and remain technologically competent (Lee et al., 2009).

Paralleling the growth in the number of older adults is the use of mobile technology as a key method for delivering training to distance learners (Adipat, Zhang, & Zhou, 2011; Galagan, 2012). Kant (2012) defined *mobile learning* as learning that is based on mobile technology and is not tied to a particular location. The Advanced Distributed Learning Initiative (2013) described mobile learning as "leveraging ubiquitous mobile technology for the adoption or augmentation of knowledge, behaviors, or skills through education, training, or performance support whereas the mobility of the learner may be independent of time, location, and space" (n.p.). Wong (2012) described mobile learning as a seamless learning environment where the learner can switch from formal to informal learning using a personal mobile technology device (p. 19). Mobile learning is being reviewed and utilized due to the ubiquity of many mobile technology applications and cellular availability. Suki and Suki (2011a) researched the acceptance of mobile learning due to mobile phone users' perceptions of enjoyment, mobility,

usefulness, and ease of use. These factors may directly influence the adoption of mobile technology.

The purpose of this study was to improve understanding of older adults' adoption of mobile technology in the field of EC. Rather than focusing on older adults' deficiencies alone, I looked at which mobile technologies older adults are using and how they are using these technologies. This examination of mobile technology was followed by analysis of which discrete factors affect older adults' adoption of mobile technology and how these factors affect older adults' use of mobile technology.

The literature review in the first section of this chapter provides the theoretical foundation for this study based on Rogers's (2003) diffusions of innovation theory. Rogers provided a framework for the adoption of an innovation. The stages of adoption in Rogers's framework provide factors that can influence the adoption by older adults of mobile technology. Rogers also identified types of change agents and networks where change occurs. The current research on diffusion of innovations theory and technology are also reviewed.

In the second section, I review the growth of older adults as a percentage of the population and workplace. Key statistics and observations of the phenomena are reviewed. The paucity of literature on older adult learning in general and specifically on older adults' adoption of mobile technology is noted (Liu, Han, & Li, 2010). The role of ageism as a bias factor is discussed as a further deterrent to older adult opportunities and research on older adult technology use.

The third section introduces the adoption of mobile technology. The nature of mobile technology adoption, mobile technology's widespread usage, and the lower cost of mobile technology are discussed as factors that drive the growth of mobile technology usage. The fact that they did not grow up with computer or mobile technology is a unique factor for the current generation of older adults.

The final two sections of Chapter 2 cover older adults' use and adoption of mobile technology. Chapter 2 describes the convergence of two current trending phenomena: a growing population of older adults (Blau & Goodstein, 2010; Maestas & Zissimopoulos, 2010) and the growing use of mobile technology (Hamilton, 2011; Park, 2011). The current literature on older adults' use of technology and factors in the adoption of mobile technology is covered.

Literature Search Strategy

The literature search strategy involved accessing Walden University Library online databases and conducting supplementary research at the Boston College library. I searched ERIC, Academic Search Complete, Business Source Complete, Education Research Complete, Military and Government Collection, Communication and Mass Media Complete, Computers and Applied Sciences Complete, and Google Scholar. Key terms included *andragogy, gerontology, adult learning, adult development, older adults, silver surfers, older learners, age differences, mobile technology, mobile learning, electronic learning*, and *M-Learning*. When I could not find specific studies on mobile learning and older adults' adoption of mobile technology, I used related literature on older adults' use of technology and mobile technology adoption studies. Journal articles

were included if they were full text, peer reviewed, and dated after 2009. I used earlier articles if they were foundational or critical studies.

Theoretical Foundations

Rogers's (2003) diffusion of innovations theory, which describes the adoption process that innovations undergo, provided the theoretical foundation for this study. The process Rogers described includes the stages of adoption, the types of change agents, and the networks where change occurs. Adoption requires that communication in a community or network facilitates the introduction of the innovation. The focus then becomes the communication needed to spread the innovation rather than just the features and benefits of the innovation. Innovations can be conceptual—as with paradigm shifts—performance based, or driven by standards that generate innovations; or physical such as Google Glass, which integrates mobile technology and eyeglasses.

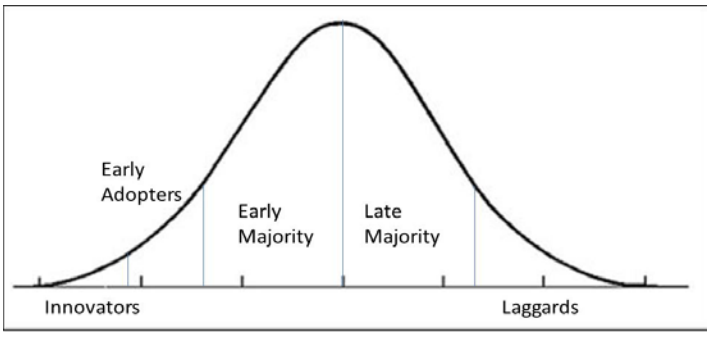

Figure 1. Rogers's five stages of adoption. Adapted from *Diffusion of Innovations*, by E. M. Rogers, 2003, New York, NY: Free Press, p. 281. Copyright 2003 by E. M. Rogers. Reprinted by permission.

The five stages of adoption, shown in Figure 1, are based on the characteristics of adopters identified by Rogers (2003). *Innovators* drive the first stage. Innovators are the adopters who actively seek out and champion new ideas, technologies, or practices.

Innovators need a high degree of competency and comprehension of the innovation and its potential. Rogers described them as being impulsive, venturous, and willing to assume risk. *Early adopters* drive the second stage. Early adopters are more in the mainstream than innovators. The early adopter population has a greater percentage of thought leaders. Early adopters tend to be more conscientious in their analysis and support of an innovation than innovators. The use of an innovation by early adopters shows their acceptance of the innovation. *Later adopters* usually communicate with early adopters for advice and recommendations. Rogers's *early majority adopters* are part of the larger acceptance of an innovation. They are not usually thought leaders but are highly deliberate in their analysis and adoption of an innovation. Rogers saw the early majority making up one third of the innovation adoption population. The fourth stage is made up of the late majority. *Late majority adopters* will not use an innovation until it is generally accepted and in wide use. Other adopters in the community, field, or business areas have already successfully adopted the innovation before the late majority accepts it. Late majority users are concerned about their resources and time. *Laggards* make up the final stage. Rogers viewed the laggard adopter as never being a thought leader. The laggards' future choices are tied to past successful decisions. If the laggards have not experienced a success in the past with an innovation, they view it with considerable suspicion. Laggards often adopt an innovation when there is no other choice and it is no longer a current innovation.

A new operating system can be used as an example. Innovators want to be beta testers, often getting the operating system before it is generally available. Early adopters

update their computers as soon as the operating system is generally available and communicate their experiences. Early majority users wait for about a year before adopting a new operating system. The early majority users review the experience of early adopters. The late majority users wait until the operating system has been out for a few years, has had at least one major update cycle, and is now the most popular release. The laggard users will only abandon the old release when the operating system provider will no longer support the release. In a business environment, Microsoft had a high percentage of users still on XP despite the fact that Vista, Windows 7, and Windows 8 had been released. Microsoft has released several "end of life" notices to force laggards to adopt newer releases (Van Camp, 2011). In this study, it was expected that older adults could be in each of these stages. The factors that enhance or inhibit their adoption are influenced by the stage they inhabit. The relation between the stages of adoption and factors that may influence older adult adoption of mobile technology in the laggard and late majority stages is examined below. Older adults in these stages are the most resistant to technology adoption (Rogers, 2003).

Change agents link the community to the innovation and facilitate its adoption (Rogers, 2003). The role of change agents is to help their communities understand an innovation and why it is beneficial. A change agent must establish a reputation for trustworthiness and objectivity. The effectiveness of the change agent is reduced if there is concern that the change agent will personally gain from the adoption process. Competency and communication skills are critical traits for change agents. A change agent must be able to understand the needs of community members and how to help them

plan and execute the change. The final activity of a change agent involves helping community members continue the use or practices without the change agent's continued intervention. For older adults, mentors, training classes, and publications can help perform change agent activities.

The community where an innovation can be introduced could be viewed as being either one of *homophily* or *heterophily* (Rogers, 2003). Homophily refers to similar members in a community. Heterophily refers to the diversity of members of a community and the way they interact. Rogers (2003) identified demographic, socioeconomic, and educational factors as determinants in the interaction of members. Jan, Lu, and Chou (2012) also postulated that the adoption of e-learning was based in part on gender, age, and economic factors. According to the literature that Jan et al. reviewed, the following factors were significant. Women were more influenced by social interactions that included the role of change agents, members of their social network using the e-learning, and materials that supported the use of the innovation. Men were more influenced by the usefulness of the innovation. Additionally, men were focused on how they could use the innovation in their work or personal lives. Older adults were less affected by social interactions than were younger men or women. In addition, adults in higher economic classes saw more value in e-learning. Members of higher economic classes understood the value of e-learning in their work environments based on ease of access, freedom of location, and interactivity. Jan et al. found that mimetic and normative forces influenced the adoption of e-learning: "Mimetic pressures force social actors to seek examples of established behaviors and practices to follow through voluntarily and consciously

copying the same behaviors and practices of other high-status and successful actors" (p. 331). Mimetic influences are based on individuals mimicking the behavior of change agents. In Rogers's stages, the ones most influenced by mimetic factors are in the early and late majority. Normative influences—the adoption of an innovation based on the influence of other people or events—are driven by the movement and adoption of the majority of users to the innovation (Jan et al., 2012). Social and administrative pressures to reproduce the success driven by an innovation in an industry or environment augment the normative influences. These pressures are a driving force in Rogers's late majority and laggard stages.

De Silva, Ratnadiwakara, and Zainudeen (2011) studied mobile technology adoption in a different demographic population. Their study was based on the poorer members of society, whom they identified as the base of the population (BOP) in the countries of Bangladesh, Pakistan, India, Sri Lanka, Philippines, and Thailand. The BOP was driven to mobile technology adoption by contact with individual members' social groups that used mobile technology. The other key factor De Silva et al. found was that the availability of benefits that tied the social network with economic and business networks provided a perceived reason to adopt. This factor included the ability to find work, access market prices, and access information about sales, work, and travel. The role of change agents and the effectiveness of their communication can be dependent on the degree of homophily or heterophily. The older adult population in this study was homophilic in age, work area, and the ability to use technology and communicate in a social media forum. They were heterophilic in gender, region, and social and economic

class. There was also the possibility that a portion would come from countries other than the United States.

The relation of Rogers's (2003) diffusion of innovations to new technology is reviewed in current literature. Liu and Li (2008) analyzed andragogy's principle of self-directed learning in relation to the adoption of mobile learning. The ability of learners to manage their own learning and to be able to direct their learning activities is a key factor in the adoption of mobile learning technology (Liu & Li, 2008).

Older adult innovators want to try new technology. Rogers (2003) suggested that innovators possess complex technology understanding and expertise. Older adult innovators' expertise is paired with a willingness to experiment and start the adoption process. Older adult early adopters are respected members of their communities and social networks (Rogers, 2003). They are thought leaders in their environments (Rogers, 2003). Early adopters base their decisions on the potential of the innovation to advance their business or interest area. Early adopters' acceptance of an innovation marks the innovation's transition into common use. Late majority older adult adopters would express a more restrained and even skeptical view of mobile technology (Rogers, 2003). These adopters need to see mobile technology being widely used by their peers. The use of mobile technology by older adopters in the late majority marks the popular acceptance of the innovation. Finally, older adult laggards are focused on "the way it was done"; new technology is faddish and threatening to their resources and values. Laggards are the last users to adopt an innovation. Each of Rogers's stages could provide factors that affect older adults' adoption of mobile technology.

Rogers's (2003) five stages of adoption provide factors that affect adoption. Essen and Ostlund (2011) suggested that viewing older adults as laggards or technophobes is a form of stereotyping. There is no reason to assume that older adults are only in the last stages of adoption.

One other theory of adoption is common in the literature on technical innovation adoption. The technology acceptance model (TAM) was developed to determine why workers were not adopting innovative technology (Holden & Karsh, 2010). Davis (1989) built the original TAM model to assess the degree to which workers believed that a technology would increase their work efficiency (National Library of Medicine, 2011).

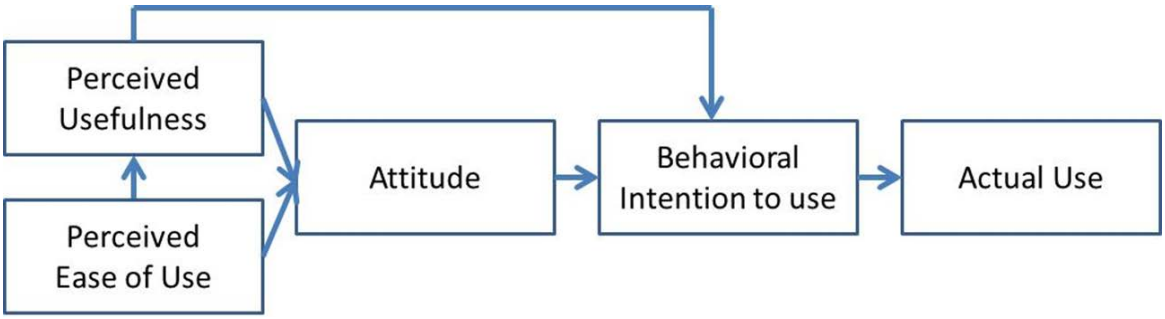

Figure 2. Technology acceptance model. Adapted from "The Technology Acceptance Model: Its Past and Its Future in Health Care," by R. Holden and B. Karsh, 2010, *Journal of Biomedical Informatics, 43*, p. 161. Copyright 2010 by the authors. Reprinted by permission.

Holden and Karsh (2010) diagrammed the standard path of the TAM theory, which demonstrates how perceived ease of use combined with perceived usefulness changes attitudes about the innovation and leads to an intention to use (the acceptance of the innovation), and then to the use of the innovation. In some cases, the perceived usefulness of the innovation is so strong that the path goes immediately to the acceptance of the innovation. Tan et al. (2012) used the TAM theory as the research model for their

study. They found that age was a significant factor for perceived ease of use. Over 85% of their respondents were under 30 years of age and found mobile technology flexible and easy to use, based on their experience with mobile technology phones. This age group was also affected by change agents in their age range. There were too few older adults in the study to be able to generate any significant results. This example of the lack of research for the older adult population supports the existence of a research gap for older adults and technology adoption.

TAM has been used primarily for information system and information technology research (Lee, Hsieh, & Hsu, 2011). Lee et al. (2011) found that TAM and Rogers's (2003) theory of innovation diffusion (ID) had been integrated in previous studies. They noted that although they are not a unified theory; there are similar, shared constructs in both, and the TAM factors can be used to identify participants' placement in Rogers's participants' stages. Lee et al. combined TAM and ID with a quantitative study using a survey and 566 returned questionnaires. Their research questions were derived from employees' acceptance and adoption of e-learning. A blended approach primarily based on ID but with factors described by TAM could provide a solid theoretical foundation.

Rogers's (2003) theory of the diffusion of innovation and stages of adoption provides a map to identify older adults' willingness to change and attitude toward innovation. It is also a commonly used theory of innovation adoption in "education, sociology, communication, agriculture, marketing, and information technology" (Lee et al., 2011, p. 126). The role of change agents and stages was used in the survey and

interviews to help determine the factors affecting older adult adoption of mobile technology.

Growth of the Older Adult Worker Population

The growth of an older generation of adult workers has begun. Chen et al. (2008) projected growth of the over-65 population from 12.4% of the population in 2000 to 19.6% in 2030. The number of adults over 60 years of age is projected to triple by 2050 (United Nations Population Division, 2001). Older adults are reentering learning due to delayed retirement, longer lifespans, and economic needs.

Adults are working beyond the standard retirement ages of 62 and 65. Older adults want to work longer, reversing earlier retirement trends (Center on Aging Studies, 2014). In addition, declining pension plans are influencing the decision to delay retirement (National Institute on Aging, 2007). The expectation of working full time after 65 by workers with some college education rose from 32.4% for males in 1992 to 46.3% in 2004, and showed an increase for women from 23.8% in 1992 to 31.6% in 2004 (National Institute on Aging, 2007, p. 49).

Ageism and Older Adults

The rising number of older adults in the workforce and the increasing need to adopt and learn new technologies is hampered by ageism. Iversen et al. (2009) defined ageism as “negative or positive stereotypes, prejudice and/or discrimination against (or to the benefit of) aging people because of their chronological age” (p. 4). Castillo, Camara, and Eguizabal (2011) described the limited ability of older adults in combating negative stereotypes and biases. Their study identified an “image of an older adult who shows a

level of stereotyping and bias higher than the general population" (p. 167). The stereotyping and bias that an older adult faces due to ageism are greater than the bias faced by the population as a whole. McKay (2008) illustrated ageism in U.S. culture by its strong marketing of antiaging products and activities in the media. The use of technology can be one path away from ageism to quality of life and value (Longino, 2005).

Learning Technology

Technology has opened the door to modern distance learning. Technology bridges the gap between time and space (Wedemeyer, 1981). The nearly instantaneous information exchange of the Internet removes the limitations to interactivity and communication caused by the delays in exchanges by older distance learning methods such as postal mail. The distance between instructors and learners is bridged by the speed and interactivity that technology provides. Learners can stay in their homes or workplaces and not have to travel to brick and mortar institutions.

A media-based review reported that online education was being driven by corporate sponsored training (Winters, 2000). Winters (2000) identified the corporate sales value of Baby Boomers who were the age group growing the quickest on the Internet. Winters added that a study found Baby Boomers spent more time logged in than Generation X. This degree of Internet connectivity indicates another factor that shows the ability of the older adults to use new technology and a differentiation between older adults and other age groups.

Mobile technology promises a ubiquity and low cost training medium (Liu & Li, 2011; Park, 2011). The adoption of mobile technology by older adults is a significant issue for the workforce and society due to the growth of mobile learning, the ubiquitous nature of mobile technology devices, and the cost advantages of mobile learning options, as noted by Hamilton (2011). Hamilton concluded that older adult learners needed to be able to enter into the new technologies for learning. Hamilton stressed the need for studies on how older adults can use technology in their work, life, and learning. A more reserved view of the growth of mobile learning in a research study by Iqbal and Qureshi (2012) highlighted the need for educators, software developers, and technicians to work together to help move the potential of mobile learning to a reality. Research into older adult mobile adoption needs could potentially help this collaboration by identifying factors that inhibit mobile technology adoption.

Older Adults and Mobile Learning

The intersection of the growing older adult population and mobile learning opens a significant area for educational technology research. In this study, the focus was on mobile adoption as the required prerequisite to mobile learning. Adoption of mobile technology is required to provide interactivity and communication in organizations (Serrano-Santoyo & Organista-Sandoval, 2010). In addition, Liu and Li (2008) followed a discussion on the increase of older adults in China and Japan of over 30% by 2025 by noting the increased need to retrain this population and the limited research aimed at older adult learners, especially older learners and mobile learning. Researching older adults' experience with mobile adoption could help fill this gap. Increased understanding

of the factors that enhance and limit older adult mobile adoption can improve the diffusion of mobile learning among older adults.

Liu et al. (2010) found five factors to be significant in their review. The first was the perceived ease of use by the adopter. Users were more likely to adopt an innovation if they felt it was easy to use and understand. A complicated interface could delay an innovation's adoption. Davis (1989) defined difficulty of use as a hindrance to adoption. The second factor found by Liu et al. was the short- and long-term usefulness of a mobile technology device. Usefulness was determined by how a mobile technology device helped the user's work, finances, or successful learning. Liu et al. found the freedom provided by mobile technology as the third factor in their literature review. This freedom was based on the ability to access mobile devices anytime and anywhere. This accessibility is part of the generally accepted concept of the ubiquity of mobile technology. Crescente and Lee (2011) described these freedoms by noting that both South Africa and India have greater mobile learning than e-learning use due to limited Internet access via LAN or Wi-Fi. The fourth factor noted by Liu et al. was the perceived quality of the mobile learning. This perception reflects how valuable mobile learning is to the user. Liu's perceived quality aligns with Davis's perceived usefulness. The value and rate of adoption of mobile learning are influenced by the value the users assign to it in their work or life. The fifth factor detailed by Liu et al. was the learner's readiness for mobile learning. Readiness is an attitude and aptitude trait. The attitude is the willingness to try the innovation. The aptitude is the learner's ability to use mobile technology and mobile learning based, in part, on their adequate prerequisite knowledge or training. This

ability is included in the description of ease of use by Davis and is a key trait needed to understand the stage the learner is in (Rogers, 2003).

Older Adults and the Instructional Value of Mobile Technology

Before discussing the question of older adults adopting mobile technology, it is important to review the value and learning applications of mobile technology. Liu et al. (2010) described the perceived quality of mobile learning as based on the learner's personal values, current and future goals, and personal enjoyment of the learning. This study may help to clarify the value of mobile technology by drawing information of this sort from the interview participants and exploring the factors that help or hinder mobile adoption.

Suki and Suki (2011b) saw the potential for mobile learning to become an effective, convenient, and appropriate supplementary tool for learning. They researched Malaysian students in a brick and mortar environment and found that they did not rely significantly on mobile technology in their educational activities. One reason for this lack of reliance may be that mobile technology users can be subdivided into digital natives and digital immigrants. The concept of the digital divide is used to identify those with access to computer-based technology and those without access (Haffner, 2013). Suki and Suki saw digital natives as those who have access to and the ability to use mobile technology. Mobile immigrants do not have access to or the ability to use to mobile technology. Older adults are usually in the mobile immigrant population. The participants in Suki and Suki's study saw mobile technology as an expensive added cost. This view is surprising considering the high cost of personal computers and broadband access

compared to the lower cost of mobile technology (Kaur, Rani, & Singh, 2013). This view may be explained by the students' lack of mobile technology experience and the lack of heavy technology use in their current courses. This lack of mobile technology experience may be a relevant factor to review with older adults who are digital immigrants.

Delayed retirement (Timmerman, 2011), longer lifespans (National Institute on Aging, 2007), economic need (Weber, 2013), and the desire for a productive life (Kidahashi & Manheimer, 2009) are behind the need for instructional opportunities for older adults. Mobile learning has the potential to deliver instructional opportunities based on a variety of educational learning theories (Keskin & Metcalf, 2011), convenience and effective learning (Suki & Suki, 2011b), and emerging instructional design advances (Crescente & Lee, 2011). Cochrane and Bateman (2011) stressed mobile technology's ability to deliver learner content, facilitate internal and external classroom communication, and construct virtual learning environments. The adoption of mobile technology will lead to strengthening the ability of older adults to learn and maintain their work competencies.

Mobile Technology Adoption

Rao and Troshani (2007) discussed studies that researched users' behavior and their inclination to adopt mobile technology. They noted that the most common diffusion research type was TAM but also that those studies had left many questions unanswered. These unanswered questions included the users' mobile technology expertise, degree of innovative behavior, and compatibility with other technologies. In EC, other new technology options include SMS, CMAS/WEA, geographic information systems (GIS),

and signaling and alerting devices. Rao and Troshani described innovative behavior as a measure of the user's desire and ability to use a new technology. Innovative behavior is a combination of Davis's (1989) ease of use and usefulness measures in TAM. Compatibility measures the congruity of the technology with the user's lifestyle and work environment. Liu (2011) described seven factors that can drive the diffusion of mobile technology: relative advantage, ease of use, image, visibility, compatibility, results demonstrability, and voluntariness of use (p. 44). Liu's study focused on factors that the participants felt would assist their adoption of mobile learning. In this study, EC participants using mobile technology were interviewed, and the factors that drove their adoption were recorded.

Studying the impact and diffusion of mobile technology in the EC field could help fill gaps that need further research. Liu and Li (2011) stated that knowledge-based employers will have to provide learning via mobile technology to a lifelong learning and aging employee population.

Keesee and Shepard (2011) applied Rogers's (2003) stages of innovation readiness to their study adoption of a content management system (CMS) at historically Black colleges and universities (HBCUs). CMS is software designed to provide online courses by handling course content, training activity tracking, and classroom communications (Carliner, 2005). HBCUs were chosen because, as with older adults, they have not received attention from researchers. Keesee and Shepard researched the relationship between adoption and faculty perceptions of CMS. Their study was a

nonexperimental quantitative study using a survey. Demographic information and questions to elicit participant viewpoints were utilized.

Keesee and Shepard (2011) identified Rogers's (2003) adoption stages that the CMS users were in based on their survey responses. Innovators made up 16.8% of the participants. Keesee and Shepard identified them by their willingness to take risks, quick acceptance of new technology, interest in technology for its nature rather than usefulness or application, and willingness to use their time and resources to learn a new technology. Keesee and Shepard found that 56.2% of the participants were early adopters. The participants in this group were identified by their interest in the way the CMS could enhance their teaching, willingness to take a calculated risk, and their role as mentors and change agents in the social and professional network. Only 15.3% of the surveyed participants were members of the early majority. That may be due to the nature of the 137 participants who were surveyed. Many of the participants were conservative and comfortable in their less technical skill sets. In their colleges, they were expected to adopt the new CMS technology. Pressure from their administrators and peers may have driven them to early adoption rather than the early majority stage. Early majority participants were classified by their reluctance to embrace the new technology immediately until they saw it was useful, the value was plainly evident, and the technology would not require major time expenditures for them to support and learn it. Late majority participants made up 5.8% of the pool. They were identified by their lack of trust in the CMS, need to maintain their current practices while using the CMS, and need to succumb to social pressures by the school. Finally, the laggards saw no need to change or use any new

technology. Social pressures did not move them and ease of use or usefulness were not driving their adoption. What worked in the past was good enough.

Table 1

Self-Reported Adopter Categories

Adopter category	Frequency	%
Innovator		
I am often one of the first persons to try new technologies such as the CMS. I tend to be a risk-taker and active-information seeker. I tend to latch on to new technology as soon as it is available to me. My interest tends to be more with the technology itself than with its application to specific problems. I am willing to invest time and energy to learn on my own and adapt quickly to new technologies.	23	16.8%
Early Adopter		
I explored the CMS for its potential to bring about improvements in my teaching. I am willing to try new things technologies and am not averse to occasional failure. I share my experiences with the CMS with my colleagues. My colleagues often ask for my advice/help regarding the CMS. I experiment with a new CMS feature to see if it might improve teaching and learning.	77	56.2%
Early Majority		
I adopted a "wait and see" attitude toward the CMS. I wanted examples of close-to-home successes before adopting the CMS. I wanted to see the value of the CMS before adopting it. I wanted to make sure that adoption would be easy and hassle-free. I wanted to make sure I would have the necessary technical support and advice to learn/use the CMS.	21	15.3%
Late Majority		
I was skeptical about using the CMS. I accepted the CMS later in the game once it had become established among the majority of the faculty. I accepted the CMS only when it became a necessity. I began using the CMS because of pressure from my peers and/or students. I tend to use CMS features that seem similar to the ways I have always taught.	8	5.8%
Laggard		
I am usually not interested in adopting new technology. I see no use for adopting the CMS in my teaching practices. My current teaching practices have worked well so far without using the CMS. Just because everyone else is using the CMS, doesn't mean that I need to.	8	5.8%

Note. Reprinted from "Perceived Attributes Predict Course Management System Adopter Status," by G. S. Keesee and M. Shepard, 2011, *Online Journal of Distance Learning Administration, 14*(1), n1. Copyright 2011 by G. S. Keesee and M. Shepard. Reprinted with permission.

The answers provided by the interviewed population could identify factors that are derived by the stage of the older adult. As seen in Table 1, Keesee and Shepard (2011) tabulated the responses that instructors gave regarding the use of CMSss. The responses were tied to the respondents' innovation stage. The responses to these questions could also be used during the interviews being done in the study for data analysis. Determining the stage that older adults are in would help identify which factors could inhibit or enhance older adults' adoption of mobile. Keesee and Shepard recommended technical support for CMS users, utilizing a variety of professional development training activities to meet different adopter characteristics, providing instruction and support in the use of the technology and best practices, and the review of programs and procedures to enhance past results. These recommendations could be useful for older adult learners in colleges or school systems. However, the recommendations would require that attention and research be directed to the older adult population in EC.

Jan et al. (2012) focused on factors of adoption that included coercive, normative, and mimetic forces, attitude, and adoption intention. The questions Jan et al. used in the survey were drawn from their own conceptual model. The institutional force theory they designed incorporates elements of Rogers's (2003) infusion diffusion theory and TAM.

Jan et al. (2012) focused on the external forces that lead employees to adopt e-learning in their survey questions. They defined coercive factors as forces that provide no option but to adopt the technology. These forces manifest themselves in statements including *required* and *only option*. Normative factors focus on the employees' observations of people in their social networks using the innovation. They include

employee observations of people in their home or work networks using e-learning. When employees associate status or greater prominence in their institutions with e-learning, it is the effect of mimetic factors. Using the technology is seen as a way to gain importance in an institution. These three factors move an adopter towards positive feelings about an innovation and a willingness to adopt it. The final step is the adoption and willingness to continue the use of an innovation.

Summary

The understanding of the growing population of older adults in the workforce is critical to both society and individuals (Lee et al., 2009). Mobile technology is a growing learning delivery methodology due to freedom of movement, increasing use of mobile technology devices, and interactive applications (Adipat et al., 2011; Galagan, 2012). I sought to research a neglected population and their willingness to adopt and use mobile technology. The gap in the literature on mobile technology adoption by older adults in EC was the focus of this mixed-methods study, which could help address the issue of ageism in older adult learning.

The acceptance of mobile adoption can be measured by two research models. Rogers (2003) delineated five stages of adoption that can be used to identify and determine adoption practices for adults. Rogers further identified the role of change agents and the homophily or heterophily of the community. Liu and Li (2009) researched the relation of Rogers's diffusions of innovation theory to technology. Essen and Ostlund (2011) noted the need to identify older adults place in Rogers's stages. The common perception is to place them in the late majority or laggard stages. The research in my

study could help identify the stages older adults inhabit. Keesee and Shepherd's (2011) study aligned Rogers's stages with CMS adoption. The alignment between older adult learning and mobile learning technology using Rogers's stages has not been done.

The second theory developed for information sciences and technology was Davis's (1989) TAM theory. The TAM theory identifies traits and attitudes that move users to technology adoption, primarily ease of use and perceived usefulness. The TAM theory has been used to identify the role of age in technology acceptance, but according to Tan et al. (2012), older adults did not make up a significant percentage of the participants in TAM research studies that included Legris, Ingham, and Collerette (2003) and Lu, Yu, Liu, and Yao (2003).

Chapter 2 examines the potential and the increasing role of mobile technology. The promise of a ubiquitous and low-cost training medium (Liu & Li, 2011; Park, 2011) is one of the factors driving mobile technology use initiatives. There is a paucity of research matching older adult learners and mobile technology (Hamilton, 2011). Liu et al. (2010) reviewed the literature for mobile adoption, but the role of mobile technology for older adults and older adults' experiences was not represented in the reviewed literature.

Older adults are a growing work population due to delayed retirement, longer lifespans, and economic needs. Mobile technology adoption by older adults is significant due to the growth of mobile learning, the ubiquitous nature of mobile technology devices, and the cost advantages of mobile learning options noted by Hamilton (2011). Using a mixed-methods model, the study explored the experiences of older adults with mobile technology. This study could also help mitigate the lack of research, due in part to

ageism, by documenting older adult workers' needs. This study could provide data that could give voice to older adults and their future learning needs. The research methodology was the vehicle to provide knowledge about the adoption of mobile technology by older adults. The third chapter discusses the mixed-methods research model that was used to examine older adults and their adoption of mobile technology. This discussion includes the design, participant population, role of the researcher, data analysis, interview, and survey research instrument.

Chapter 3: Research Method

The number of older adults deferring their retirement and remaining in the workforce is rising (Timmerman, 2011). The Health and Retirement Study viewed this rising population as a major change in demographics that could transform the United States (National Institute on Aging, 2007). These older adults will require ways to maintain their work competencies and skills (Charness & Czaja, 2006).

The purpose of this mixed-methods study was to examine the factors influencing older adults in their adoption of mobile technology to work in the EC field. The design involved a mixed-methods approach. First, I conducted a survey to establish Rogers's (2003) stages of adoption and the factors that enhance or hinder mobile technology adoption. Qualitative interviews followed the survey to obtain a deeper and richer understanding of the older adults' experiences. Chapter 3 contains descriptions of the research methodology, setting, research design and rationale, role of the researcher, methodology, threats to validity, and issues of trustworthiness.

Setting

The population for this study was the members of a LinkedIn group, the Everbridge Incident Management Professionals Group. It was a population that included EC workers from state and local governments, healthcare, education, corporations, and the military. The group had over 1,100 members who worked in the areas of incident management, emergency management, risk management, or business continuity. The membership was composed of U.S. and international federal and state employees, corporate employees, health care, and academic personnel. This group was part of the

movement to mobile technology-based devices. There is a growing shift from laptop and desktop computers to mobile technology devices and tablets (Barnhart & Pierce, 2012). Microsoft recognized this shift with its release of Windows 8 in an attempt to move into mobile technology user interfaces (Collings, 2012). In addition, it is difficult for emergency personnel to maintain access to their laptops and workstations as they travel to emergency sites. Mobile technology devices are becoming a key communication device for crisis communication.

The study used a convenience sample composed of members of a LinkedIn group who were over 50 years of age and located in the United States. The scope of the study was limited to EC workers in the United States to reduce the role of customs, national characteristics, and language. The group does not identify the exact number of older adult members. However, there were 276 individuals in senior management, 212 managers, 176 directors, and 83 chief-level officers such as chief information officers, chief executive officers, or chief financial officers. These positions generally require longer terms of service than entry-level positions. Wiesman (2011) found the average age of government employees to be 46.8 years old, and the 75th percentile to be 55.3 years old. Using the 75th percentile as a guide, approximately 275 members of the group should have been 55 or older. Using the baseline age of 50 rather than 55 years old increased the potential number of participants based on Wiesman's study. A small set of LinkedIn group members may have been Everbridge colleagues of mine. None of these colleagues reported to me or had any direct or indirect reporting responsibilities to me. The focus of the study was not the organization, Everbridge, but a particular demographic, older adult

workers, reached through the LinkedIn group. The Everbridge Incident Management Professionals Group is hosted by Everbridge, Inc.

Research Design and Rationale

Research Questions

This study explored older adults' experiences regarding their adoption of mobile technology. The central focus was their adoption of mobile technology and which factors help or hinder the use of mobile technology by older adults. The current use of mobile technology and the ways in which the technology is being used were researched. This study addressed the following questions:

1. How do older adults in the EC field perceive the usefulness of mobile technology in the EC workplace?
2. How do older adults in the EC field perceive the ease of use of mobile technology in the EC workplace?
3. How do older adults describe the discrete factors that affect their adoption as they relate to ease of use and usefulness of mobile technology in the EC workplace?
4. How do older adults describe the impact of these discrete factors their adoption and use of mobile technology in the EC workplace as they relate to ease of use and usefulness? Do the interviewed older adults have suggestions to enhance the usefulness or ease of use of mobile technology?

The first two research questions cover which mobile technologies older adults are currently using and how older adults are using mobile technology, particularly in the EC field. The first two questions were the focus of the survey that began the study. A survey

is a research method that is used to collect data about a group's characteristics, activities, and behaviors (Johnson & Christensen, 2008). In this study, the survey collected data about current mobile technology usage and adoption factors. The survey provided a focus for the purposive selection of participants for the in-depth interviews and was addressed by the collection of quantitative data. The last two research questions required in-depth interviews to document the experiences of older adults and the impact of mobile technology adoption factors for older adults. The third research question explored what the discrete factors are that affect older adults' adoption of mobile technology in EC. The fourth question addressed how these discrete factors influence older adults' adoption and use of mobile technology in the EC field. The last two questions required qualitative, in-depth interviews to explore how the identified factors impact older adults' adoption of mobile technology in the EC workplace.

The design of the research was sequential mixed-methods, starting with a quantitative survey and followed by in-depth qualitative interviews. The sequential mixed-methods explanatory design provides for the collection of quantitative data followed by qualitative research that explores, broadens, and richens the recorded participants' experiences (Ivankova, Creswell, & Stick, 2006). This study used a phenomenological approach for the qualitative section. Campbell and Roden (2010) described phenomenology as an approach that can be used to collect and record the experiences and essential meaning in the participant's life. This description echoes Johnson and Christensen's (2008) description of the value of phenomenology as the study of individuals' experiences with phenomena that involves researching their "life worlds"

and derived meaning (p. 395). Johnson and Christensen identified in-depth interviews as a primary source of data for phenomenology. The quantitative survey identified the current mobile technology in use and how the mobile technology was used. The qualitative method was in-depth interviews. Merriam (2002) described the role of the interview in providing an opportunity to engage the participants in a dialogue that can provide insights into concepts, opinions, and expectations. The interviews that follow the survey were used to gather data on what factors help and hinder older adults' adoption of mobile technology. A sequential mixed-methods design can provide qualitative data that can be analyzed to refine and explain the statistical results by exploring the participants' views in more depth (Ivankova et al., 2006). In this study, the statistical information on older adults' adoption of mobile technology was made richer by direct interviews and dialogues with the older adults. The direct interviews and dialogues provided richer data and the opportunity for deeper analysis than a purely quantitative or qualitative study would have.

Role of the Researcher

I was responsible for the collection and analysis of the data. I have worked in corporate education for over 30 years. I have held positions ranging from instructor, education manager, and director of education to learning officer. Within my current company, Everbridge, Inc., I am the Everbridge learning officer, but no one in the LinkedIn Group (Everbridge Incident Management Professionals Group) who reported to me was included in the survey or interviews. One employee, who was a member of the LinkedIn Group, reported to me, and he was not included in the survey. I have no

administrative or review authority over any of the other Everbridge employees in the group. The Everbridge personnel who agreed to be interviewed were told that their results would not be included in the survey but would be used to refine the interview protocol.

My age, over 50 years, could have affected my interpretation of the collected data, particularly in the qualitative interview sessions. I maintained my role as an objective researcher and professionally conducted the survey in an objective manner. The survey questions and probes were documented and were reviewed to provide a consistent and objective interview protocol. In addition, triangulation of the survey and interview data was used to help maintain objectivity (Graf, 2003; James, 2011; Verheggen, 2007). NVivo software was used to provide an objective analysis of the interviews' qualitative data. I maintained a balanced view of the data and participants. I was prepared to allow the data and participants to "speak" in the research rather than following my opinions or expectations. There were no accommodations that I could have made for favored participants. In addition, there were no work or financial personal benefits that I could have received from the study.

Methodology

Participant Selection Logic

The phenomenon in this study was the adoption and experiences of older adults in the EC workplace with mobile technology. Adults over the age of 50 years who were members of a LinkedIn group were invited to participate. LinkedIn group membership implies that the participants have computer skills and access to the Internet. A survey was used to determine basic mobile technology adoption levels using Rogers's (2003) stages

and Davis's (1989) TAM theory. The survey requested that only participants in the group who were over 50 years of age respond. I anticipated that approximately 100 participants would respond to the survey. Eighty five participants took the survey. At the end of the survey, there was a written invitation for participants willing to be interviewed. I estimated that 10 to 15 would volunteer to be interviewed. Ten survey participants volunteered for in-depth interviews. The laggards and late majority stages represent the users who are most resistant to adopting a new technology such as mobile technology. These two stages provided the most pertinent data regarding reluctance to adopt mobile technology. If there had not been 10–15 participants from these stages, participants from the next stage or stages that represent resistance to adoption would have been selected. No laggards took the survey. Volunteers were selected from the other four stages.

The study provides a deeper understanding of why older adults resist adopting mobile technology by addressing the experiences of laggard and late majority older adult workers. This number of interviewees was within the range set by Johnson and Christensen (2008). The details of the selection process are covered below, in the Procedures for Recruitment, Participation, and Data Collection sections.

Instrumentation

The quantitative data collection instrument was a researcher-developed instrument, the Mobile Technology Diffusion of Innovations Survey (MDIS; see Appendix D). A copy of the survey consent form is available in Appendix C. An introduction to the survey is in Appendix B. A panel of corporate subject matter experts reviewed the survey to establish its validity and reliability. The panel consisted of three

subject matter experts from Everbridge. Two were responsible for sales and product management survey construction and design. The third was responsible for training survey construction and design. The panel reviewed the survey, and its members' recommendations resulted in changes to the survey. The survey consisted of four sections. The total number of questions was 25. The estimated time required to take the survey was 20 minutes.

The CMS Diffusion of Innovations Survey, used with permission from its authors (Keesee, 2010; Keesee & Shepard, 2011), was modified to focus on mobile technology rather than CMSs. The survey was reviewed by my committee and a panel of experts. An expert panel analyzed the question descriptions, terminology, and wording of each question and answer. The panel was made up of three experts in the field of emergency management, marketing, and education: Rob Larson, Erin Daly, and Daniel Kobialka. Rob Larson is the Everbridge Learning Management System Architect, has 30 years of experience in education, and has designed training for emergency notification personnel. Erin Daly, director of marketing communications, is responsible for marketing collateral and surveys. Erin has over 12 years in communications and marketing. Daniel Kobialka is a marketing communications specialist at Everbridge. Daniel is responsible for writing corporate communications, including company website content, brochures, case studies, byline articles/blogs, Q&A documents, social media campaigns, press releases, and white papers. Daniel is the owner of the Everbridge LinkedIn Group, Everbridge Incident Management and Emergency Notification. I revised the questionnaire as suggested by the panel. Minor corrections were suggested in terminology, reduction of jargon, and clarity.

Questions were added for gender and to identify Everbridge employees who were willing to participate in the pilot study.

The first section of the survey collected demographic information. Demographics included the participants' location in the United States, age, and industry area. The last five questions of the demographic section surveyed the participants' experience with mobile technology. The next three sections were adapted from the CMS Diffusion of Innovations Survey, used with permission from its author (Keesee, 2010; Keesee & Shepard, 2011). The MDIS instrument uses a 6-point scale survey question format that provides a range of agreement from *strongly agree* to *strongly disagree* and *not applicable*. Scoring of the responses was done with 1 representing *strongly disagree*, 6 representing *strongly agree*, and 0 representing *not applicable*. Each survey question had a comment field that could be used by the participants to provide further feedback on the question.

Table 2

Survey Question Review

Survey sections	Survey question numbers	Total questions	Researcher produced or adapted from
Demographic (age range)	1	1	Researcher produced
Demographic (technology use)	2 to 5	4	Keesee & Shepard (2011)
Stages of adoption	6	1	Keesee & Shepard (2011)
Perceived usefulness	7 to 14	8	Keesee & Shepard (2011)
Perceived ease of use	15 to 23	9	Keesee & Shepard (2011)
Willingness to be interviewed	24 to 25	2	Researcher produced

Table 2 includes the sections of the survey, question numbers, total number of questions in each section, and where the questions originated. The final section of the survey included an invitation to be interviewed for a more in-depth review of the participants' perceptions, experiences, and potential adoption of mobile technology. Participants who fell into Rogers's stages of laggard and late majority adoption groups would be chosen for interviews. Within these stage groups, the first 10 participants to respond were selected to be interviewed.

The second section, the stages of adoption, asked the participant to select their stage of adoption (Rogers, 2003). This section of the survey focused on the participants' attitudes and approaches to the adoption of mobile technology.

The third and fourth sections of the survey measured the perceived usefulness and perceived ease of use (Holden & Karsh, 2010). The perceived usefulness of mobile technology identified the adopters' apprehension regarding the value of mobile technology in their life, career, and learning (Davis, 1989). This section explored the participants' institutional and collegial support. Support provided a basis for the usefulness of the adoption by allowing participation in technical working procedures offered at work and supported by their management and colleagues at work. The perceived ease of use section surveyed a number of factors relating to use. These factors included the participants' opportunities to try mobile technology, freedom to use mobile technology at their own pace, perceptions of the complexity of mobile technology, and opportunities to explore personally critical mobile technology features. The last question

asked if the participants would be willing to be interviewed to provide an opportunity for them to clarify their answers and provide more specific personal insights.

A researcher-developed protocol (Appendix F) was used to guide in-depth interviews with older adult participants. The interview protocol used a semistructured interview format designed to narrow the focus (Rabionet, 2011) to the factors that affect mobile technology adoption and the participants' adoption perceptions.

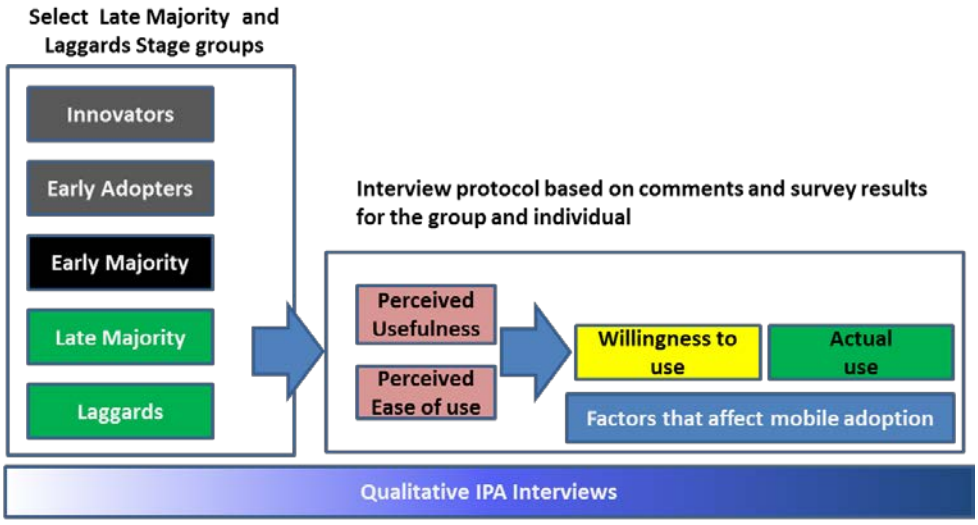

Figure 3. Conceptual model of the interview protocol process.

Figure 3 outlines the design for the interview protocol. The selection of interview participants was based on the membership in Rodgers's adoption stages. The survey comments from these groups were used in the development of the interview protocol. The interview protocol is described in Appendix G. The general questions and probes that were used are listed in this protocol. The probes provided a part of the structure for the interviews designed to draw out the participants' experiences in a deeper way. The interview questions focused on the experience of the participants with the factors that affected their adoption of mobile technology and the influence of these factors in their

workplace. Content validity was maintained through triangulation with the survey questions and comments and member checking.

The Overview of the Mobile Adoption and the Older Adult Interview Protocol (Appendix G) describes the relation between the research questions, interview protocol, and themes. The themes derived from the stage group's comments added depth to the interview by seeking the participants' reactions to these themes. The most common themes were utilized in the interviews. The basic structure of the interview was to identify a factor and then probe for the participants' response to that factor, specifically how it helped or hindered their adoption of mobile technology. The strategy was to allow the participants to present their stories and build on their experiences and perceptions. The findings of their group in the survey results and the participants' results and comments were used to generate the questions. The interview questions were tested in the pilot study discussed in the Instrumentation section.

Pilot Study

A pilot study was conducted using Everbridge personnel who wished to participate in the interviews. They were informed that they were participants in a pilot study to help refine and review the interview questions. The results of the pilot study were used to fine tune the interview protocol.

None of my colleagues at Everbridge were interviewed as part of the data collection, but they may have been asked to participate in the pilot study and comment on the interview process. The Everbridge interviewees were told their results would not be included in the study.

Procedures for Recruitment, Participation, and Data Collection

Quantitative Procedures

The Walden IRB approval number for the survey, pilot study, and interviews is 11-11-14-0110734. The survey data were collected from the LinkedIn Group, Everbridge Incident Management Professionals Group. The group had over 1,100 members who work in the areas of incident management, emergency management, risk management, or business continuity. The membership was composed of federal and state employees, corporate employees, health care, and academic personnel. I was the only person who collected data for this study. The data collection procedures involved an invitation to take a survey for members of the LinkedIn group's mailing list who were over 50 years old. The initial contact for the survey was an announcement that a survey was offered in the LinkedIn group by the Group Owner in Everbridge. I sent an invitation letter to all of the LinkedIn Group members, and I posted the invitation in the LinkedIn group. The survey was electronic and conducted through Ingenious Testcraft survey software. The survey displayed the electronic informed consent procedure at the start of the survey. The electronic informed consent document described the study and the possible follow-up interviews. The survey questions were opened after informed consent was read and accepted by participant. If there had not been not enough participants, a follow-up invitation would have been posted in the LinkedIn group and sent by e-mail.

Qualitative Procedures

I collected the interview data from respondents to the survey who volunteered. Respondents who were over 50 years of age and indicated that they were interested in

being interviewed were put in a pool. Based on the survey results, interview respondents were chosen from Rogers's (2003) stages of adoption that demonstrate the greatest reluctance to adopt new technology. Rogers identified laggards and late majority as the class of users who are slowest to adopt new technology. The qualitative interview was used to explore what factors hinder or help their adoption of mobile technology. The interviews utilized elements of the situated meaning structure for a phenomenological investigation (Merriam, 2002). The identification of the factors found in their survey responses was the source of the interview questions.

The interview process became more refined and effective as the interview sessions proceed (Creswell, 2009). Each interview could shape and sharpen the next interview. The interviews were conducted and audio recorded using GoToMeeting, a web-based communication tool. The interviews were conducted online, and I was in a private and secure location, away from my workplace. NVivo software was used to analyze the qualitative data through coding. NVivo facilitates storing and documenting the insights derived from phenomenological research (Richards, 1999).

Member checking provides a validation method by allowing the participants to review the collected data for accuracy (Koelsch, 2013). Member checking of the interview content by the participants was used to ensure that researcher bias did not skew the interview data collection. The interview participants were asked if they would be willing to look over the collected summary and interpretation of their interview. They were able to verify or correct their comments.

The interview informed consent form was sent to the non-Everbridge Interview participants. If they agreed to the consent form, the interview was scheduled. The interview was recorded using Citrix GoToMeeting software. I transcribed and reviewed the data obtained from the interviews. If there was a lack of clarity, member checking by the interview participants was available for their review and validation. A digital copy of the final dissertation will be offered to all members of the LinkedIn group.

The interview participants were asked questions that could draw on their experiences with mobile technology. The questions were based on the participants' survey results, including their stated stage of adoption, what mobile technology they use, and how they use mobile technology. The questions also drew on their perceptions concerning ease of use and usefulness of mobile technology. The factors that drive the participants' perceived ease of use and usefulness were further explored.

Data Analysis Plan

Quantitative Components

The data analysis for this study involved a sequential mixed-methods analysis. First, the survey responses were sorted into Rogers's (2003) stages of adoption groups. In the analysis, I looked for trends within and between stage groups based on the survey data collected. Each group was analyzed using descriptive statistics, specifically mean, median, and mode. Figure 4 illustrates the constructs that were analyzed.

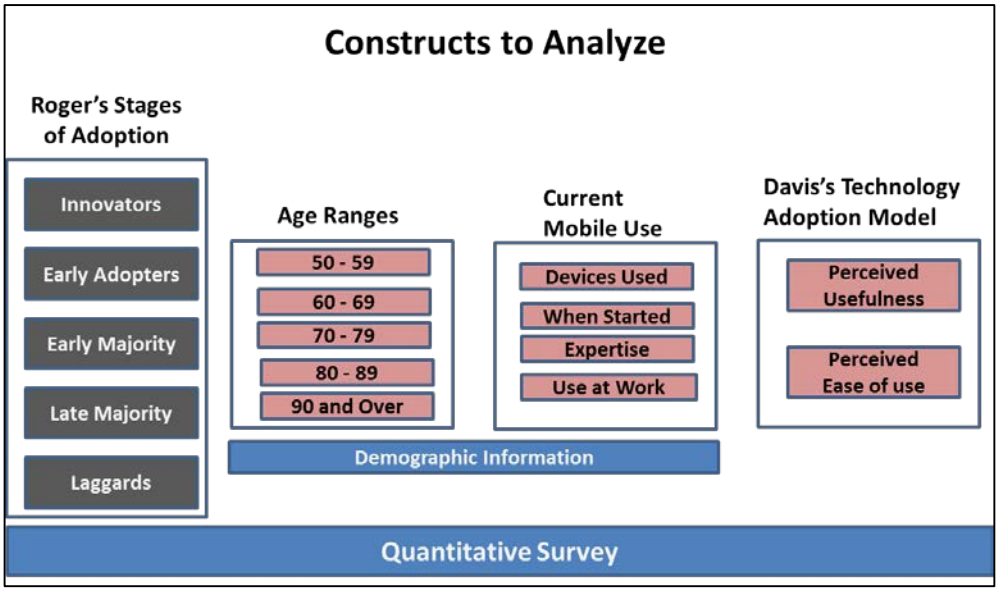

Figure 4. Conceptual model of the constructs used in this study.

After the survey, participants were sorted into the stages of adoption that they selected, and the percentage of the total participant population within each stage was presented in the analysis. All the data were sorted first by stage, and then the stage groups were compared based on age range, current mobile technology use, perceived usefulness, and perceived ease of use. Trends were reviewed based on expected stage of adoption behavior. Rogers's (2003) stages of adoption were not explicitly related to age, but adoption tendencies that align with the TAM model's perceived usefulness and perceived ease of use. It was generally expected that demographic data would be asked first within the survey. However, the sorting of the participants into Rogers's stages of adoption groups was the first step for the analysis.

The demographic section identified each participant's age and experience with mobile technology. I then reviewed the data to determine the percentage of participants by age within each of Rogers's (2003) stages of adoption. I then described what mobile

technology the older adult participants were currently using. I used descriptive statistics to identify differences in mobile technology usage between the participants' stages and their age range in the use of mobile technology. The demographic and stage group data helped answer the first two research questions. Question 1 asked what mobile technology the older adult participants were currently using. Question 2 asked how the participants were currently using mobile technology.

The perceived usefulness section identified the factors the participants' viewed as key components of their positive or negative perception of mobile technology's usefulness regarding their careers and lives. These questions provided insight into the factors covered in Research Question 3. The survey examined what discrete factors affect the mobile technology adoption of the participants. The survey also gathered information on how these discrete factors affect older adult mobile technology adoption. The data analysis for both questions provided more depth to the exploration of Research Questions 3 and 4. As an example, the data analysis could provide a line of questioning if the survey's results for laggards and late majority older adults were not consistent with the interviewed participants responses.

The perceived ease of use section identified the factors that the participants viewed as making mobile technology easy or difficult to use. I analyzed both sections using descriptive statistics and grouped by the stage the participants occupied. The perceived ease of use was compared between stages using descriptive statistics.

Qualitative Components

NVivo was used to analyze the comments made on each survey question. These data provided a bridge to the qualitative research section. The comments added depth to participant responses and were analyzed using NVivo to track reoccurring themes that could be used to enhance the interview questions. The comments were sorted and analyzed by stage group.

The qualitative section utilized interpretative phenomenological analysis (IPA) in semistructured interviews (Roberts, 2013). IPA is valid in this study as the focus is on the experiences of the participants. IPA is designed to be conducted on small, homogenous, sample groups using a flexible data collection system (Smith & Osburn, 2007).

The factors that influence participants' willingness to adopt mobile technology and their actual use of mobile technology were also explored. The results of the interview provided insight for Research Questions 3 and 4. The data from the interviews were coded using NVivo and broken into categories and themes. Research Question 3 addressed the discrete factors affecting older adults' adoption of mobile technology. Research Question 4 addressed how these factors affect the adoption of mobile technology and was a key part of the interview protocol.

The final part of the interview invited the participants to discuss their interview experience. The respondents were asked if there were any comments, or questions, they had with the interview process. These data were analyzed for common themes and concerns. This ongoing analysis helped to refine the interview process and facilitated a better interview protocol due to changes recommended by the participant.

Threats to Validity

Creswell (2009) identified procedures such as triangulation, member checking, and the use of a rich description of the participants' experiences to address threats to validity. There was a threat to internal validity based on the danger of invalid data collection. Data triangulation, member checking, and the review of transcription and coding results were used to address this threat in this study.

Issues of Trustworthiness

Credibility

Trochim (2006) stated that credibility provides the basis to determine if results are reasonable and tenable. To address credibility each survey question was followed by an optional, open comment section. Being able to add comments provided the participants with the opportunity to clarify or respond to a survey question. The comments provided further data to maintain internal validity.

The interviews provided another approach to addressing this threat by offering an insight window into the participants' experiences and survey answers. Additionally member check interviews enabled participants to review the documentation of their interviews. This process also provided a further check for internal validity.

The interview data provided a voice for older adult participants to express their experiences regarding the use of mobile technology adoption. Member checking was used to help ensure that any ambiguous findings are reviewed. Statements were checked if they were found to be unclear, incomplete, or difficult to interpret during the transcription and review of interview data.

Transferability

The data were collected from adults over 50 years old who were members of the EC workforce and members of an Everbridge LinkedIn group. They were computer-literate active users of the Internet and social networking. These factors make the findings applicable to older adult workers in the security, communication, and emergency medical fields.

Dependability

The information collected was tied to the use of the boomer generation, who did not grow up using computers. It provided an insight into this participant group that should be observable in other studies. Later generations that have grown up using computers may provide different results. The survey data and interview data provided a triangulation strategy. Triangulation provided a check on the data's trustworthiness. In addition, every step of the processes in the study was documented.

Confirmability

The procedures for obtaining, reviewing, and verifying the data to provide confirmability (Trochim, 2006) have been documented in this study. Data were collected by electronic media. The survey was electronic and conducted through Ingenious Testcraft survey software. The interviews were electronic, using GoToMeeting (collaboration software) to record and store the audio for the interviews. At the time of the study GoToMeeting did not allow for the recording of web cams. The data were kept on external hard disks stored in my own residence and encrypted. Transcription was done

only by the researcher. In addition, the role of the researcher, assumptions, and steps to reduce bias are documented.

Ethical Procedures

Permission to access the members of the LinkedIn group, the Everbridge Incident Management Professionals Group, was obtained through the group owner (see Appendix H). The survey was electronic, conducted through Ingenious Testcraft survey software. The invitation and group announcements indicated that the participants' participation was voluntary and that participants could withdraw from the study at any time. The accepted consent forms for the survey and interviews were stored. IRB approvals for the survey, pilot program, and interviews were obtained and documented in the study.

Data collected through the survey and interviews were secured and encrypted. There was no connection between the quantitative data and subject identification other than the e-mail address used. Each interviewed participant was assigned a pseudonym to maintain anonymity. After 5 years, the data and recordings will be erased.

The inclusion factors for the survey were older adults, 50 years of age or older, who were members of the Everbridge LinkedIn group. For the interviews, the first 10 members of the lowest of Rodgers's stages who were willing to be interviewed were chosen. There were no minors, prisoners, facility residents, or subordinates of the researcher who participated. No participant risk should be associated with participation.

Summary

This chapter presents the setting, research design, research questions, and role of the researcher for this study. The study used an online survey with 25 questions. Each

question allowed the participants to add comments. In-depth interviews of 10 participants followed the survey. The respondents were selected from survey participants who met two key criteria. The interview participants had to be at least 50 years old and in Rogers's (2003) laggard or late majority stage of adoption. The interviews were 30 to 60 minutes in length and followed by a review of the data collected in the interview by the respondents. The data from the interviews were coded by NVivo and broken into categories and themes. The results of the survey and interviews were analyzed using mean, mode, and median charting and reported in Chapter 4.

Chapter 4: Findings

The purpose of this study was to explore the experience of older adults in the adoption of mobile technology utilizing a mixed-methods approach. The first phase was done using a survey to gather demographic data, information on adoption stage, perceived usefulness, and perceived ease of use. The survey participants were drawn from the EC field of work. EC workers face a greater need to interact with mobile technology due to social networking and EC software systems (Chandler, 2010). Rogers's (2003) stages of adoption provided a way to categorize the degree of innovativeness of the survey participants. The stages could then be reviewed by examining their relation to Davis's (1989) TAM model. The TAM model was used in relation to the perceived value of mobile technology in the older adults' work and personal life and the older adults' opinions on the ease of use of mobile technology.

I developed four research questions to examine the mobile technology adoption of the EC workers. The research questions for this study were the following:

1. How do older adults in the EC field perceive the usefulness of mobile technology in the EC workplace?
2. How do older adults in the EC field perceive the ease of use of mobile technology in the EC workplace?
3. How do older adults describe the discrete factors that affect their adoption as they relate to ease of use and usefulness of mobile technology in the EC workplace?

4. How do older adults describe the impact of these discrete factors on their adoption and use of mobile technology in the EC workplace as they relate to ease of use and usefulness? Do the interviewed older adults have suggestions to enhance the usefulness or ease of use of mobile technology?

The first question reviewed how older adults in the EC field perceive the usefulness of mobile technology in the EC workplace. The second question focused on how older adults in the EC field perceive the ease of use of mobile technology. The first two questions were used for the survey. The next two questions were used in the interviews to gather a richer set of data. Research Question 3 asked how the older adults describe the discrete factors that relate to ease of use and usefulness. Research Question 4 examined how older adults describe the impact of these discrete factors as the factors relate to ease of use and usefulness of the older adults' adoption and use of mobile technology in the EC workplace. This chapter presents the analysis of the results of this study based on the research questions.

Pilot Study

The purpose of the pilot study was to refine and review the interview protocol. Three Everbridge personnel volunteered and were chosen from the survey participants. Everbridge is a corporation that provides tools and expertise for EC workers in academic institutions, state and local governments, healthcare organizations, and corporations. The pilot study volunteers were told that their participation would not be used for data collection but would be used to refine the interview process and questions. The three

volunteers' roles in Everbridge were documentation manager, senior system engineer, and senior support engineer.

The feedback the pilot study volunteers offered can be grouped in two areas. The first area of feedback was process suggestions:

1. Avoid repetition; if the interviewed person answers a later question in an earlier question, acknowledge that and ask if there is any other information that could be added.
2. Be careful to slow the pace and give the person being interviewed "thinking time" to answer the questions.
3. The reviewers were comfortable with the pace and questions.
4. Two of the reviewers appreciated seeing the questions before the interview and recommended providing the written questions prior to the interviews.

The process recommendations further refined the question language and helped eliminate redundancy. The suggested slower pace allowed the participants to have time to consider their responses and add further details. Sending the questions before the interview resulted in four of the interview participants expressing appreciation. One said that the questions helped him gather details for his answers.

The second area of feedback was based on the content. The recommendations were as follows:

1. Ask how the interviewees are currently using mobile technology and how long they use it, perhaps during a day.

2. The questions are important and provide a good basis for reviewing the degree of adoption and how the technology was acquired.

The content-based recommendations from the pilot study resulted in the addition of a question on the length of time that the participants had used mobile technology. This change added more information about the participants' experience levels. Finally, the acknowledgement that the questions provided a solid basis for examining mobile adoption provided an important reinforcement for the interview protocol.

Data Collection

Data collection for the quantitative survey ran from November 2014 to February 2015. The occurrences that influenced the length of the collection period are discussed in the Setting section that follows. The goal was 100 surveys, but 85 surveys were received after one initial request and five reminders to the Everbridge LinkedIn Group. The total population of the LinkedIn Group was 1,020 members. This suggests a response rate of 8.3% from the total LinkedIn group. However, it is notable that there are no age demographics maintained by the LinkedIn group. U.S. Bureau of Labor Statistics (2015) data indicate that 22% of the working population is over 50 years of age. Twenty-two percent of 1,021 adults would be 225 older adults. Eighty-five participants from a population of 225 would be a 37% response rate. A more conservative estimate, based on the results from one urban city, suggests that 45% of the working population is over 45 years of age (South Dakota Department of Labor and Regulation, 2015). Using 45% would suggest approximately 460 older working adults out of the LinkedIn population of 1,021, or a response rate of 18%, were needed.

The 10 interviews took place from February to April 2015. Each involved follow-up invitations based on willingness to be interviewed in the survey, scheduling, and a recording session. Several participants expressed willingness to be interviewed but either did not respond to the interview invitation, provided no way to contact them, or later asked not to be interviewed.

The survey instrument, the MDIS, was adapted from the CMS Diffusion of Innovations Survey. The CMS Diffusion of Innovation Survey was used with permission from its author (Keesee, 2010; Keesee & Shepard, 2011). The MDIS instrument uses a 6-point scale survey question format that provides a range of agreement from *strongly agree* to *strongly disagree* and *not applicable*. It used a self-reporting methodology to identify the participant's stage of adoption (Rogers, 2003). The survey is in Appendix D.

A researcher-designed interview protocol was used for the interviews. The protocol was reviewed by my committee and by a pilot study of subject matter experts. The protocol is in Appendix F.

Setting

The setting for this mixed-methods study was the Everbridge LinkedIn Group, Everbridge Incident Management and Emergency Notification. During early 2015, the LinkedIn group consisted of 1,020 members. EC personnel who are state and local government, healthcare, corporation, and academic workers populate the LinkedIn group. The members range from first responders and management teams to administrative staff and software engineers.

Several factors may have delayed the collection of survey results and interview data. The EC personnel were required to monitor and communicate during the Ferguson shooting and trial, as well as the following unrest. The reaction to the shooting of Michael Brown in Ferguson, Missouri, in August 2014 affected many cities and communities in the United States. The event also triggered reactions to further confrontations and shootings involving police and African Americans.

Weather events also may have delayed the collection of results. EC personnel are required to report on (a) the approach of storms, (b) events during storms, and (c) the effort to return to normal operations. Storms were frequent in the Midwest, East Coast, and other parts of the country during this period.

In addition, the data were collected during the 2014 holiday season between December and January. Celebrations, vacations, and city or town activities also required that many EC personnel remain on longer hours at higher alert. The holiday season may have increased the time required for both the survey and interview collection to proceed.

Finally, the nature of LinkedIn posts also played a part in delaying responses to the survey requests. When a survey request post is made to a LinkedIn group, it is placed at the head of the list. As new messages are posted, the survey request message is pushed down the list. The message can be pushed down to the point where a member of the group would have to scroll through many messages in order to see it. On an active list, this can happen quickly. The request had to be repeated due to the combination of messages being pushed down and sporadic logging in by members. Members are not

constantly logged in; rather, they log in when they have time or an interest in the group's activity.

Data Analysis

Mobile Technology Diffusion of Innovations Survey: Introduction to the Data Analysis

Descriptive statistics were used to present the results and indicate the nature of the data by providing the "measures of central tendency" (Larson, 2006), which consist of the mean, median, and mode. The *arithmetic mean* presents the average of the values collected in the data set. The *mean* takes into account all the values collected and tends to limit the fluctuation between different samples (Manikandan, 2011). The *median* is the middle value of a dataset. It is not as skewed by outlier values as the mean (Manikandan, 2011). The *mode* provides the value most frequently contained in the dataset. It does exhibit a greater variance if the sample size is small (Manikandan, 2011).

The first section of the MDIS survey provided demographic information. The second section allowed the participants to select their stage of adoption (Rogers, 2003). The sorting of the participant population based on stages of adoption groups was the first step of analysis. The sorting was followed by the analysis of the demographic questions by total participants and then by stage.

The questions dealing with the two constructs—perceived ease of use and perceived usefulness—were then asked. The two constructs provided insight into the participants' attitudes toward and approaches to mobile adoption. Research Question 1 asked, "How do older adults in the EC field perceive the usefulness of mobile

technology in the EC workplace?" The perceived usefulness of mobile technology measured the value of mobile technology in the participant's life, career, and learning. Research Question 2 asked, "How do older adults in the EC field perceive the ease of use of mobile technology in the EC workplace?" The perceived ease of use measured the participants' attitudes toward the complexity of mobile technology, the ability to learn how to use mobile technology, and the support of their adoption by friends, colleagues, and their organization's management. The final stage of the analysis involved analyzing the questions based on the two constructs by total responses and by age.

The MDIS survey provided the total number of responses for each item, which showed how many people who were surveyed answered the question. The count of responses for an answer and, where applicable, the percentage of the total, mean, median, and mode were also shown.

Two types of questions were asked in the MDIS survey. A question of the *choose one* type allowed only one answer. The count of responses, if added, would equal the number of total responses received. There were also *all that apply* questions. For these questions, more than one answer was accepted, which may have resulted in the number of responses to the question exceeding the total number of participants responding. For the *all that apply* questions, mean, median, and mode are not shown, as they would not be meaningful. The count and percentage of respondents selecting the answer are shown.

The participants were asked in the final questions if they were willing to be interviewed for the qualitative portion of the data collection. Participants of Everbridge

were told that they could be used for the pilot study. Non-Everbridge participants were told that their responses would be used for the dissertation data collection.

Participant Demographics

Demographic characteristics collected from the participants included age, gender, and current or past use of mobile technology. Data collected on past use of mobile technology focused on the specific devices used, when they were first used, and how they were being used. The demographic details review and expand upon this information.

Age Range of Participants

As shown in Figure 5, the MDIS survey participants ranged in age from 50 to 80 years. The majority of users were 56 to 60 years old (36.5%), followed by 50 to 55 years old (34.1%) and 61 to 65 years old (22.4%). Then there was a very significant drop in the number of participants for the following age groups: 66 to 70 years old (3.5%), 71 to 75 years old (2.4%), and 76 to 80 years old (1.2%). The significant drop in age precedes the full retirement age of the boomer generation, 66 years of age (Social Security Administration, 2015).

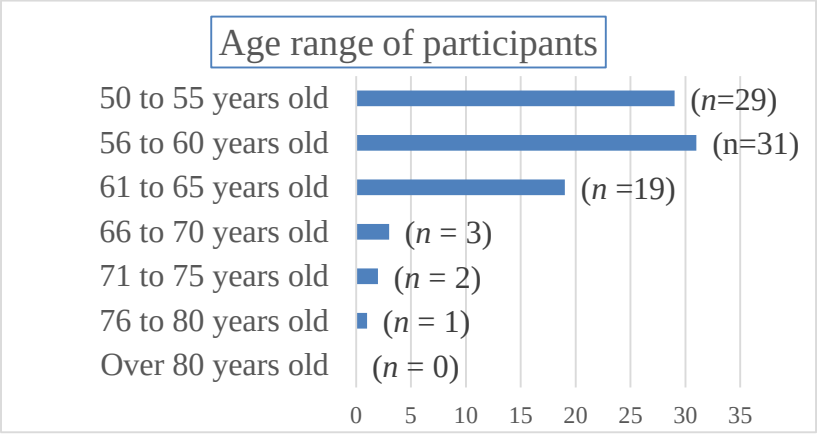

Figure 5. Age range of participants (*N* = 85).

Count and Percentage of Participants in Each Stage of Adoption

After the demographic data were collected in the survey, a question was asked that allowed the participants to select their stage of adoption (Rogers, 2003). The stages were based on their reaction to adopting new technology. The stage of the participants was used in the next sections of the survey to review ease of use and usefulness by stage. In Table 3, the reported stages of adoption based on Rogers's (2003) work showed 62% of the older adults as early adopters, 19% as early majority, 12% as innovators, and 7% as late majority. No survey participants in this study chose laggard as their stage.

Table 3

Count and Percentage of Participants in Each Stage of Adoption

Stage of adoption	Descriptions used for self-reporting by MDIS survey participants	*n*	%
Innovator	I am often one of the first people to try new technologies such as the mobile. I tend to be a risk-taker and active-information seeker. I tend to latch on to new technology as soon as it is available to me. My interest tends to be more with the technology itself than with its application to specific problems. I am willing to invest time and energy to learn on my own and adapt quickly to new technologies.	10	11.76
Early adopter	I explored mobile for its potential to bring about improvements in my work. I am willing to try new technologies and I am not averse to occasional failure. I share my experiences with mobile with my colleagues. My colleagues often ask for my advice/help regarding mobile technology. I experiment with a new mobile feature to see if it might improve work.	53	62.35
Early majority	I adopted a "wait and see" attitude toward mobile. I wanted examples of close-to-home successes before adopting mobile. I wanted to see the value of mobile before adopting it. I wanted to make sure that adoption would be easy and hassle-free. I wanted to make sure I would have the necessary technical support and advice to learn/use mobile.	16	18.82
Late majority	I was skeptical about using the mobile. I accepted the mobile later in the game once it had become established among the majority of my coworkers and friends. I accepted the mobile only when it became a necessity. I began using the mobile because of pressure from my coworkers and friends. I tend to use mobile features that seem similar to the ways I have always used phones.	6	7.06
Laggard	I am usually not interested in adopting new technology. I see no use for adopting mobile in my work or learning. My current practices have worked well so far without using mobile. Just because everyone else is using the mobile, does not mean that I need to use it.	0	0.00

Note. $N = 85$

Comparison between the MDIS survey results and Rogers's expected stages of adoption. Figure 6 shows a comparison of the results obtained in the MDIS survey and the results predicted by Rogers (2003). In the MDIS survey results, the percentage of innovators and early adopters as greater was predicted by Rogers in the general population. In addition, no laggards were reported in the MDIS survey. This disparity may be explained by the fact that the EC older adult workers surveyed were workers in a field where the Internet, social media sites such as LinkedIn, and mobile technology are often used. Another possible explanation is that mobile technology has become more accepted, even among older adults.

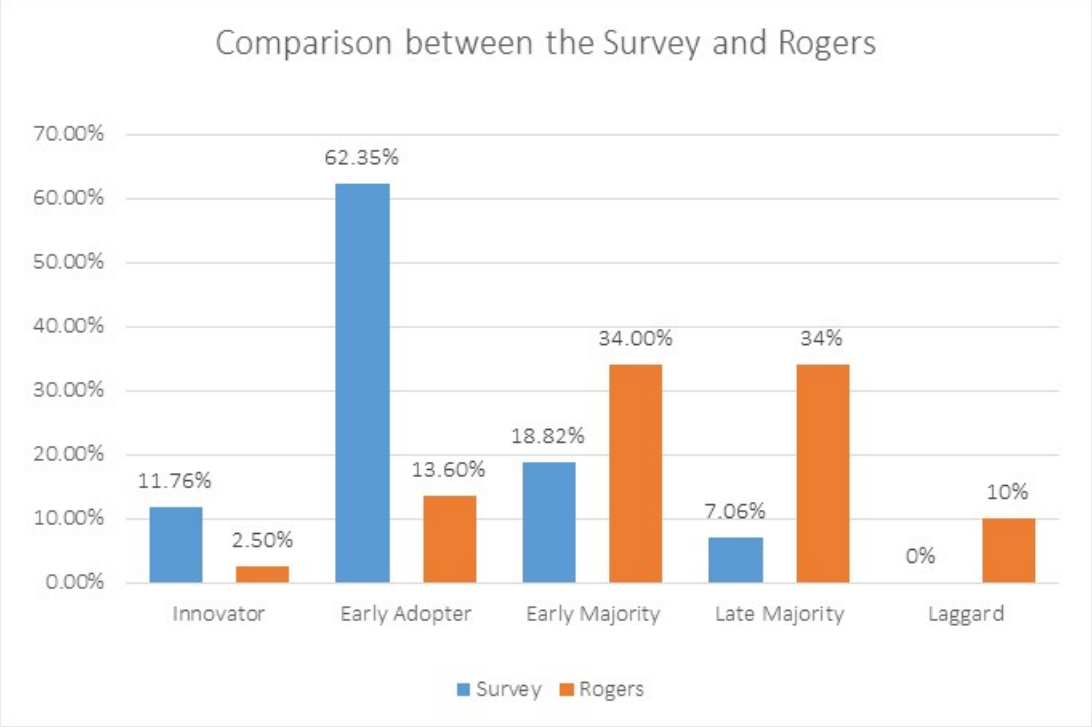

Figure 6. A comparison between the MDIS survey results and Rogers's (2003) expected stages of adoption.

Comparison between the MDIS survey results and the Keesee and Shepard study. In Figure 7, the results of a comparison between the older adults in the MDIS survey and Keesee and Shepard's (2011) results from their CMS Diffusion of Innovations Survey. Their survey was given to college teachers who were currently using or would in the future use a content management system. The overall findings were similar. The scores for innovators and early adopters were very close. In addition, early majority and late majority are very close for the two surveys. There were laggards in the Keesee and Shepard study; however, no laggards participated in this study.

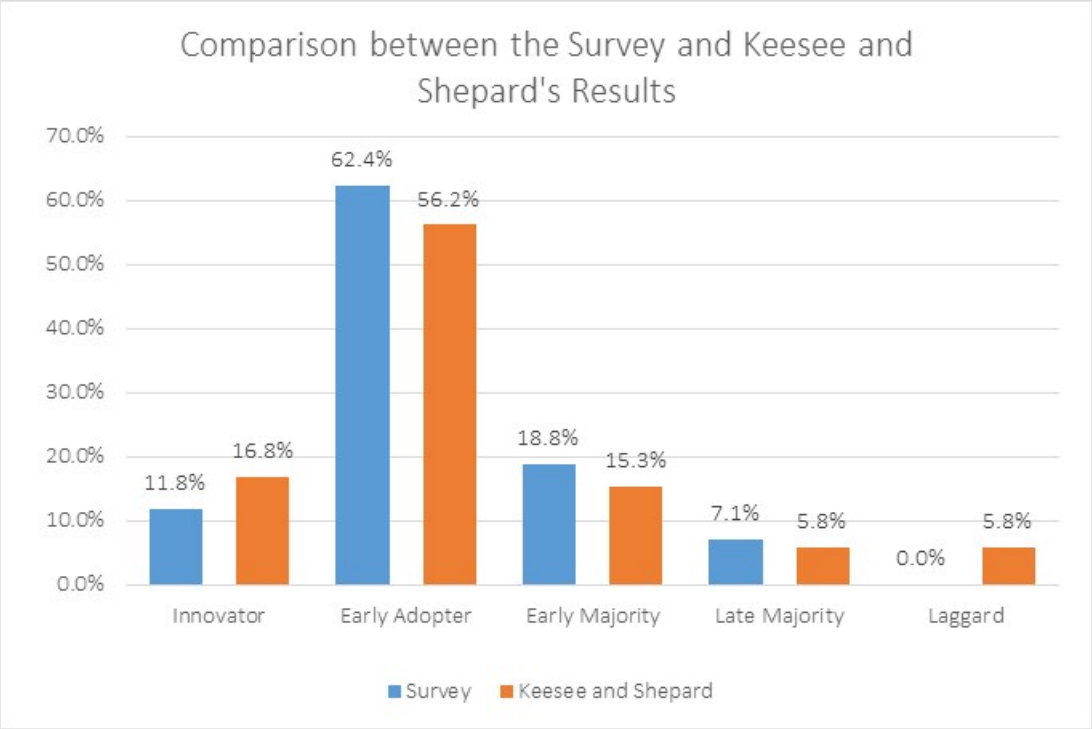

Figure 7. Comparison between the MDIS survey and the Keesee and Shepard (2011) results.

There were two constructs researched in the MDIS survey: perceived usefulness and perceived ease of use (Davis, 1989). Davis (1989) stated that these constructs might determine why the adoption of a new technology or innovation occurs. A unidimensional

rating scale (Trochim, 2006) was used to measure the participants' agreement with eight statements each for the two constructs. The scale was made up of an interval response scale with a rating of 1 to 5: 1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree*, and 5 = *strongly agree*. If all participants responded with 1 for *strongly disagree*, the mean, median, and mode would be 1.

Age range of participants by stage. The breakdown of stages by age is shown in Table 3. Early adopter was the leading stage for all age ranges, with 25.9% for 50 to 55 years of age, 17.6% for 56 to 60 years of age, and 11.8% for 61 to 65 years of age. All participants over 66 years of age were early adopters. For 50 to 55 years of age, the next most popular stage was Innovator (5.9%), whereas 56 to 60 years old selected early majority (17.6%).

Table 4

Age Range of Participants by Stage of Participants

Age range	Innovator	Early adopter	Early majority	Late majority	Laggard
50–55	5.9% (*n* = 5)	25.9% (*n* = 22)	2.4% (*n* = 2)	(*n* = 0)	(*n* = 0)
56–60	4.7% (*n* = 4)	17.6% (*n* = 15)	11.8% (*n* = 10)	(*n* = 0)	(*n* = 0)
61–65	2.4% (*n* = 2)	11.8% (*n* = 10)	4.7% (*n* = 4)	2.4% (*n* = 2)	(*n* = 0)
66–70	(*n* = 0)	3.5% (*n* = 10)	(*n* = 0)	(*n* = 0)	(*n* = 0)
71–75	(*n* = 0)	2.4% (*n* = 2)	(*n* = 0)	(*n* = 0)	(*n* = 0)
76–80	(*n* = 0)	1.2% (*n* = 1)	(*n* = 0)	(*n* = 0)	(*n* = 0)

Note. $N = 85$.

Gender of participants. Figure 8 shows men made up approximately 72% of the MDIS survey responders. Women made up the remaining approximately 28% of responders. There are no specific surveys on female and male percentage of workers in EC, but a similar field is first-line police and correctional officers. The percentage of female EC workers is higher than the percentage of female first-line police and correctional officers at 16% (Bureau of Labor Statistics, 2015).

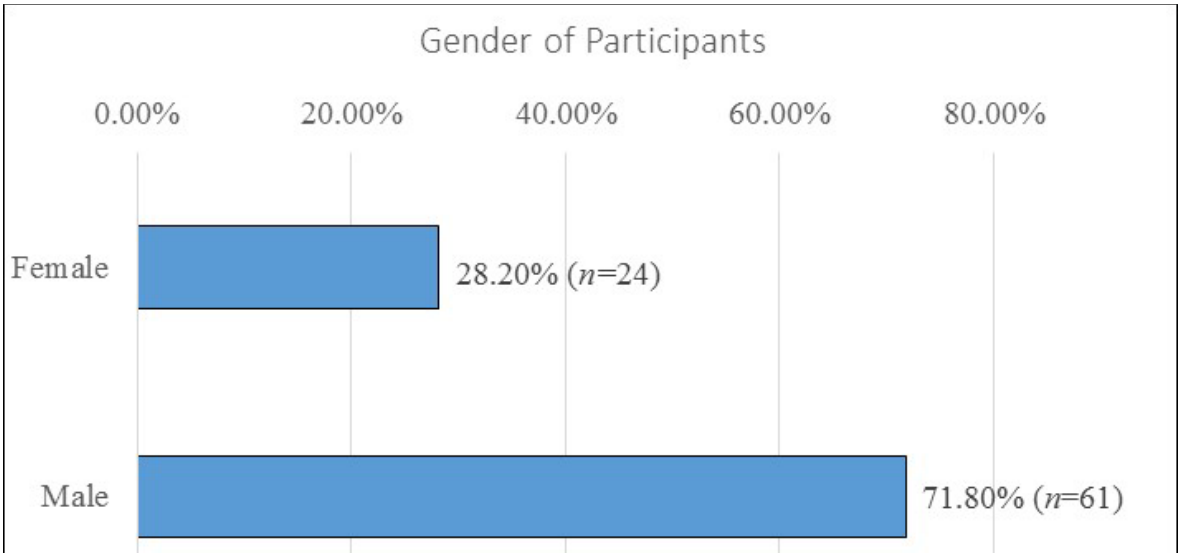

Figure 8. Gender of participants (*N* = 85).

Gender of participants by stage. The stage with the most participants for both female (17.6%) and male (43.5%) participants was early adopter (Table 5). early majority was next with 5.9% for women and 12.9% for men. Female participants equally selected innovator and late majority at 2.4%. Male participants selected innovator at 10.6% and late majority at a lower percentage of 4.7%.

Table 5

Gender of Participants by Stage

Gender	Innovator	Early adopter	Early majority	Late majority	Laggard
Female	2.4% (*n*=2)	17.6% (*n*=15)	5.9% (*n*=5)	2.4% (*n*=2)	0% (*n*=0)
Male	10.6% (*n*=9)	43.5% (*n*=37)	12.9% (*n*=11)	4.7% (*n*=4)	0% (*n*=0)

Note. $N = 85$.

Mobile devices currently used by participants. As seen in Figure 9, the use of a smartphone by the study group was 97%. This was higher than the use by Americans found in a survey by the Pew Research Center (2014). The Pew Research Center survey found 88% of people between 50 and 64 years of age and 74% of people over 74 years of age used smartphones. These results can be compared to 86% of the Millennials aged 25 to 34 who owned smartphones (Perez, 2014). The highest use was of smartphones (98%), including iPhone, Blackberry, and Android. Next were tablet computers (79%) and mobile Wi-Fi hotspots (74%). The values for older adults can be compared to the percentage usage found by Murphy, Farley, Lane, Hafeez-Baig, and Carter (2014) in their study of college students in Australia. Smartphone use by older adults in this study, at 98%, was slightly higher than the college students' use of 95% (Murphy et al., 2014). Tablet use by older adults (79%) was also higher than college student usage (67%).

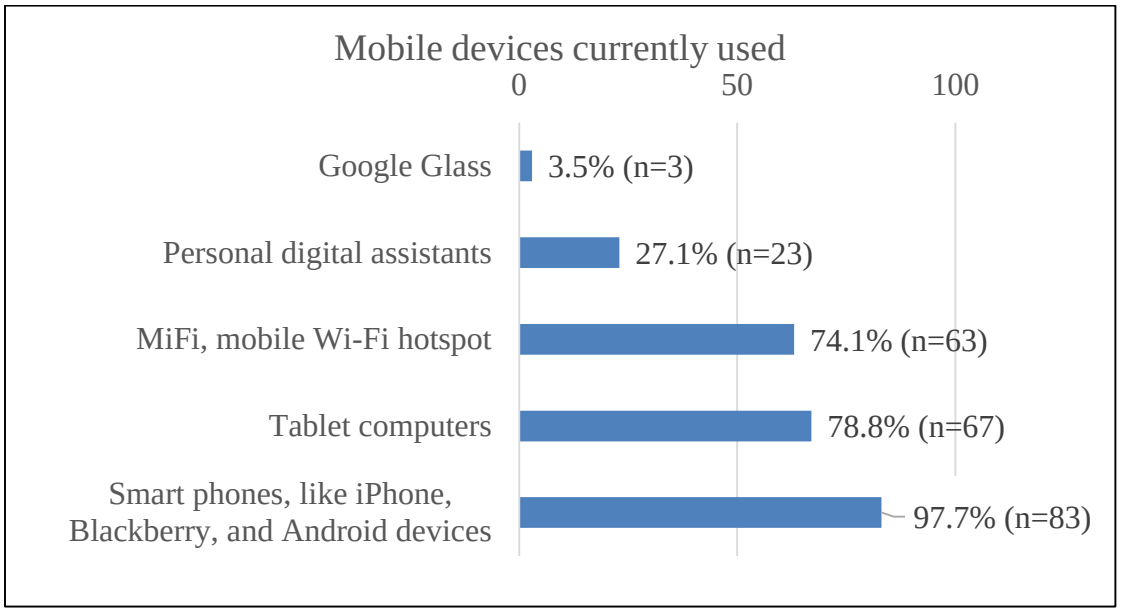

Figure 9. Mobile devices currently used by participants (*N* = 85).

Mobile devices currently used by stage. Smartphones were the most frequently used mobile devices by all stages as seen in Table 6. Smartphones were used by innovators at 12.9%, early adopters at 58.8%, early majority at 16.5%, and late majority at 7.1%. Tablet computers were the second most frequently used mobile device for innovators (11.8%) and early adopters (50.6), whereas early majority (12.9%) and late majority (5.9%) participants used MiFi and mobile Wi-Fi as their second devices. Personal digital assistant use was lower, followed by Google Glass being used the least.

The needs of EC workers make Google Glass less useful in emergencies. Swider (2015) listed the reasons that have hampered the adoption of Google Glass. Swider noted were that the glasses were outrageously expensive, the battery life was too short, the ability to take photos required extra lighting, and there were not enough useful apps. All of these issues contributed to the low adoption statistics seen in the survey.

Table 6

Mobile Devices Currently Used by Stage

Devices used	Innovator	Early adopter	Early majority	Late majority	Laggard
Personal digital assistant	4.7% (*n* = 4)	14.1% (*n* = 12)	5.9% (*n* = 5)	1.2% (*n* = 1)	0% (*n* = 0)
Tablet computers	11.8% (*n* = 10)	50.6% (*n* = 43)	11.8% (*n* = 10)	3.5% (*n* = 3)	0% (*n* = 0)
MiFi, mobile Wi-Fi hotspots	10.6% (*n* = 9)	43.5% (*n* = 37)	12.9% (*n* = 11)	5.9% (*n* = 5)	0% (*n* = 0)
Smartphones (e.g., iPhone, Blackberry, and Android devices)	12.9% (*n* = 11)	58.8% (*n* = 50)	16.5% (*n* = 14)	7.1% (*n* = 6)	0% (*n* = 0)
Google Glass	0% (*n* = 0)	2.4% (*n* = 2)	1.2% (*n* = 1)	0% (*n* = 0)	0% (*n* = 0)

Note. $N = 85$.

When mobile devices were first used. As seen in Figure 10, for length of time that the older adults used mobile technology, the longest time offered, over 10 years, was selected most often (64%). Next were 4 to 6 years at 14% and then 7 to 10 years at 11%. The option least selected was 1 to 3 years (4%).

Mobile devices were first used more than 10 years ago by 54% of the respondents. The next time interval was 4 to 6 years ago by 14.1% of the participants. Seven to 10 years ago accounted for 11.7% of the participants. The least chosen time range was 1 to 3 years ago with 10.6% of respondents.

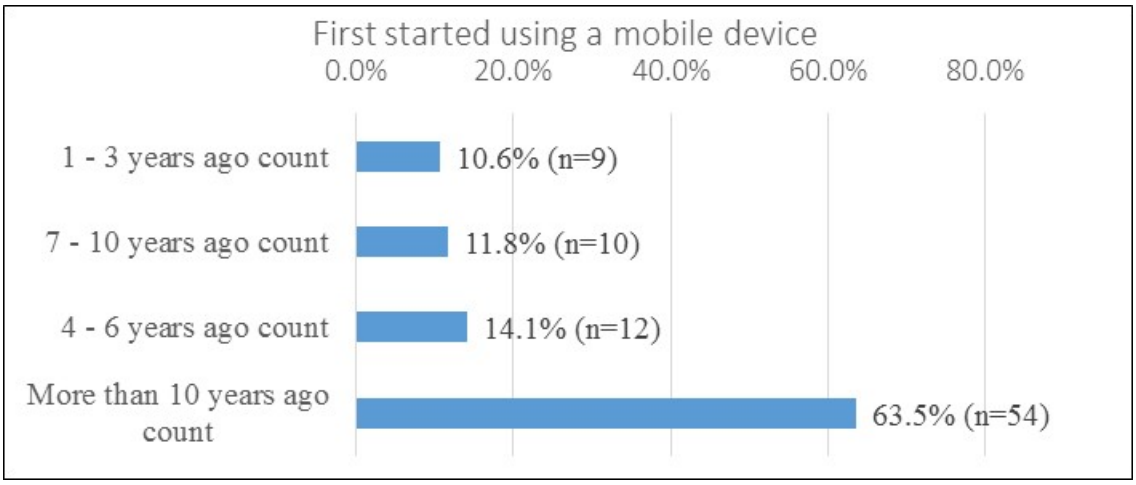

Figure 10. When mobile devices were first used (*N* = 85).

When mobile devices were first used by stage. When the device-used date range is broken down by stages, more than 10 years ago is the most common. This includes innovator (9.4%), early adopter (42.4%), and early majority (10.6%). Late majority was led by 1 to 3 years ago (3.5%), followed by 4 to 6 years ago (2.4%).

Table 7

When Mobile Devices Were First Used by Stage

Device used	Innovator	Early adopter	Early majority	Late majority	Laggard
1–3 years ago	1.2% (*n* = 1)	4.7% (*n* = 4)	1.2% (*n* = 1)	3.5% (*n* = 3)	(*n* = 0)
4–6 years ago	(*n* = 0)	8.2% (*n* = 7)	3.5% (*n* = 3)	2.4% (*n* = 2)	(*n* = 0)
7–10 years ago	2.4% (*n* = 2)	5.9% (*n* = 5)	3.5% (*n* = 3)	(*n* = 0)	(*n* = 0)
More than 10 years ago	9.4% (*n* = 8)	42.4% (*n* = 36)	10.6% (*n* = 9)	1.2% (*n* = 1)	(*n* = 0)

Note. *N* = 85.

How mobile devices were used while working. The use of mobile devices while working is shown in Figure 11. EC workers need to communicate with other employees, their management, and customers. Customers could be city or state citizens, corporate employees, hospital workers, or other recipients based on the industry.. The lowest usage is in various forms of training. The older adults' use of mobile technology to communicate (85%) is slightly higher than the average American's usage of a cell phone (81%; Pew Research Center, 2014). Accessing the Internet is about the same: Older adults' use stands at 61% and Americans' use at 60%. Older adults' use of mobile technology for training, learning, and sharing materials is lower than for communicating and Internet searches. Thirty-nine percent of the older adult participants in the MDIS survey shared training materials and/or articles. Professional development or training was done on mobile devices for 35%. Only 21% of the participants used mobile devices for training sessions, taking online courses, and attending webinars.

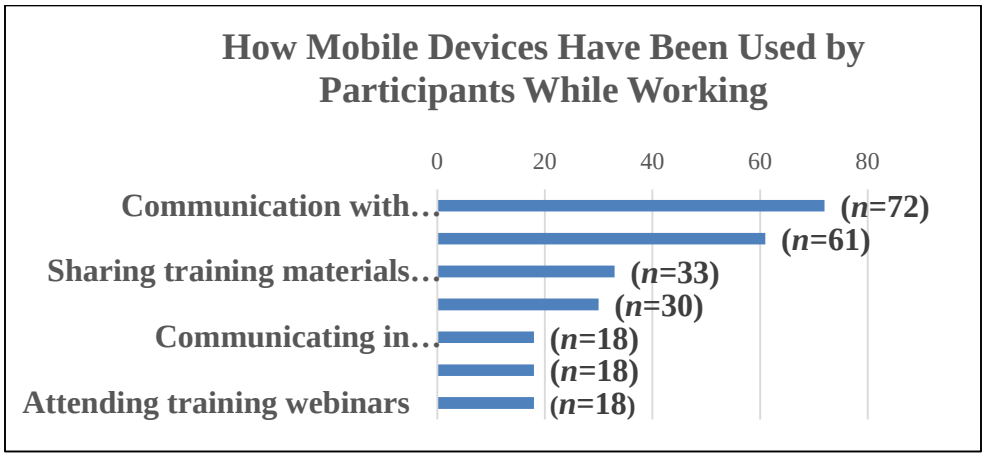

Figure 11. How mobile devices were used while working (N = 85).

How mobile devices were used while working by stage. As shown in Figure 11, communication with employees, management, and/or customers was the most common

use of mobile devices by early adopters, early majority, and late majority participants. Innovators had twice as many participants choosing professional development/training rather than communication with employees, management, and/or customers. The third highest use was searching for information while working.

Table 8

How Mobile Devices Were Used While Working by Stage

How mobile device is used	Innovator	Early adopter	Early majority	Late majority	Laggard
Attending training webinars	4.7% (n = 4)	21.2% (n = 18)	8.2% (n = 7)	1.2% (n = 1)	(n = 0)
Communicating in training sessions	4.7% (n = 4)	20.0% (n = 17)	4.7% (n = 4)	2.4% (n = 2)	(n = 0)
Communication with employees, mgmt., and/or customers	5.9% (n = 5)	57.6% (n = 49)	17.6% (n = 15)	7.1% (n = 6)	(n = 0)
Professional development/training	11.8% (n = 10)	32.9% (n = 28)	7.1% (n = 6)	1.2% (n = 1)	(n = 0)
Information search while working	5.9% (n = 5)	50.6% (n = 43)	16.5% (n = 14)	5.9% (n = 5)	(n = 0)
Sharing training materials and/or articles	8.2% (n = 7)	32.9% (n = 28)	8.2% (n = 7)	1.2% (n = 1)	(n = 0)
Taking online courses	7.1% (n = 6)	21.2% (n = 18)	4.7% (n = 4)	1.2% (n = 1)	(n = 0)

Note. N = 85.

There were two constructs researched in the MDIS survey, perceived usefulness and perceived ease of use (Davis, 1989). Davis (1989) stated that these constructs might determine why the adoption of a new technology or innovation occurs. A unidimensional

rating scale (Trochim, 2006) was used to measure the participant's agreement with eight statements each for the two constructs, The scale was made up of an interval response scale with a rating of 1 to 5: *1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.* If all participants responded with a 1 for *strongly disagree*, the mean, median, and mode would be 1.

Research Question 1 looked at the relationship between the adoption of mobile technology and the perception of usefulness of mobile technology by older adult EC workers. The first construct, perceived usefulness, had eight questions in the survey. In Appendix I, the questions and the results are expressed in mean, median, and mode scores.

Table 9

Total Statistics for Perceived Usefulness

Stage of adoption	Mean	Median	Mode
Innovator	4.6	4.5	5.0
Early adopter	4.1	4.0	4.0
Early majority	4.1	4.0	4.0
Late majority	4.0	4.0	4.0

Note. N = 85.

Total statistics for perceived usefulness. The combination of results for all eight MDIS survey questions based on the first construct, perceived usefulness, show a small difference in values between innovator and late majority, as seen in Table 9. The innovator values for the mean (4.6), median (4.5), and mode (5.0) are slightly higher than

the values for early adopter and early majority with mean (4.1), median (4.0), and mode (4.0). Late majority is only slightly lower with mean (4.0), median (4.0), and mode (4.0). This suggests that, for the surveyed EC workers, all four stages of adoption saw all eight different facets of perceived usefulness as helpful for their adoption of mobile technology. As expected, the values, particularly of the mean, decrease from innovator to late majority. For the individual questions, Table 10 displays the questions and mean by stage.

Table 10

MDIS Survey Questions 3.1 to 3.8: Perceived Usefulness

Question	Innovator	Early adopter	Early majority	Late majority
Many of my colleagues use mobile and it helps me work with them. (*N* = 85)	4.4	4.1	4.3	3.4
I would be able to explain why using mobile may or may not be beneficial. (*N* = 85)	4.5	4.2	4.2	3.8
The results of using mobile for work are apparent to me. (*N* = 85)	4.5	4.4	4.2	4.0
Using mobile is compatible with most aspects of my learning. (*N* = 85)	4.1	3.8	3.7	3.7
Using mobile fits well with my work activities. (*N* = 85)	4.3	4.3	4.4	3.8
Using mobile is compatible with organization's needs. (*N* = 85)	4.5	4.3	4.4	4.7
Using mobile is compatible with the resources I am currently using in my work. (*N* = 85)	4.4	4.1	4.3	4.0
In terms of using mobile, it is important to me to consider what my management thinks.	3.9	3.4	3.6	3.8

The individual table showing the mean, median, and mode for each question for perceived usefulness are in Appendix I and for perceived ease of use are in Appendix J.

Colleagues and mobile use. The greatest distinction between the descriptive statistics for innovator and late majority occurred on the question "Many of my colleagues use mobile and it helps me work with them," as shown in Table 10. Innovators had a mean of 4.4 between *agree* and *strongly agree,* with a median and mode of 5.0. Late majority participants had a mean of 3.4, between *neutral* and *agree,* with a median and mode of 3.0. There are values that are not in the range expected. The early majority had a higher mean value (4.3) than the early adopters' mean of 4.3. Both had median and mode values of 4.0.

Why mobile is beneficial. As shown in Table 10, the question "I would be able to explain why using mobile may or may not be beneficial" also provided greater distinction between the innovator and late majority values. The innovator mean value was 4.5 with a median and mode of 5.0. Late majority participants had a mean of 3.8 with a median and mode of 4.0. Both early adopter and early majority had means of 4.2, medians of 4.0, and modes of 4.0. One early adopter answered (N/A).

Results of using mobile for work. The results in Table 10 indicated that all four stages scored at *agree* to *strongly agree*. The mean values slightly declined for each subsequent stage. Innovators had a mean of 4.5, median of 5.0, and mode of 5.0. Early adopters had a mean of 4.4, early majority had a mean of 4.2, and late majority's mean was 4.0. The mean and mode for early adopter, early majority, and late majority were 4.0.

Compatibility with learning. There was less of a differentiation between the stages for the MDIS survey question on the compatibility of mobile technology with the participant's learning in Table 10. Innovator had the highest mean (4.1) but early adopter followed with a mean of 3.8; early majority and late majority had mean values of 3.7. All stages had medians and modes of 4.0 except for early majority, which had a mean score of 3.0. The early majority mean score is out of the pattern of higher to lower values from innovator to late majority.

Fits well with work activities. The results in Table 10 for the MDIS survey question that asked whether mobile fit with the respondents' work activities had the early majority with the highest mean (4.4). Innovator and early adopter had a mean of 4.3. Late majority followed with a mean of 3.8. Innovator had the highest median (5.0) and mode (5.0). Late majority had a median of 4.5 and mode of 5.0. Early adopter and early majority both had medians of 4.0 and modes of 4.0.

Perceived usefulness: Compatible with organization's needs. The MDIS survey question on the compatibility of mobile with their organization's needs, in Table 10, provided a reverse of the standard MDIS survey results. The late majority had the highest mean value (4.7), followed by innovator (4.5), early majority (4.4), and early adopter (4.3). The median and mode values were also slightly reversed. Late majority and innovator had a median of 5.0 and mode of 5.0. early majority's median was 4.5 and its mode was 5.0. Early adopter had a median and mode of 4.0.

Compatibility with work resources. Table 10 shows the results of the MDIS survey question on the compatibility of mobile with the resources used by the

participants. Innovators' mean score was 4.4; early majority followed with 4.25. Early adopters' mean score was 4.1, and late majority's score was 4.9. The median and mode values for all four stages were 4.0.

What management thinks. In Table 10, innovator with a mean of 3.9 and late majority's mean of 3.8 were the highest values. Early majority's mean score was 3.6. Early adopter followed with 3.4. The median score for all stages was 4.0. The mode for innovator, early adopter, and late majority was 4.0. Early majority's mode was 5.0

Research Question 2 considered how older adults in the EC field perceive the ease of use of mobile technology in their workplace. The next eight questions in the MDIS survey examined perceived ease of use. The results are presented with the greatest difference between stages followed by the questions with less difference in mean, median, and mode.

Table 11

MDIS Survey Questions 4.1–4.8: Perceived Ease of Use—Composite Descriptive Statistics

Stage	Mean	Median	Mode
Innovator	4.1	4.0	4.0
Early adopter	3.9	4.0	4.0
Early majority	3.7	4.0	4.0
Late majority	3.3	4.0	4.0

Note. $N = 85$. Five early adopters answered N/A. Four early majority answered N/A.

Composite descriptive statistics. The combination of results for all eight MDIS survey questions based on the second construct, perceived usefulness, showed a small

difference in values between innovator and late majority as seen in Table 11. The innovator values for the mean (4.1), median (4.0), and mode (4.0) are slightly higher than the values for early adopter with mean (3.9), median (4.0), and mode (4.0). Early majority had a mean (3.9), median (4.0), and mode (4.0). Late majority had the lowest mean (3.3) and a median (4.0), and mode (4.0). The results suggest that for the MDIS surveyed EC workers all four stages of adoption saw all eight different facets of ease of use as helpful for their adoption of mobile technology.

Table 12

MDIS Survey Questions 4.1 to 4.8: Perceived Ease of Use

Question	Innovator	Early adopter	Early majority	Late majority
I feel (would feel) comfortable using mobile. (*N* = 81)	4.5	4.5	4.1	3.7
Mobile is (would be) compatible with my level of technology expertise and experience. (*N* = 84)	4.3	4.3	3.9	3.8
Learning to use mobile technology is (would be) easy for me. (*N* = 85)	4.3	4.2	3.7	3.0
I am (would be) able to use mobile communication tools quickly and easily for my learning. (*N* = 85)	4.0	4.0	3.6	3.0
Innovation and experimentation are encouraged at my institution. (*N* = 83)	4.0	3.6	3.7	3.3
It is (would be) easy for me to remember how to perform tasks in mobile. (*N* = 84)	3.9	4.1	3.9	3.3
My management supports/encourages the use of mobile. (*N* = 83)	3.7	3.8	3.7	4.2
My institution provides professional development activities to help employees learn and use mobile. (*N* = 85)	3.4	2.9	2.7	2.8

As expected, the values, particularly of the mean, generally decreased from innovator to late majority. For the individual questions, Table 12 displays the question and mean averages by stage.

Comfort level using mobile. The greatest distinction for perceived ease of use was seen in the MDIS survey question asking about participants' comfort with mobile. Innovators and early adopters had a mean score of 4.5. The early majority participants' mean was 4.1, and late majority was 3.7. The mean scores were 4.5 for innovator, 5.0 for median, and 4.0 for early and late majority. The mode scores for innovator and early majority were 5.0. The early and late majority mode scores were 4.0.

Mobile compatible with expertise and experience. The compatibility of mobile technology with the participants' expertise and experience had a mean score of 4.3 for innovators and early adopters. The mean score for early majority was 3.9 and for late majority was 3.8. The median and mode score for all stages was 4.0.

Learning to use. The ease of using mobile for learning was lower, in the range of *strongly agree* to *strongly disagree*. The mean score of innovators was 4.3, early adopters was 4.2, early majority was 3.7, and late majority was 3.0. The median and mode scores for innovator, early adopter, and early majority were 4.0. Late majority had the lowest median (3.0) and mode scores (2.0).

Quick to learn and easy to use. MDIS survey questions asked about the ease of use and the ability to learn quickly to use mobile tools. Innovators and early adopters' mean, median, and mode scores were 4.0. The early majority' mean was 3.5 and the

median and mode scores were 4.0. Late majority's mean and median scores were 3.0, and the mode was 4.0.

Innovation and experimentation. A survey question asked about the support of innovation and experimentation in the participant's organization. The innovators had a mean, median, and mode of 4.0. Early majority's mean was 3.7, early adopter's mean was 3.6, and late majority's mean was 3.3. All four stages had medians and modes of 4.0.

Easy to remember. Early adopters had the highest mean for the degree of ease to remember how to perform tasks, at 4.1. Innovators and early majority mean scores were 3.9. Late majority had the lowest mean score of 3.3. Innovator, early adopter, and early majority had median and mode of 4.0. Late majority's median score was 3.5, and the mode was 4.0.

Management encouragement. The results of the MDIS survey question on the support of mobile by the participants' management provided almost the opposite of the expected results. Late majority had the highest mean value (4.2). Early adopter had the next highest mean value of 3.8. Innovator and early majority had the lowest mean values of 3.7. All four adopter stages scored 4.0 as the median score. Early adopter, early majority, and late majority's mode value was 4.0. Innovator had the lowest mode value of 3.0.

Professional development. The results for the MDIS survey question on the degree of professional development activities designed to help the participants learn and use mobile in their organizations. Innovators had the highest mean score (3.4) followed by early adopter (2.9) and late majority (2.8). The lowest mean score was early majority

at 2.7. The median scores ranged from innovator, early adopter, and early majority at 3.0 to late majority at 2.0. The mode scores were 3.0 for early adopter and 2.0 for innovator, early majority, and late majority.

Quantitative Results Summary

The results of the MDIS survey suggest that that both perceived usefulness and perceived ease of use affect the adoption of mobile technology by older adult users in the EC field. The majority of responses were *agree* to *strongly agree*. MDIS survey participants saw the two constructs described by Davis (1989) as important factors in mobile adoption.

The majority of MDIS Survey results matched the expected results based on Rogers (2003) stages of adoption. The scores generally declined when the results were examined for innovator, early adopter, early majority, and late majority. There were exceptions, but they may be the results of smaller stage groups.

The low incidence of *strongly disagree*, *disagree*, and *neutral* across all stages and age groups may be the result of the career being examined. EC requires the use of portable and versatile mobile equipment that can be used on the scene of an incident. Further, mobile technology can collect data from first responders and citizens in as rapid a manner as possible. The other factor that was noteworthy was the length of time that the older adults had used mobile—in many cases more than 10 years. That is notable for a more recent technology.

In the qualitative data analysis section, interview data that was collected to gain a deeper understanding of the MDIS survey results and to address Research Questions 3 and 4 are presented.

Qualitative Components

The survey instrument included a request for volunteers for interviews. The volunteers were selected based on their stage of adoption (Rogers, 2003). The selected participants came from the lowest stages of adoption based on the participants reluctance to adopt new technology. The qualitative data analysis utilized the elements of situated meaning structure for a phenomenological investigation (Merriam, 2002). Interpretative phenomenological analysis was used to analyze the qualitative interview data to gain a deeper understanding of the phenomenon under investigation. The interviews were designed to draw information about the participant's life, social interactions, and work (Smith & Osborn, 2007). According to Smith and Osborn (2007), participants reflect on their interactions with the world and researchers reflect on the participants' reflections. Demographic questions were asked to help generate an understanding of the participants' interactions and adoption of mobile technology.

The interview participants were selected from the participants who volunteered at the end of the survey. On the survey, there was a question for non-Everbridge responders that asked if they were willing to be interviewed. Thirty one survey responders initially responded "Yes." The 31 responders were contacted in order of their stage of adoption from late majority to early majority then early adopter and finally innovator. Fourteen survey participants, when contacted, did not respond. Of those who responded, the stages

of the 10 participants interviewed consisted of one late majority, four early majority, four early adopters, and one innovator. The survey had the self-reported stages of adoption as 37 of the older adult participants as early adopters, 11 as early majority, nine as innovators, and four as late majority.

No female participants accepted the invitation for the interview. As a result, all the interview participants were male. The age range of the participants was between 50 and 65 years old. Two participants were between 50 and 55 years old, five between 56 and 60 years old, and two between 61 and 65 years old. No participants were over 65 years old.

The expertise of the participants matched their stages with one exception. All early majority and the innovator reported that they had a high expertise using mobile technology. All late majority and early majority users, except one, reported they had moderate expertise. The one exception, Brian, stated he had high expertise in mobile and was an early majority user. This match of high expertise and a lower stage could be because he stated he had used mobile devices for over 10 years. He was one of the four participants who had over 10 years of experience with mobile. There were two participants with 7 to 10 years' experience, four participants with 6 years, and one with 3 years' experience. The full demographic details are in Table 13.

Table 13

Interview Participants' Demographic Data

Pseudonym	Age range	First used a mobile device	Expertise using mobile	Stage
Daniel	61–65 years old	More than 10 years ago	High	Innovator
Arthur	50–55 years old	4–6 years ago	High	Early adopter
Dick	56–60 years old	More than 10 years ago	High	Early adopter
Ken	61–65 years old	More than 10 years ago	High	Early adopter
Ron	50–55 years old	7–10 years ago	High	Early adopter
Larry	56–60 years old	7–10 years ago	Moderate	Early majority
Edgar	56–60 years old	1–3 years ago	Moderate	Early majority
Charles	56–60 years old	4–6 years ago	Moderate	Early majority
Brian	61–65 years old	More than 10 years ago	High	Early majority
Abner	56–60 years old	1–3 years ago	Moderate	Late majority

The interview participants who responded to the invitation e-mail were sent the interview consent form by e-mail and the interview questions. The interviews were scheduled and then recorded using GoToMeeting. Before the interview, the participants were reminded not to provide any personally identifiable information. After the recordings, the interviewees were asked if they had anything else to say or any comments on the interviews. All 10 participants were satisfied with the interview, and several asked for a copy of the dissertation when it was finished. The interviews were stored on a secure computer, and pseudonyms were given to all the participants. The recorded

interviews were then sent to a transcriber after a nondisclosure statement was obtained and the IRB Committee had approved adding a transcriber.

The returned transcripts were formatted for auto-coding by NVivo and added as sources. The questions were set as nodes. Queries were run for word frequency in the transcribed interviews. The transcribed interviews were manually reviewed for themes using the query results and survey results. The themes found were added as nodes.

Interview Results

The purpose of this study was to examine the experience of older adults in the EC field with the adoption of mobile technology through a mixed-methods study based on Rogers's (2003) diffusion of innovations theory and Davis's technology acceptance model (TAM). The two research questions that were the focus of the interviews were

3. How do older adults describe the discrete factors that affect their adoption as they relate to ease of use and usefulness of mobile technology in the EC workplace?

4. How do older adults describe the impact of these discrete factors as they relate to ease of use and usefulness on their adoption and use of mobile technology in the EC workplace? Do the interviewed older adults have suggestions to enhance the usefulness or ease of use of mobile technology?

Research Question 3 identified and described the discrete factors that affect the adoption of mobile technology. In Discrete Factors—Perceived Ease of Use, these factors were examined. Research Question 4 looked at the effect, as perceived by the participant, caused by the identified discrete factors. The section, titled Impact of the Discrete

Factors, presented the effect on adoption of mobile technology of the factors delineated in Research Question 3.

The results compare themes found in the interviews broken down by the constructs perceived ease of use and perceived usefulness and reviewed by stage.

Discrete Factors That Affect the Adoption of Mobile Technology in the EC Workplace

Perceived ease of use. In the survey, discrete factors were listed offering the participant the option to rank them based on the participants' perception of the factors value. The interviews added depth to the survey findings by giving the participants the opportunity to provide more detail on the factors and expand into factors that were not directly covered by the survey.

The survey used interval scale questions. The questions could determine if the respondents agreed or disagreed with a statement about mobile adoption. The interview used open-ended questions. The interview provided reasons and vocabulary that could not be derived by the survey's questioning of the constructs. Research Question 4 examined the depth and impact provided by the interviews. The first construct examined was perceived ease of use.

Five factors are under perceived ease of use that affected mobile adoption. They were (a) technical background, (b) assistance, (c) education and training, (d) self-initiative, and (e) simplification. These discrete factors are listed in the order in which they were most frequently stated by the 10 participants. The number and stages of the

participants were one late majority, four early majority, four early adopters, and one innovator.

Technical background. The most common factor related to the adoption of mobile technology under perceived ease of use was technical background. Eight of the 10 interview participants mentioned technical background as a factor in adopting mobile technology. The breakdown by stage was one late majority participant, three early majority, three early adopters, and one innovator. This factor was defined as experience with technology, and mobile devices. Participants also described the impact of having a background in information technology. Brian, considered an early majority adopter, described his extended experience with smartphones:

> Mobile devices, smartphones, I have been using for 20 years. I have had about five different models of Sharp phones . . . I think I had some flip phones in between that were useless because the screen was too small. Now, I am running with an iPhone.

Their experience with computer technology was a factor that carried over to mobile technology for all of the participants. As an example, Abner, considered an early adopter, described his past technical experience.

> Most recently, I have used wireless laptops and smartphones. Before that I used, satellite phones when I was in the Department of Defense for telemedicine from Korea back to Hawaii. We were bouncing medical parameters, medical demographics and using a satellite phone. We were sending x-ray images, MRI, CTs and patient demographic information…around 1986 to 1990.

Assistance. Assistance was the next most common factor in the adoption of mobile technology. Seven participants, three late majority and four early adopters, described assistance as a factor. Assistance primarily came in two forms. The first was defined as assistance from friends and family. Charles, considered an early majority adopter, learned from his wife.

> On a personal level, no, I didn't have a smartphone at all until the company issued them to us. My spouse, on the other hand, picked up an iPhone, I think it was an iPhone 4, so she's been out there for a while.

The second was defined as assistance from colleagues or management. Daniel, considered an innovator, discussed assistance from colleagues: "Of course, they are very eager to share. You raise the consciousness of all the people in the room. So some of it is done that way… I'll show you how this works when you bring in new people." This assistance could be formal mentoring or informal demonstrations.

Self-initiative. The third most common factor was self-initiative. The participants who were willing to experiment with their mobile devices had an enhanced mobile adoption. Self-initiative was defined as exploration and trial-and-error activities that helped to familiarize the adopter with the technology and application to work and life needs. Larry, considered an early majority adopter, highlighted this approach "Well I started playing with it first." This factor often accelerated the ability to use mobile technology by making the device easier to use. As Abner described, "I one of those who used and started playing with it and found out how it worked in my personal life for…doing income taxes and keeping track." Six participants identified self-initiative as

an important factor in mobile adoption. The participants included one late majority, one early majority, three early adopters, and one innovator.

***Simplification*.** The fourth most common factor was simplification. Six participants highlighted simplification as a factor. Simplification is the practice of reducing the feature set of the device by focusing only on the applications needed or the applications that were the easiest to use. The participants included one late majority, two early majority, and three early adopter participants. The participants defined this factor as the process of ignoring applications that required detailed configuration, more complicated user interfaces, or unclear documentation. As described by Arthur, considered an early adopter, "Again I think there are probably a lot of things that are available in applications on smart devices today that we're not taking advantage of that I could certainly use." Simplification was a factor in cases where the participants used only the most critical applications for a task. Three participants described focusing solely on the tasks that were needed by work or family communications. Brian, considered an early majority adopter, shared this focus, "I'm a management consultant, so I'm using mine mainly focused on business." These participants ignored other applications of the mobile devices.

***Education and training*.** The least frequently mentioned factor was education and training, with only four participants stating this factor was an issue: one late majority, two early majority, and one early adopter. The role of both academic education and corporate training was a factor in the adoption of mobile technology. Academic classroom work could both directly train on the use of mobile and indirectly help in the adoption of

mobile technology by providing opportunities to use it in the classroom and through student or teacher course communications or materials sharing. As described by Abner, considered a late majority adopter, “They’ll post their lessons. I will grade them online. I will send them back. I can do all that in my smartphone.” Corporate training usually focused on the use of a product or internal process, such as human resources or expense reporting, which depended on mobile adoption. As an example, Arthur, considered an early adopter, said, “If I were sending a team of people out to do a survey of some sort then I would have a training related to how you use the device to conduct the survey.”

Perceived ease of use summary. The survey provided perceived ease of use results for four of the five factors found in the interviews. Three of the demographic questions referenced the technical factor. The questions were Question 3, the devices they used; Question 4, when they started using a mobile device; and Question 5, how they described their level of expertise in using mobile devices. The survey results showed a variety of devices used by all 10 of the interview participants. The years of use of mobile devices generally matched the stages reported by the participants. These results were in line with the information provided in the interviews. The participants described how the experience of their years of mobile use affected their adoption. Research Question 4 explored the impact of the specific factors on adoption identified by Research Question 3.

The factor of education and training was reflected in survey questions that asked the participants why mobile use may or may not be beneficial, mobile technology’s compatibility with most aspects of their learning, and the ability to use mobile

communication tools quickly and easily for their learning. All participants scored the survey questions with a mean that ranged from agreement to strong agreement.

The factor self-initiative was in two survey questions. One question asked if innovation and experimentation were being encouraged at their institution, and the second referred to the participants' capability to remember how to perform tasks in mobile. Mean, median, and mode were all lower in comparison to the other factors in the survey, but the interview results suggest it was an important factor.

There was only one question in the survey that covered the factor assistance. The survey question made reference to the participants' colleagues' use of mobile. The mean scores ranged from slightly above neutral to agreement. In the interviews, all of the participants mentioned assistance.

There were no questions related to simplification in the survey. However, the role of simplification as a factor was revealed in the interviews. Several participants used simplification to help them focus on what they needed to use rather than allowing the wide range of features to overwhelm them. The focus on simplification might involve only using the work or life applications they needed.

Perceived usefulness. Five factors emerged from the interviews. These are presented in the order of the number of participants identifying the factors: (a) gathering information, (b) comfort, (c) used or required by employer, (d) message modality, and (e) applications available. The discussion of each factor includes the total number of participants who described the factor and the breakdown by stage of adoption of the participants.

***Gathering information*.** The most common factor noted by nine of the 10 participants was the ability to gather information when away from their desk or a Wi-Fi connection. One late majority, four early majority, three early adopters, and one innovator discussed gathering information. EC require workers to be able to respond to ever-changing conditions from their current location, whether it is at an incident site, home, on the road, or in a remote locale. As Arthur, considered an early adopter, recounted, "You can be almost anywhere and still get the information. It allows you to send information to people and to get it back." The ability to search the Internet using mobile and handheld devices was also noted as a key factor. Ron, considered an early adopter, related this usage,

> I do some amount of text messaging with friends, family, and coworkers as necessary or extracurricular activities as well. I do quite a bit of email from my phone. I do a lot of information feeds, such as news, definitions or Wikipedia, or whatever.

Comfort. The second most commonly cited factor was comfort. Seven participants raised the issue of the lightness of a device and its portability. These participants included one late majority, two early majority, four early adopters and one innovator. Participants reported that the lightweight of mobile devices combined with the mobile devices network connectivity in almost all U.S. locales provided a very easy way to utilize technology. Daniel, considered an innovator, enjoyed the comfort of being kept in touch with critical events and emergencies almost instantaneously. Participants also noted the usefulness of mobile technology due to the transportability of the device and its

small size for storage. Daniel mentioned that he was “completely comfortable to the point that that’s how business is transacted.” Ken, considered an early adopter, described the value to an EC user.

> I am very comfortable using smartphones, and I use them for all sorts of things, whether it is just rudimentary things like text message but also for other things. I’ve got apps that allow me to share large text files between things and so I feel like from emergency management standpoint it's a very useful device and with a number of apps that are growing…I feel like it's a tool that the I'll continue to be using in the future.

Additionally they reported that the power-to-weight ratio was very favorable. Ken noted that “I carry it with me all the time, this iPhone does everything I need to do. Why do I need to carry a tablet?”

***Used or required by employer*.** The participants’ employers generated the third most commonly mentioned factor. One late majority, two early majority, and two early adopter participants mentioned two major ways that employers required employees to use mobile. First, their management promoted the use of mobile technology. Ken, considered an early adopter, noted, “I have to be able to invest [time] in it because of my state emergency management agency.” Second, management required it, was based on the services or technology they used. Abner, considered a late majority user, said, “I think what’s important is I could not do the job I’m doing, I would truly be retired if it wasn’t for using mobile technology.” ECs using global positioning services (GPS), instant messaging, and image transmission was an integral part of many first responders and

operation centers. Ron highlighted programming that drives mobile devices: “I find particularly helpful are the additional features they programmed, for example, the GPS tie-in.” The role of mobile technology in their careers created a very high perception of usefulness. Often the adoption of mobile technology was a condition of employment.

Message modality. The next most commonly cited factor leading to mobile adoption was the ability of the mobile devices to handle voice, text, and e-mail. Five of the participants named this factor: one late majority, two early majority, and two early adopters. Each mode of messaging was present in a variety of environments and end users. Abner, considered a late majority adopter, noted the need for multiple modalities especially when communicating with younger friends and colleagues.

> I happened to learn…that they don’t like to talk on the phone, they would rather text. It changed my plan for my smartphones so that I had more texts and less voice because they don’t really care to talk to me or anybody else. And so, you know, when I do communicate with them, it’s almost always text or email. It’s very rarely voice.

Edgar also agreed with the value of the range of uses of the smartphone.

> From a mobile perspective, I use a smartphone constantly. [I use] the calendar, the texting, the SMS messages, texting, checking email, [for] staying in touch with the office. Today, our email system went down for half a day. The only way I knew where to go and what to do was because I have the calendar on my phone.

As an example, the message modality that required the least bandwidth and had the fastest delivery was text. Using text is critical in an emergency when landlines could be

down and the networks are saturated with activity. Several interview participants also discussed the need for mobile texting to communicate with their children or grandchildren.

***Applications available*.** The final key factor participants described in the interview was the role that mobile applications (apps) played in the adoption of mobile due to usefulness. The same number of participants named this factor as named the message modality. These participants were one early majority, two early adopters, and one innovator. The role of work applications to drive adoption was noted earlier, but other apps also provided greater usefulness. Dick, considered an early adopter, said, "You can run lots of apps. I can pick up my documents in my PC and sync them on my smartphone. Then I have them all with me at all times." GPS allowed the mobile device to serve as a GPS driving device. Personal use while traveling was described by Abner, considered a late majority user, "I got a smartphone app so I'll find a La Quinta and we'll make a reservation, you know, electronically." GPS also allowed the immediate location of first-time responders during a crisis for the emergency operation center and other team members. Expense reporting, camera, and video capturing, and the availability of literally hundreds of business, safety, and informational applications also helped drive mobile adoption.

Perceived usefulness summary. The interviews deepened and added to the understanding of the survey results. The most frequent factor measured in the survey was "used or required by work." The survey questions asked about (a) how apparent the results of using mobile for work were, (b) how mobile fit with their work activities, (c)

how compatible mobile was with their organization's needs, (d) how compatible mobile was with their working resources, (e) the importance of management's mobile concerns, (f) the existence of mobile training activities, and (g) if management was supportive of mobile adoption.

The mean score of the role of work and management in furthering the adoption of mobile in the surveys ranged from agreement to strong agreement. The data gleaned in the interviews supported the results of the surveys. The participants are members of a mobile-dependent work area, EC, which makes the results predictable.

Two survey questions were related to comfort as a factor. The first was whether learning about mobile was easy; the second was whether the participant felt comfortable using mobile. Both questions described comfort although not focused on the size of the mobile device or its portability.

Although the survey could identify the degree of agreement with a question related to an identified factor, Research Question 4 provided a deeper insight into the impact of these factors based on the perceptions and experiences of the interviewed participants. The impact went beyond the "what?" into the "why?" of the mobile adoption factors. Research Question 4 broke the factors into the two constructs, perceived ease of use and perceived usefulness.

Impact of Discrete Factors on the Adoption and Use of Mobile Technology in the EC Workplace

Perceived ease of use. The construct perceived ease of use generated five factors. The factors were (a) technical background, (b) assistance, (c) self-initiative, (d) education

and training, and (e) simplification. In this section, the factors are listed in the order of frequency of occurrence. The discussion of each factor will start with the lowest adoption stage, late majority, where applicable, and continue with the higher adoption stages.

Technical background. Participants at all the stages of adoption felt the significant impact of a technical background on the ease of adopting mobile technology. Abner, considered a late majority adopter (which is the stage least likely to rush into the adoption of a new technology), drew from his experience to ease his perceived use of mobile. Abner's experience helped him handle the new technologies he faced at work such as mobile.

> Most recently, I have used wireless laptops and smartphones. Before that, I used satellite phones when I was in the Department of Defense for telemedicine from Korea to Hawaii. We were bouncing medical parameters, medical demographics, with a satellite phone around 1998. I am very comfortable [with technology]; I've lived with them all the time.

Considered an early majority stage member, Charles, echoed that he was comfortable with earlier technology such as the Blackberry phone, which he found more intuitive. Smartphones, such as an iPhone, were less intuitive for him. In part, the Blackberry was more like a phone, whereas the iPhone was more like a small computer.

Considered an early adopter, Dick has been in information technology for 33 years. This technical experience has helped him transition into new technologies such as mobile. He remembered using e-mail for the first time to communicate between the United States and the United Kingdom. He related the progressions from mainframe e-

mail to UNIX, then PCs, and finally mobile. He talked about it in a way similar to the way that older adults might discuss the changes in automobiles or flying. Progress was to be expected and needs to be experienced.

Daniel, considered an innovator, tied his adoption stage to his experience and mobile adoption. The role of experience and experimentation to drive adoption matched the characteristics of an innovator as described by Rogers (2003). Daniel said, “I’m very comfortable with them [mobile devices]. I tend to be a power user so I tend to go for a lot of technical features or try to see what advanced feature something might have.” Daniel has programmed computers and has always explored new technology successfully.

In the survey, the participants agreed that technical experience and use were important. In the interviews, the role of experience and the willingness to try new technologies based on past technology usage was shown.

***Assistance*.** The impact of assistance was the next most frequently referenced factor under the construct perceived ease of use. Help by family, friends, or work colleagues to use the mobile device defined this factor. These responses ranged from informal help that was offered as needed to a relationship that was very close to mentoring. Brian, considered an early majority adopter, described a family relationship:

> My daughter is a network administrator for Corel, so she keeps me linked up a lot there. My son uses a lot of technology going back and forth. He’s a mechanic, he’s getting things like repair manuals online, et cetera. So our functionality is a little bit different but we do keep in touch electronically through various means and methods.

The help was from Brian's family and provided on an ad hoc basis, when there was a reason to help or a feature his children thought he needed. Daniel, considered an innovator, talked about assistance that came from workers in an informal manner.

> Oh I think that's just a common thing because you'll sit at a meeting and somebody will be using, for example, their notebook to project PowerPoint presentation or they now put their tablet to project the PowerPoint presentation. Somebody else looks and then goes "How did you do that kind of thing." Of course, they are very eager to share. So then, you raise the consciousness of all the people in the room.

Larry, considered an early majority user, described a more formal relationship. His relationship bordered on mentoring with a trusted advisor.

> Well, I started playing with it first. I would hit a snag, and I would call a trusted advisor, they'd call me a fool again, and then get it straight. Pretty soon, I figured it out. The aversion therapy of being called a fool, no I'm kidding, but yeah, I eventually picked it up and some of it was, some of it there was some bad moments but for the most part it came easily but then I've messed with technology in the EOC is using web EOC and things like that in the past.

For Larry, mentoring combined with his past technical experience helped him adopt mobile. Rogers (2003) noted that assistance could be provided by the champions and change agents to help users adopt a technology. Champions use a technology and promote it in the company. Change agents can be employees or outside consultants that help other members adopt the change.

In the survey, the participants agreed that having family, friends, and colleagues who used mobile technology was useful. In the interviews, the vital role that associates played in mobile adoption was described. Family, friends, and colleagues could be change agents who help influence the adopters to champions who can influence much larger groups by their influence and new technology evangelism (Rodgers, 2003).

Self-initiative. The ability to explore and play with a new technology can be very valuable in the adoption of a new technology. All these skills were prerequisites to using a computer-based phone system. Hunger and travel needs affected Abner's desire to adopt mobile technology, even though he was a late majority user.

> So, for example, I'm a big fan of Waffle House, which is only really in the south mainland US, it's not out Las Vegas. So, when I'm travelling, one of the first things I do when I hit the ground is to find out if there's a Waffle House nearby because I'm going to have cheese grits for breakfast the next day. So its things like that, when we're traveling, I use my Urbanspoon app to look for places to eat.

Arthur, considered an early adopter, used it to take pictures of nameplates and individuals to help remind him of key personnel. It keeps this critical information close to him and in a graphic format. The use of note taking was not as helpful as seeing the name, role, and a picture of the person he was interacting with at work.

The most basic use of self-initiative is "just use it." Facer et al. (2004) noted the value of the use of gaming by mobile applications to help drive user adoption and learning. Charles, considered an early majority user, highlighted this factor.

> When I got the iPhone I said, hey I don't know the first thing about this, what do I do with it? And the response I received [from my colleagues] was, "Hey it's intuitive, just turn it on and follow the prompt."

The survey did not focus on the role of self-initiative directly. The degree to which the user interface provided the freedom to experiment and the willingness of the older adult adopter to experiment were key adoption factors identified in the interviews.

***Simplification*.** Simplification, as a factor, focused on the use of the most basic features needed to perform a task or meet work usage requirements. The mobile adopter learns what is needed to handle critical tasks and may not explore further features. Arthur, although considered an early adopter, expressed this approach.

> Well, I discovered it on my own for the most part and I probably, honestly have only just scratched the surface of what my mobile devices are capable of. I was born at the tail end of the Baby Boom so I came up through—the first computer I was ever exposed to was in college, and that was the mainframe where we had a number of terminals that were timesharing the processing.

As an older adult who was not part of later generations that grew up with computer technology, Arthur used a limited set of mobile features. In contrast, Dan, considered an innovator, sought out all that the mobile devices could do. Arthur used what he needed and what he could easily access. Brian described his mobile smartphone as a "handheld databank." That may be a very limiting definition based on the full power of a smartphone, but it defined his usage.

The interview did not have questions focusing on simplification. In the interviews, the adopter's ability to simplify the use of mobile for key work and life needs provided a mobile adoption pathway. Simplification tied into assistance where the change agents reinforced the key features. The assistance could be as simple as a child demonstrating how to text or a colleague helping with the key work applications. The fear of a complex interface with too many options and applications could be overcome by simplification.

***Education and learning*.** The use of mobile devices for education and learning was the least frequent perceived ease of use factor. Abner, considered a late majority user, was an instructor in an online university.

> I teach for the University. . .in their MBA program and their undergraduate nursing health administration program and their criminal justice administration program. The students have no idea I'm not in Hawaii. . . . They'll post their lessons, I'll grade them online, I'll send them back. I can do all that in my smartphone because I got mobile office on here. So everything comes up just like it normally would from the University . . . website. . . . I think the largest class I have was like seven students online. And honest to God, they don't know where I am, they think, literally think I'm in the same time zone they are, it's wonderful.

Abner found that the mobile smartphone was very useful both for his work as an instructor and his students' work in the virtual classroom.

Larry, considered an early majority adopter, described his office using a web-based emergency operation center simulator. Larry described his work role as shifting

from a practitioner in EC to a teacher. Testing using portable devices allows for the simulation of various scenarios in various locales.

One of the most common concerns about the use of mobile technology for learning applications was the size of a smartphone screen. Brian specifically stated this when asked if mobile technology was a good fit for learning.

> Generally no, and the reason I say that is the screen is too small and I haven't gotten into this electronic newspaper thing or anything like that, you know. With the iPad or whatnot it's a little better, but I would use an iPad or a PC or a laptop. As far as using a smartphone, I'm just not interested in wading through all kinds of material and scanning back and forth and up and down all day.

Brian's concern was echoed by three of the 10 participants interviewed. The size of the screen is perceived as too limited for use in a learning environment.

The survey showed the lowest mean score on the *strongly disagree* to *strongly agree* interval scale. Though positive, it had more neutral scores. The interviews showed that education activity, either as a student or instructor, helped increase mobile adoption among the older adults. In most cases, it was the facilitation of learning and use of the mobile device for classroom activities, schedules, and communication that was the adoption driver rather than mobile-based training.

Perceived usefulness. Five factors fell under the construct perceived ease of use. The factors were (a) gathering information, (b) comfort, (c) used or required by employer, (d) message modality, and (e) applications available. In this section, the factors are in the order of how frequently the interviewees discussed the factor.

***Gathering information*.** The use of mobile technology, especially the smartphone, for gathering information was the most common factor under perceived usefulness. Data collection is a prime adoption factor for mobile. The mobile user generates information or family, friends, or work generates it. Abner, considered a late majority interviewee, tied it to his work needs: "I am totally reliant on my smartphone when I'm traveling for attendance rosters and students who have shown for the pretest." Charles, considered an early majority user, echoed this view, saying he may use a smartphone for GIS navigation but other than that, it was for work.

Edgar, also considered an early majority user, described the addictive power of the Internet, social media, and mobile technology.

> But one of the reasons I find it useful is any time you're not sitting at your desk, you feel like you're missing something, you're out of touch. There's potentially something going on or someone needs to reach you and they can't. There's a certain efficiency and consistency of operations that happened when you know, whoever has to get a hold of you can do so. It's right there in your pocket wherever you go. So, I can see an e-mail or a phone call or [text] message. I'm always reachable. In some ways, it extends the office and has an intrusion into your personal life but on the other hand, to a certain degree, it lowers your stress because when you know when there's something going on. You don't have to keep going back somewhere and check [something else].

Edgar noted a negative aspect of mobile technology in his work and personal interactions: "You are never really out of touch or off the grid. Workers and family can

expect to reach you instantly." Dick, considered an early adopter, also had to live with the balance between the need to be reached and the need to be left alone. He said,

> You have got to be able to get that information, response to the information as quickly as possible. And certainly within our business, clients need to be able to contact us at any time. It's not an unknown for clients to phone us up at 11:00 PM on Saturday or Sunday evening. It's very annoying [Laughs]. But it's a [fact of life].

Daniel, considered an innovator, saw the arrival of mobile as a new wave of work and personal technological dependency. The majority of American mobile users realized it was a necessity for today's world.

The survey covered the variety of mobile devices used and using mobile to search for information while working. More depth was provided in the interviews. The areas of use and need for the information in older adults' life and work were documented.

Comfort. Comfort can involve other usefulness factors such as gathering information. But comfort focuses on the adopter's feeling of power, safety, or awareness due to the features of a smartphone. The smartphone is an easily carried and ubiquitous device that provides critical information, networking to emergency information, and the ability to facilitate communication in dangerous situations. Daniel, considered an innovator, described the comfort it can provide.

> What they need to be comfortable with is the idea of being able to search and find. A case in point, we have a location in Phoenix. Three months back, 5:30 in the morning, I get an e-mail and a text because they want to make sure I got the

> point that there was a flood going on in Phoenix. My first response to that was to turn to Twitter and Facebook and start searching. I was able to pull together a mountain of facts about the flood in Phoenix within about the first half hour. Now, if you were going to depend on the radio and TV for that, you would be waiting hours.

Daniel appreciated that he was instantly warned of danger, even when he was away from workers and friends. He could use the same device to reach further information from sources that provided more information when needed than the standard media outlets. The smartphone is on all the time; it does not need a connection to an LAN cable and has network service throughout the United States.

The size of the smartphone is part of the comfort. Ken, considered an early adopter, expressed this: “I carried [an iPad] with me all the time but once I got the iPhone, I wondered ‘Why do I have an iPad?’ The iPhone does everything I needed.” The power of live communication and valuable applications in a small, portable, and connected device provides a degree of comfort to the adopter.

In the survey, participants were asked whether they were comfortable with mobile technology. In the interviews, the features and size of the mobile device were specifically called out. An example of an interviewee avoiding a potentially life threatening event helped establish the comfort that mobile technology can provide.

***Used or required by employer*.** The need to use mobile communications at work is a factor critical to mobile adoption. Abner, considered a late majority user, did not need a manager’s directive to use mobile.

> I'm currently on the East Coast visiting with family but I'm headed to Huntingdon, Pennsylvania, to teach a class on leveraging tools for community communications and disaster. And I just taught that course in New Orleans, and there're two other courses I teach. So I'm totally reliant on my smartphone when I'm traveling for updates to the curriculum for attendance rosters, students who showed up they have to take a pre-test.

Abner needs mobile technology to maintain his role as a traveling instructor. Mobile allows him to keep up to date on class activity and changing schedules.

Brian, an early majority adopter, discussed how dependent he was on mobile:

> I would be lost without it. In fact I lost an iPhone a year ago, I thought I was going into septic there for a bit, but I've got on my computer a backup with iTunes here. I also have hard drive backup to my PC. I masked over on laptop and I have a separate hard drive that I leave at my daughter's place beyond that. So, at least I'm not going into withdrawal symptoms if I did lose the actual device because I still have the technology available.

Brian's mobile device is so crucial to him that he has backed up the data and applications on four separate devices.

Arthur, considered an early adopter, was not as strong in supporting the need for mobile in his work.

> I think mobile devices really aren't very prevalent in my business yet and my business is local government but is becoming more prevalent all the time, but I

> think probably the biggest barrier or the biggest concern that we have is the network security issues that come with bring your own device.

Arthur works in a state and local government (SLG) workplace. He views the penetration of mobile technology in that workplace as just starting. Security is a critical issue that the SLG teams face. It is one of the issues that are slowing mobile adoption for SLG.

Daniel, considered an innovator, summed up the need for mobile technology in the workplace: “Is it absolutely required, yeah. There are no two ways around it.” The need for EC workers to be connected and able to send text and images at an emergency site makes mobile technology a requirement.

The survey asked several questions about the use of mobile at work. The survey identified how the mobile device was used, where it was necessary for emergency notification workers, and areas where adoption was trailing. In addition, the role of the workers as change agents was discussed.

***Message modality*.** Mobile technology’s ability to carry voice, e-mail, text, and graphical data is another factor supporting the adoption of mobile. Smartphones can provide access to personal and business e-mail. Carrying a laptop to a meeting or on-site session can be difficult. Many governments and universities restrict guest access to their network. Mobile carriers still work in all but specially shielded areas or very remote locales.

Abner uses mobile due to his migration from voice calls to text and e-mail.

> I happened to learn for example when they don’t like to talk on the phone, they’d rather send text. It changed my plan for my smartphones so that I had more texts

> and less voice because they don't care to talk to me or anybody else. And so, you know, I spend a lot, not a lot but when I do communicate with them, it's almost always text or e-mail. It's very, very, rarely voice.

Abner wants the text and e-mail capabilities that are available on his smartphone due to mobile technology.

Edgar, considered an early majority adopter, utilizes the multiple communication modes of his smartphone.

> From a mobile perspective I use a smartphone constantly, you know, the calendar, the texting, the SMS messages, checking e-mail, and staying in touch with the office. Today, our e-mail system went down for half a day. And the only way I knew where to go and what to do was because I have the calendar on my phone.

Edgar pointed out another advantage of having multiple modes of communication on his smartphone. The smartphone provides access to his schedule, mail and messaging when a network outage occurs at work. This is very important to an EC worker.

Daniel, considered an innovator, used an analogy to describe the growth in the need for adopting mobile technology. If you are a hunter, then the need for a tractor is slight. When your technology grows to farming, the need for a tractor becomes obvious. In the same way, mobile becomes more necessary as the modes of communication and need for connectivity increase in our society. The smartphone moves from a conversation piece to a needed business tool. Daniel further identified the role of mobile communications with social media such as Twitter and Facebook.

The survey asked if different message modalities were used but did not explain why or where each modality was needed. In the interviews, more depth was provided, describing the use ranging from simple family communications with children who only use texting to emergencies where text-based communication can be sent quickly and with fewer resources. The ability of the mobile devices to handle voice calls, e-mail, social media, and texting/SMS was an important factor for older adults' adoption.

Applications available. The number of applications available for mobile devices is growing daily. The applications provide more features and reasons to use the mobile device in personal and work environments. Abner, considered a late majority adopter, described the applications that helped him adopt mobile.

> I use my Urbanspoon app to look for places to eat. I use Trivago to find a hotel room, use Travelocity for airplane tickets. I got a smartphone app so I'll find a La Quinta and we'll make a reservation, you know, electronically and don't have to worry about showing up at 3:00 and they don't have any room, that kind of stuff.

The features offered in applications make the usefulness of the mobile device that much greater.

Ron, considered an early adopter, was led into mobile use by his family but then discovered the applications.

> So I mentioned earlier that I got my family on mobile technology ahead of myself. Once I finally did that, now it's really important . . . But again, using some of the other features, for example, GPS, audio and over time they're building more features and more functions in the phone aside from just the

> computing power and the voice. Things like add-ons. I mentioned heart rate monitor, you think it might be an add-on for taking infrared temperatures, checking a compass direction, which obviously it can already do. Another way that you can integrate other devices that I think is pretty powerful.

Ron described the applications that drew him into mobile and noted that the future offers more. Health monitoring applications and applications that integrate other devices with your mobile device are part of the concept of an "Internet of things," wherein all kinds of appliances, devices, and objects are connected via the Internet and controlled by an application.

Applications were not directly referenced in the survey but were viewed as important factors for adoption. The apps met personal needs and work responsibilities. Apps were recommended by family friends and colleagues (as part of the factor assistance). The apps also helped in common scenarios such as finding directions and less common uses such as health monitoring.

Perceived ease of use summary. Five factors were identified under the construct perceived ease of use. The factors were (a) technical background, (b) assistance, (c) self-initiative, (d) education and training, and (e) simplification. These factors provided a deeper understanding of the construct ease of use first introduced in the summary. The discussions provided the reasons for the survey responses by the participants of various stages of adoption.

Technical background identified the role of past technology in facilitating the adoption of mobile technology. The role of experience was in line with older adult

learning (Knowles, 1980). The participants often saw mobile adoption as one more stage in the progress of technology.

Assistance was the next most frequently discussed factor. It could be informal help when needed by a friend, family member, or coworker. It could also be more formal, mentoring by more experienced workers or trusted helpers. Assistance might also be spontaneous, a question asked during a presentation or meeting.

The ability of the older adults to try various features of the mobile device due to their self-initiative was also an important factor. It required the older adult to take the advice of “just try it” to heart. Self-initiative resulted in a greater confidence and the willingness to adopt mobile technology.

Using mobile in higher education programs and corporate training also helped older adult participants to adopt mobile technology. Mobile use was encouraged by older adults acting as instructors in programs or students. The key element that reduced the role of education and training was the small screen size.

Finally, several of the older adult participants used simplification to help them adopt mobile. This factor led some of them focus only on the needed applications for their work. Others focused only on the applications that allowed them to communicate with their families or coworkers. In either case, simplification helped the participant to avoid being overwhelmed by the wide variety of features and applications available in their mobile devices.

Evidence of Trustworthiness

The first issue of trustworthiness was to determine if the results obtained from the survey were reasonable and tenable. There were very few comments made on the survey. When comments existed, they often reinforced statements or raised questions to be addressed. These questions were addressed either by e-mail or during the interview. The interviews were recorded and transcribed. Review of the statements during the interview provided agreement with the recorded responses. None of the interviews were unclear or difficult to transcribe.

The second issue was transferability. The data were collected from adults over 50 years of age who were members of the EC workforce and the Everbridge LinkedIn group. This would make the findings applicable to older adults who are computer literate, able to use the Internet and participants in social media. The findings would be most transferable to older adult workers in EC, security, and incident management workplaces.

The final area was confirmability of the data collection and storage. Data were collected by electronic means. The survey was administered online, and the results stored in a secure external hard disk. The interviews were recorded online, transcribed by a company that provided a nondisclosure agreement, and stored on an external hard drive. The change to the procedure to use a third party company to transcribe the interviews was approved by the Walden IRB. The role of the researcher to reduce bias was followed.

Chapter Summary

Research Question 1 asked, “How do older adults in the EC field perceive the usefulness of mobile technology in the EC workplace?” The results for the survey

questions based on the perceived usefulness were that the participants' views ranged from agreed to strongly agreed. Late majority, the lowest stage, results averaged as *agree*, whereas the highest stage, innovator, averaged at *strongly agree*.

Research Question 2 was, "How do older adults in the EC field perceive the ease of use of mobile technology in the EC workplace?" The results obtained from the perceived ease of use survey questions were lower than the perceived usefulness questions. Late majority users' average for the ease of use questions was between over *neutral* and *agree*. The innovators were slightly over *agree*. The low results were primarily driven by the questions covering support by the institution and management.

Research Question 3 asked, "How do older adults describe the discrete factors that affect their adoption as they relate to ease of use and usefulness of mobile technology in the EC workplace?"

For perceived ease of use, five factors were identified through the interviews: (a) technical background, (b) assistance, (c) self-initiative, (d) education and training, and (e) simplification. For perceived usefulness, there were also five factors: (a) gathering information, (b) comfort, (c) used or required by employer, (d) message modality, and (e) applications available. These factors deepened the understanding of the scores seen in the survey by providing the reasons for the survey's rating of *agree* to *strongly agree*.

Research Question 4 asked, "How do older adults describe the impact of these discrete factors as they relate to ease of use and usefulness on their adoption and use of mobile technology in the EC workplace?" The impact of the specific factors was examined. Four factors positively impacted older adults' perceived ease of use and

mobile technology adoption. These were the role of experience from a technical background, assistance by friends and coworkers, the user's willingness to experiment, opportunities to take courses or training using mobile, and a willingness to reduce the scope to the features needed. Five factors impacted the interview participants' perceived usefulness of mobile technology. These were gathering needed and desired information for work and life, being comfortable with the mobile hardware and software, the required use of mobile technology at work, the multiple communication modes, and a wide range of applications that meet work and life needs.

The interviews provided additional depth to the survey questions and drew out the experiences, needs, and utilization of the older adults. In addition, there was a stronger focus on EC uses of mobile. Beyond the values of agreement, the interview provided a deeper understanding of why the older adults adopted mobile.

In the next chapter, a discussion of the conclusions and recommendations are offered. This included an interpretation of the findings, limitations of the study, recommendations for future research, implications, and recommendations for practice.

Chapter 5: Discussion, Conclusions, and Recommendations

This chapter provides an overview of the research problem, study design, research activities, and conclusions. The problem addressed in this explanatory sequential mixed-methods study was the need for older adults to adopt mobile technology to work in EC and other technical fields requiring mobile technology. The increasing number of older workers remaining in the workforce and the growth of mobile technology within modern work and life applications makes the adoption of mobile technology by older adults a critical life skill. The fact that older adults did not grow up with technology as did Generation X and Millennial workers further complicates the adoption of mobile technology by older adults.

The purpose of the study was to determine what factors influenced the adoption of mobile technology by older adults in the EC field. The study was designed to add to the research on older adults' adoption and use of mobile technology. The use of an explanatory sequential mixed-methods design provided both quantitative results through a survey and qualitative results to deepen the understanding of the survey through interviews. The survey explored Research Question 1 ("How do older adults in the EC field perceive the usefulness of mobile technology in the EC workplace?") and Research Question 2 ("How do older adults in the EC field perceive the ease of use of mobile technology in the EC workplace?").

The results of the survey indicated that older adults agreed with the importance of ease of use in their adoption of mobile technology. The participants indicated high values on the perceived ability to use mobile devices quickly, remember how to perform tasks,

as well as personal comfort with mobile technology use.. Perceived usefulness was high when mobile technology was integrated in the older adults' work and life activities. The effect of the range of Rogers's (2003) stages of adoption was seen. As anticipated, the level of acceptance by the innovators was higher than that of the early adopters, early majority, or late majority users for both perceived ease of use and usefulness.

Under the constructs of perceived ease of use and perceived usefulness, Research Question 3 asked, "How do older adults describe the discrete factors that affect their adoption as they relate to ease of use and usefulness of mobile technology in the EC workplace?" During the interviews, five factors were identified under perceived ease of use. The factors were (a) technical background, (b) assistance, (c) self-initiative, (d) education and training, and (e) simplification. Under perceived usefulness, there were also five factors found: (a) gathering information, (b) comfort, (c) used or required by employer, (d) message modality, and (e) applications available.

Research Question 4 asked, "How do older adults describe the impact of discrete factors on the adoption and use of mobile technology in the EC workplace?" A deeper analysis of the themes drawn from the factors found in Research Question 3 occurred. The interview provided an enhanced understanding of how, when, and where the factors affected mobile adoption. The older adults drew from their experience and environments to explain the role of all 10 factors found for the constructs of ease of use and usefulness.

Interpretation of the Findings

The interpretation of the findings presents the two constructs used for the study, perceived ease of use and perceived usefulness, which were reviewed in the research

literature. It includes a discussion about the role of this study in expanding the scholarly literature. The convergence of the increasing number of older adults remaining in the workforce and the need for older adults to use mobile technology is an important social and personal issue. It is important to understand which factors enable older adults to adopt mobile technology, as well as the impact of these factors. For older adults, the desire to remain productive (Timmerman, 2011) and the need to maintain their financial status under difficult economic conditions (Maestas & Zissimopoulos, 2010) have resulted in delayed retirement (Matz, 2011; Weber, 2013). However, to continue working, older adults need to remain competent in technology and avoid obsolescence (Lee et al., 2009). This study identified and examined how specific factors impacted older adult workers' adoption of mobile technology in the EC workplace.

Rogers (2003) described a range of stages of adoption based on the individual's approach to the adoption of an innovation. This study used Roger's stages of adoption to analyze both the survey and interview data that were collected. The responses by the individuals in each stage were examined. The survey and interview participants were part of a homophilous population (Rogers, 2003). The participants in the LinkedIn group were members of a homophilous population in that they had computer skills, social media awareness, and at least basic competency with Internet access. All worked in the EC field and needed the applications available by mobile technology.

The findings of this study differ from Rogers's previous research in a number of ways. Though Rogers's (2003) work led to a prediction that 2.50% of the participants would be in the innovator stage of adoption in this study, the percentage was higher at

11.76%. Rogers predicted that early adopters would be 13.60% of a sample population. In this study, the population of 62.35% was considerably higher. Rogers predicted the early and late majority to be 34.00%. In this study, the early majority was 18.82%, and the late majority was 7.06%. Rogers expected about 10% of the participants to be laggards. In this study, there were no participants in the laggard stage of adoption. The higher preponderance of participants in the innovator and early adopter stages could be due to the nature of this homophilous population. EC workers need to be able to adopt new technology that can be used in their event- and incident-driven activities. The findings in this study suggest that in the EC work community, there is a higher percentage of early adopter and early majority users than would be expected in the general population. This finding adds depth to Rogers's research on the adoption of technology by focusing on this particular population.

Though the results of this study are quite different from Roger's findings, overall the results more closely resemble those seen by Keesee and Shepard (2011). Keesee and Shepard surveyed adult college teachers who were required to use a content management system. These teachers were also part of a homophilous group who used technology in their work. One major stage difference can be noted between Keesee and Shepard's results and this study. In the Keesee and Shepard study, the laggard stage was indicated for 5.8% of the sample, whereas the corresponding percentage in this study was 0%.

Examining the survey results for their relation to Rogers's research suggested further differences. The mean score for all survey questions on perceived usefulness showed a small difference between innovator and late majority scores. The means

generally ranged from a higher score for innovators to a lower one for the late majority. Rogers's model would predict a larger difference in scores. The nature of the EC workplace may have caused the more homogenous results. New technology and processes are common for workers in the EC workplace.

The results of this study agreed with Davis's (1989) TAM model. In the TAM model, the adoption of a new technology could be enhanced by factors that help adopters perceive the technology's ease of use and usefulness. As Davis's research suggested, this study found factors that fit into one of the two categories and facilitated the adoption of mobile devices by older adults.

Though the constructs studied were the same, there is a distinction between Davis's (1989) work and this study. Davis focused on how to measure perceived usefulness and ease of use. This study built upon that work by using the constructs to determine the factors that specifically impacted older adult EC workers' adoption of mobile technology.

Davis's (1989) research, based on e-mail, focused primarily on work-related factors. As in Davis's research, the survey in this study indicated that the usefulness construct was more influential than ease of use. Davis's findings and those of this study are in agreement on the critical role of work in the adoption of a new technology. This study also added the role of social factors such as family, assistance, and management support. Davis's work predated the full impact of the Internet and the role of applications as usefulness factors. At the time, there was no need to use e-mail to gather information or to locate a particular address or service.

The results of this study differ from the range of factors found by Liu et al. (2010) in a study on mobile learning adoption. When this study was conducted (5 years after the Liu et al. study), mobile technology devices and infrastructure had become rich in content and very stable. Though Liu's study noted concern over the reliability and availability of mobile devices, no one in this study mentioned lack of dependability. Participants also accepted the ubiquity of mobile technology. Factors named in both studies were self-management and comfort with mobile technology.

This study's usefulness results agreed with the National Library of Medicine's (2011) meta-analysis, which found that perceived usefulness was tied to the understanding that a technology would help the participants in their work. The interview data collected for this study demonstrated the role that job requirements play in older adults' adoption of mobile technology. The National Library of Medicine also noted the addition of subjective normative and social factors. This study noted the role of assistance from family, friends, and work colleagues.

The results of this study on older adults were similar to the results found by Tan et al. (2012). Both studies found that participants reported mobile technology to be flexible, easy to use, and easier to adopt if assistance was available from change agents. Additionally, both studies highlighted the role of social factors in the adoption of technology.

Research Question 1 asked, "How do older adults in the EC field perceive the usefulness of mobile technology in the EC workplace?" There were eight facets of perceived usefulness in the survey that helped adoption: colleagues using mobile

technology, understanding the benefits of mobile technology, work that incorporated mobile technology, compatibility with learning, work activities, organizational needs, work resources, and management. The surveyed EC workers, from all four stages of adoption, saw eight different facets of usefulness as helpful for their adoption of mobile technology. As expected, the values of the mean decreased from the innovator to the late majority stage. Colleagues using mobile technology, understanding the benefits of mobile technology, and compatibility with the organization's needs received the highest mean scores. The lowest mean score was for considering what management thinks.

Research Question 2 asked, "How do older adults in the EC field perceive the ease of use of mobile technology in the EC workplace?" The highest mean score for participants was for being comfortable using mobile technology. This is important as older adults are perceived to be reluctant to adopt or use mobile devices. The next highest scores reflected the perceived ease for older adult EC workers to learn mobile technology and its compatibility with their level of technology expertise and experience. The level of technology exhibited by many older adults who participated in the rise of computer technology is an important factor in their adoption of computer technology. Again, as in Research Question 1, the role of management in supporting or encouraging the use of mobile technology was the lowest scored facet in this section of the survey.

The first two research questions added to current research by focusing on the degree of agreement by older adult EC workers based on activities centering on perceived ease of use and perceived usefulness. The results for these questions added to the limited research on older adults' adoption of mobile technology and EC workers.

Research Question 3 asked, “How do older adults describe the discrete factors that affect their adoption as they relate to ease of use and usefulness of mobile technology in the EC workplace?” During the interviews, five discrete ease-of-use factors were described: technical background, assistance, education and training, self-initiative, and simplification. Three of these factors were in the survey, but self-initiative and simplification were not. Older adult EC workers discussed their ability to drive their own adoption. Several participants described how they took the adoption of mobile technology personally. *Simplification* is the reduction of mobile device features to the few features necessary for work or life activities. Participants used simplification to make adoption of the mobile devices more rapid.

There were also five factors focused on perceived usefulness: gathering information, comfort, used or required by their employer, message modality, and applications available. Out of the five, three new factors were not covered in the survey, gathering information, message modality, and applications available. Gathering information was a key factor discussed in the interviews. The ability of mobile devices to gather news, critical events, and locations was a primary driver to adopting mobile technology. Adoption, for the participants, was enhanced by the mobile devices’ ability to collect email, SMS, instant messages, mobile phone calls, and Internet information. This provided a powerful tool for an EC worker. Another feature that made a mobile device more valuable to the participants was the variety of applications that could be used for work and in their lives. GPS locations, scheduling, communications, and emergency notification applications made mobile technology more desirable.

Research Question 4 was the following: “How do older adults describe the impact of these discrete factors on their adoption and use of mobile technology in the EC workplace as they relate to ease of use and usefulness?” The impact of the factors described under Research Question 4 focused on the effect of mobile technology on the lives and careers of the older adult EC workers. The participants’ interviews focused on the past and immediate impact that mobile technology had on their lives. In some cases, adoption was driven by the technological evolution in their lives and careers. The smaller size of the devices made them portable and easier to use at a crisis location. Many participants worked with earlier computer technologies and made the transition to mobile technology.

The factors were derived from the interviews of the older adult EC participants. Then, the factors’ impact on the older adult EC workers was determined through deeper analysis of the interview data. This analysis added factors to the research that can be further explored in the future to determine ways to encourage older adults’ adoption of technology.

Limitations of the Study

The limitations of a study delineate the areas of the research design or methodology that affected the researcher’s interpretation of the data and conclusions (University of Southern California Libraries, 2015). The limitations of this study were first due to the criteria for the selection of the sample population. The generalizability of the study was limited by the restriction of participants to the Everbridge Incident Management and Emergency Notification group. The sample members were computer

literate and employed in the EC field. In addition, the participants could access a social network site such as LinkedIn. This necessity excluded members of the older adult population who were not computer literate or involved in a field in which workers used mobile technology for communication.

There was no demographic information captured on the LinkedIn site for the age of participants. The goal was 100 survey participants; 85 took the survey. No laggards who took the survey, which was not what would have been predicted by Rogers (2003).

Ten participants agreed to be interviewed, which was in the desired range of 10–15 participants. Only one person in the lowest stage represented by the study participants, late majority, agreed to be interviewed. This resulted in selecting nine participants from the other stages, early majority (4), early adopter (4), and innovator (1). No women volunteered to be interviewed. This may have limited my ability to develop deeper insights based on gender.

Recommendations

This study presented the factors that affected older adults' adoption of mobile technology in the EC workplace. As the results demonstrated, the constructs of perceived ease of use and perceived usefulness aided the adoption of the older adults in all of Roger's stages of adoption who participated in the survey as well as the interviews. The recommendations are based on both research and practitioner interests and concerns. There are three recommendations. First, further research needs to go beyond older adults using social media. Second, further research should based on older adults who do not

have a strong technology background. Finally, future research should focus on older adults who currently do not use mobile technologies.

Further research could expand this study's contribution. Using a broader sample population of older adults who are not recruited through a social network would help generalize the findings. A population from an extended work environment, beyond the EC workplace, would also provide a greater opportunity to generalize results. Both populations would potentially provide participants who have a wider range of technical and computer expertise. Also, the need for mobile technology in their working or post-retirement careers could be measured. This might provide a wider range of adoption stages for the older adult population. Rogers (2003) estimated that laggards should make up approximately 10% of the population; however, no laggards participated in this study.

The analysis of the survey and qualitative interview data revealed that past technology expertise aided in older adults' adoption of mobile technology. A study focused on older adults who do not have these backgrounds could identify other factors that are critical in the older adults' adoption of mobile technology. A limited study of nontechnical users could also determine the percentage of older adults who do not want to or are unable to adopt mobile technology. Isolating the factors that hinder adoption would provide further areas of research into techniques to overcome these hindrances.

Another area that could provide future research opportunities is to engage older adults who do not currently use mobile technologies and apply the factors found to determine if and how they affected their adoption of mobile. A study that involved the application of the factors found affecting mobile adoption would require a longer time

frame, longer interaction with the sample population, and more resources. A quantitative pretest, posttest, and a qualitative interview using interpretive phenomenological analysis were used to understand how older adults adopt and experience mobile technology. This research would also be important to the EC workplace. EC practitioners need to know if older adults are willing to adopt mobile technology. Mobile technology is one of the most resilient communication modalities in a crisis and provides an extensive range of applications available through the almost universal mobile networks in the United States (Hamilton, 2011; Hwang & Tsai, 2011; Koszalka & Ntloedibe-Kuswani, 2010; Winter, 2000). Community and government sponsored mobile training programs could also use the gleaned research information to design their curriculum.

Implications

Social Change

Social change should be a key consideration for social science research. Understanding the factors that can enhance and accelerate mobile adoption in older adults provides an element of social change. The need to address older adult's impact on health care, the labor force, and economy is critical (National Institute on Aging, 2007). Older adults are working later in their lifespans and delaying retirement, either by necessity or by desire. The ability to maintain their technological competency, especially in mobile technology, will allow them to continue working in society. The inability of older adults to use mobile technology would be a severe handicap in EC, incident management, and other fields requiring immediate communication and multiple message modalities.

The demonstration of the ability of older adults to use current mobile technologies also weakens the stereotypes of ageism. Dittmann (2003), in an article on fighting ageism for the American Psychological Association, stated that older adults encounter ageism in the stereotypes they face and their treatment in the workplace, A tenet of ageism questions the ability of older adults to use new technology, particularly computer and mobile technology. Malinen and Johnston (2013) researched the attitudes toward older workers and concluded that workplace ageism cannot be ignored. Not only is recruitment and retention of older workers vital for older individuals and organizations, the cost of retirement income support is expected to increase dramatically in the near future. Therefore, fair treatment of older employees is essential for both economic and social reasons. This study helps to demonstrate that older adults are willing to adapt to new technology and can adopt it in their workplaces.

This study also helps to give voice to older adults. Research on their technology usage, current needs, and mobile adoption is light, especially in comparison with younger adults and other working adults. The interview provided a platform for older adults in the EC workplace to describe their technological ability and usage. This study found that older adults could and did use mobile technology if provided the factors that augmented their perceived ease of use and perceived usefulness.

Finally, mobile technology allows older adults to communicate with their families and colleagues. There is a need for social programs to promote the use of mobile communication for older adults. This would not only help in the workplace but in the

older adults' life. The interviewed older adults described the use of mobile applications in travel and social networking.

Methodological Implications

The methodological implications of a study analyze the effect of the methods used on the study's design and research. A mixed-methods study provides both quantitative and qualitative approaches to social research. The union of a statistical overview and theme-based interviews provides a more complete view of the subject and object of the study. This study used an explanatory sequential mixed-methods design. The union of the survey's statistically based method and the interviews qualitatively based method provided both the general overview of a larger population and the deeper insights and explanations provided by the smaller interview population. The survey, broken down first by the stages of adoption shown by Rogers (2003) and then by Davis's (1989) constructs of perceived ease of use and perceived usefulness provided an overview of the older adults' adoption preferences. The interviews, also broken down by the stages and constructs, provided a deeper insight into why, where, and how the constructs affected the adoption of mobile technology.

The interviews provided a validation for the statistical results, making sure the results derived from the survey matched the experiences of the interviewees. Areas of clarification, more detail, and new information were derived from the interviews. These elements strengthen the study's results.

Recommendations for Practice

Recommendations for practice provide the practical recommendations of the study for practitioners and organizations. Based on the analysis of the interview data, three recommendations can be made. In the EC workplace, the first recommendation is to offer training for older adult workers on mobile technology requires the training of employees in the general use of mobile and their particular mobile applications. Second is to use the employee's technical background to assist in their adoption of mobile technology. Third, facilitating assistance with mentor programs, promoting self-initiative, and providing formal education and training opportunities will help with the adoption and use of mobile technology. These endeavors, as with most technology adoption processes, should follow the employees' stage of adoption, experience, and needs

The analysis of the survey and interview data provided several additional recommendations. The practice of management supporting the adoption of mobile technology is an important practice. In the EC workplace, mobile technology is critical for immediate communication, gathering first responder's information, and broadcasting emergency information (Chandler, 2010).

Conclusion

In this study, the factors that impact the adoption of mobile technology by older adults in the EC community were defined and described. The need for older adults to adopt technology becomes more important as the population of older adults increases and the use of mobile technology becomes more prevalent. In the EC community, the use of mobile devices has become a required competency. The ability of older adults in the EC

community to use mobile also helps to weaken stereotypes found in ageism that prompt questioning of older adults' ability and willingness to adopt mobile technology. The perception that older adults can adopt new technologies, such as mobile technology, supports older adults' ability to work later, delay retirement, and continue working as a life choice. Corporations and organizations that are seeking to attract and keep older adults workers need to understand the factors that help in mobile adoption. This study has added a deeper understanding of the perceived ease of use and usefulness factors and the impact of those factors for older adults in the EC community. Corporations and organizations need to maintain the competency of older adult workers and the factors found in this study provide a basis for fostering older adult adoption of technology. If older adults cannot adopt a technology such as mobile technology, it will severely hamper their ability to obtain or maintain jobs in careers such as those in EC.

The current economic conditions in the United States are causing many older adults to postpone retirement and to continue working (Cutler, 2011). To continue working, older adults must adopt new technologies. Because more older adults are remaining in the workforce, corporate institutions need to understand the factors that drive technology adoption for older adults. One industry where mobile technology is especially critical is in the field of EC (Eriksson, 2010; Rhodes, 2008). The adoption and use of mobile technology are required for older adults to remain in the EC field. So the ability to continue working is affected by older adults' ability to keep up with technology changes in the EC workplace (Lisican, 2013). This study has added a deeper understanding of the perceived ease of use and usefulness factors and the impact of those

factors on the adoption of mobile technology by older adults in the EC community. This increased understanding of the factors that enhance or limit older adults' adoption of mobile technology may assist older adults to postpone retirement and continue working in the EC industry.

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Appendix A: Research Announcement for the LinkedIn Group

Bill Scerra, as part of his Ph.D. dissertation work for Walden University, will be conducting a survey on older adult mobile adoption. The information obtained will help organizations understand the factors that influence the adoption of mobile technology by emergency notification workers and managers over 50 years of age.

This age range encompasses the adult population that grew up without computer technology in their early years. It will help provide information about the willingness, needs, and interests of older workers using mobile technology.

Your participation is completely voluntary and should take no more than 20 minutes. The survey will allow you to use an e-mail address that will not identify you personally.

There will be people individually interviewed to provide more details on older adult mobile technology adoption. If you are willing to be interviewed, you will be able to signify that on your survey. Bill will contact you via the e-mail address you provide. The purpose of the interviews is to gather more in depth information and adoption concerns than the surveys. The survey should take 30 minutes or less and will be recorded. Your name and any personally identifiable information will be kept confidential.

If you have any questions on the purpose or content of the study, please conduct Bill Scerra at William.Scerra@waldenu.edu. If you have any questions on the conduct of this survey please contact Walden Universities Research Participant Advocate, Dr. Leilani Endicott, at 612-312-1210 or irb@waldenu.edu

Appendix B: Email Invitation for Survey

You are invited to take part in a research study about mobile technology adoption. The title of this study is Factors Impacting the Adoption of Mobile Technology by Older Adults in Emergency Communications. You are invited to participate in this study due to your membership in the LinkedIn Group, Everbridge Incident Management and Emergency Notification. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part. This study will be conducted by Bill Scerra, who is a PhD student at Walden University.

Background Information:

Procedures:

If you agree to be in this study and are over 50 years of age, you will be asked to:

1. Submit the consent form at the start of the survey.
2. Answer a 25-question survey. The survey will take approximately 20 minutes to complete.
3. The final question will ask if you are willing to be one of 15 participants who will be interviewed. The participants who will be interviewed must be 50 years of age or older.

You may review the tentative findings of this study for their plausibility if you wish. This review may take up to 30 minutes. Your comments about the tentative findings of this study can be e-mailed to me.

Voluntary Nature of the Study:
Your participation in this study is voluntary. This means that everyone will respect your decision of whether or not you want to be in the study. No one at Walden University or in your institution will treat you differently if you decide not to be in the study. If you decide to join the study now, you can still change your mind during the study. If you feel stressed during the study, you may stop at any time. You may skip any questions that you feel are too personal.

Risks and Benefits of Being in the Study:
A risk of participating in this study is that you may feel that some of the interview questions are difficult to answer. You may benefit from participation in this study by developing a better understanding of how mobile technology can be used by older adults.

Compensation:
There is no compensation for your participation in this study.

Confidentiality:
Any information you provide will be kept confidential. The researcher will not use your information for any purposes outside of this research study. In addition, the researcher will not include your name or anything else that could identify you in any reports of the study. The researcher will use pseudonyms for all participants in the study, and all data will be kept confidential.

Contacts and Questions:
You may ask any questions you have now, or if you have questions later, you may contact the researcher at his e-mail address. You may keep this form.

To take the survey, click on the following link: Mobile Technology Diffusion of Innovations Survey

Appendix C: Electronic Consent Form for Survey

As a member of the Everbridge LinkedIn Group, Everbridge Incident Management and Emergency Notification Professionals Group, you are invited to take part in a research study of older adults and mobile technology. The researcher is inviting older adults, over 50 years of age to be in this study. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

This study is being conducted by a researcher named William Scerra. He is a doctoral student at Walden University. You may already know the researcher as the Learning Officer of Everbridge, Inc. but this study is separate from that role.

Background Information:
The purpose of this study is to explore the area of older adult adoption of mobile technology. Many studies in the past focused on the deficiencies that older adults acquire rather than the ways to use new technologies to help older adults learn to maintain their working skills and quality of life.

Procedures:
If you agree to be in this study, you will be asked to fill out a 25-question survey.

- The survey will take approximately 20 minutes
- Complete the survey and it will be sent confidentially to the researcher.
- At the end of the survey, you will be asked if you would like to be interviewed to discuss the things that support or hinder your adoption and use of mobile technology.

Voluntary Nature of the Study:
This study is completely voluntary. Your decision on participation will have no impact on your standing as a member of the Everbridge LinkedIn Group, Everbridge Incident Management and Emergency Notification Professionals Group. You are free to drop out of the study at any time.

Risks and Benefits of Being in the Study:
Being in this type of study involves some risk of the minor discomforts that can be encountered in daily life, such as fatigue or stress. Being in this study would not pose risk to your safety or wellbeing.

The results of this study will be available to you upon written request. Your cooperation will help advance the research and training for older adult workers.

Payment:
There is no compensation for your participation in this study.

Privacy:
Any information you provide will be kept confidential.
The researcher will not use your personal information for any purposes outside of this research project. In addition, the researcher will not include your name or anything else that could identify you in the study reports. Data will be kept secure by encrypted data storage. Data will be kept for a period of at least 5 years as required by the university.

Contacts and Questions:
You may ask any questions you have now. Or if you have questions later, you may contact the researcher via e-mail at William.Scerra@waldenu.edu
If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University representative who can discuss this with you. Her US phone number is 612-312-1210 or the e-mail address to reach her is irb@waldenu.edu. Walden University's approval number for this study is 11-11-14-0110734 and it expires on November 10, 2015.

Please print or save this consent form for your records.

Statement of Consent:
I have read the above information and understand the study well enough to make a decision about my involvement. By checking the box and continuing with this survey, I understand that I am agreeing to the terms described above.

Appendix D: Mobile Technology Diffusion of Innovations Survey (MDIS)

Email Address: _____

Assessment ID:
WASDISS04

Instructions: Select a single answer from all questions where the answers are preceded with parenthesis "( )". Select one or more answers from all questions where the answers are preceded with brackets "[ ]". For any matching questions, enter the letter of the corresponding matching item inside of the brackets provided.

#	Question
	Demographics The demographic information will be used to help analyze geographic, age, and institution characteristics
1.	What is your age range? ( ) 50 to 55 years old ( ) 56 to 60 years old ( ) 61 to 65 years old ( ) 66 to 70 years old ( ) 71 to 75 years old ( ) 76 to 80 years old ( ) Over 80 years old Comments [_____ _____ _____]
2.	What is your gender? ( ) Female ( ) Male Comments [_____ _____ _____]

3. What mobile devices have you used?
   [ ] Smart phones, like iPhone, Blackberry, and Android devices
   [ ] Tablet computers
   [ ] Google Glass
   [ ] Personal digital assistants
   [ ] MiFi, mobile Wi-Fi hotspot

   Comments
   [_____
   _____
   _____]

4. When did you first start using a mobile device?

   ( ) less than 1 year ago
   ( ) 1–3 years ago
   ( ) 4–6 years ago
   ( ) 7–10 years ago
   ( ) more than 10 years ago
   ( ) N/A

   Comments
   [_____
   _____
   _____]

5. How would you describe your level of expertise in using mobile devices?

   ( ) Low, I am able to perform basic functions, but I still require help on a regular basis.
   ( ) Moderate, I am competent using a variety of mobile device features
   ( ) High, I am proficient in using a wide variety of mobile device features and tools

   Comments
   [_____
   _____
   _____]

6. Please indicate how you use mobile in Emergency Communications while working at your current organization. Choose all that apply.

   [ ] Communication with employees, management, and/or customers
   [ ] Searching for information while working
   [ ] Attending training webinars
   [ ] Professional development/training
   [ ] Sharing training materials and/or articles
   [ ] Taking online courses
   [ ] Communicating in training sessions

   Comments
   [_____
   _____
   _____]

Stages of Adoption

7. Please choose the description that best reflects your approach to the adoption of new technologies, especially related to the adoption of mobile technology.

   ( ) I am often one of the first people to try new technologies such as the mobile. I tend to be a risk-taker and active-information seeker. I tend to latch on to new technology as soon as it is available to me. My interest tends to be more with the technology itself than with its application to specific problems. I am willing to invest time and energy to learn on my own and adapt quickly to new technologies.
   ( ) I explored mobile for its potential to bring about improvements in my work. I am willing to try new technologies and I am not averse to occasional failure. I share my experiences with mobile with my colleagues. My colleagues often ask for my advice/help regarding mobile technology. I experiment with a new mobile feature to see if it might improve work.
   ( ) I adopted a "wait and see" attitude toward mobile. I wanted examples of close-to-home successes before adopting mobile. I wanted to see the value of mobile before adopting it. I wanted to make sure that adoption would be easy and hassle-free. I wanted to make sure I would have the necessary technical support and advice to learn/use mobile.
   ( ) I was skeptical about using the mobile. I accepted the mobile later in the game once it had become established among the majority of my coworkers and friends. I accepted the mobile only when it became a necessity. I began using the mobile because of pressure from my coworkers and friends. I tend to use mobile features that seem similar to the ways I have always used phones.
   ( ) I am usually not interested in adopting new technology. I see no use for adopting mobile in my work or learning. My current practices have worked well so far without using mobile. Just because everyone else is using the mobile, does not mean that I need to use it.

   Comments
   [_____
   _____
   _____]

Perceived Usefulness

8. Many of my colleagues use mobile and it help me work with them.
   ( ) Strongly Disagree
   ( ) Disagree
   ( ) Neutral
   ( ) Agree
   ( ) Strongly Agree
   ( ) N/A

Comments
[_____
_____
_____]

9. The results of using mobile for work are apparent to me.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

10. I would be able to explain why using mobile may or may not be beneficial.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

11 Using mobile fits well with my work activities.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

12. Using mobile is compatible with my organization's needs.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

13. Using mobile is compatible with the resources I am currently using in my work

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

14 Using mobile is compatible with most aspects of my learning.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

15. In terms of using mobile, it is important to me to consider what my management thinks.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

Perceived Ease of Use

16. My institution provides professional development activities to help employees learn and use mobile.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

17. My management supports/encourages the use of mobile.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

18. Innovation and experimentation are encouraged at my institution.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

19 Learning to use mobile technology is (would be) easy for me.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

20. I am (would be) able to use mobile communication tools quickly and easily for my learning.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

21. It is (would be) easy for me to remember how to perform tasks in mobile.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

22. Mobile is (would be) compatible with my level of technology expertise and experience.
( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

23. I feel (would feel) comfortable using mobile.

( ) Strongly Disagree
( ) Disagree
( ) Neutral
( ) Agree
( ) Strongly Agree
( ) N/A

Comments
[_____
_____
_____]

Willingness to be Interviewed

24. As a current Everbridge employee, I am willing to be interviewed. I understand that my interview session will not be included in the study but will be used to test and review the interview questions.

( ) Yes

25. For non-Everbridge employees I would be willing to be contacted and interviewed.

( ) Yes
( ) No

Comments
[_____
_____
_____]

Appendix E: Consent Form for Interview

As a member of the Everbridge LinkedIn Group, Everbridge Incident Management and Emergency Notification Professionals Group, you are invited to take part in a research study of older adults and mobile technology. The researcher is inviting older adults, over 50 years of age to be in this study. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part.

This study is being conducted by a researcher named William Scerra. He is a doctoral student at Walden University. You may already know the researcher as the Learning Officer of Everbridge, Inc., but this study is separate from that role.

Background Information:
The purpose of this study is to explore the area of older adult adoption of mobile technology. Many studies in the past focused on the deficiencies that older adults acquire rather than the ways to use new technologies to help older adults learn to maintain their working skills and quality of life.

Procedures:
If you agree to be in this study, you will be asked to participate in an interview

- that will take approximately 30 minutes
- that will cover the results from other surveys and your own responses.
- that will be recorded using GoToMeeting; there will be no use of cameras.
- at the end of the survey, you will be asked if you have any comments on the interview process or adoption of mobile technology.

Voluntary Nature of the Study:
This study is completely voluntary. Your decision on participation will have no impact on your standing as a member of the Everbridge LinkedIn Group, Everbridge Incident Management and Emergency Notification Professionals Group. You are free to drop out of the study at any time.

Risks and Benefits of Being in the Study:
Being in this type of study involves some risk of the minor discomforts that can be encountered in daily life, such as fatigue or stress. Being in this study would not pose risk to your safety or wellbeing.

The results of this study will be available to you upon written request. Your cooperation will help advance the research and training for older adult workers.

Payment:
There is no compensation for your participation in this study.

Privacy:
Any information you provide will be kept confidential.
The researcher will not use your personal information for any purposes outside of this research project. In addition, the researcher will not include your name or anything else that could identify you in the study reports. Data will be kept secure by encrypted data storage. Data will be kept for a period of at least 5 years as required by the university.

Contacts and Questions:
You may ask any questions you have now. Or if you have questions later, you may contact the researcher via e-mail at William.Scerra@waldenu.edu
If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University representative who can discuss this with you. Her phone number Dr. Leilani Endicott, at 612-312-1210 or irb@waldenu.edu.
Walden University's approval number for this study is 11-11-14-0110734 and it expires on November 10, 2015.

Please print or save this consent form for your records.

Statement of Consent:
I have read the above information and understand the study well enough to make a decision about my involvement. By clicking on the link below, I understand that I am agreeing to the terms described above.

Appendix F: Mobile Adoption and the Older Adult Interview Protocol

Introduction to Interview

I would like to record our conversations today. Only I will have access to the recordings that will be eventually destroyed after they are transcribed. Thank you for signing the release form. Essentially, that release form stated that (a) all information will be held confidential, (b) your participation is voluntary, and you may stop at any time if you feel uncomfortable, and (c) we do not intend to inflict any harm. Again, thank you for agreeing to participate.

I have planned this interview to last no longer than one hour. During this time, I have several questions that I would like to cover. If time begins to run short, it may be necessary to interrupt you in order to push ahead and complete the questions.

You have been selected for this interview because you are over 50 years of age and a member of the Everbridge LinkedIn Incident Management Professionals Group. My research project as a whole focuses on the needs and experiences of older adults with mobile technology and how this may be used to help in older adult mobile adoption. The purpose of the interview and research are not to evaluate your mobile technology expertise. Rather, I am trying to learn more about how to help older adults adopt mobile technology. If you are an employee of Everbridge, I cannot interview you as part of the data collection but would you be willing to be interviewed and comment on the interview process?

Interview Questions:

1. Briefly describe what mobile technology devices you have used.

Probes:

Why did you use these devices?

Which did you find useful, which weren't useful?

2. How comfortable are you with the mobile technology devices that you currently use?

Probe:

What helped you become comfortable or led to your discomfort?

3. Do your friends use mobile technology devices? Why do they use them?

Probes:

Are any friends or family members encouraging your mobile technology use? How?

Are friends or family discouraging the adoption of mobile technology? How?

4. Do your colleagues use mobile technology at work? How is it used at work?

Probes:

Are any colleagues encouraging your mobile technology use? How?

Are any colleagues discouraging the adoption of mobile technology? How?

5. Why did you find mobile technology worth your time and energy to learn and use?

Probes:

Why were you so eager to use mobile technology?

Did your experience match your expectations?

What were the initial use cases that you anticipated?

6. Do you think that mobile technology would be a useful technology for learning? Why or why not?

Probe:

How could you use mobile technology for learning?

What experiences have you had or observed?

7. Does mobile technology help you at work?

Probes:

Where does it help and where does it cause problems?

Does mobile technology pass the “usefulness test” for you in your work area? Why and how?

8. Have you or your colleague’s encountered resistance to the use of mobile technology at work?

Probe:

Is your management supportive, resistant, or neutral to mobile technology?

What actions led you to that conclusion?

9. Is innovation and experimentation supported at your workplace?

Probes:

Is your workplace a supporting your adoption of mobile technology?

How and Why?

10. Does your workplace provide training in the use of mobile technology?

Probes:

How do or did you learn the way mobile technology could help you at work?

Where did you learn to use mobile technology?

Was this help important, useful, or needed?

11. How easy is it or was it for you find uses for mobile technology in work and life projects?

Probes:

Why did you find it easy?

Why did you find it hard?

What factors drove you to either perception?

Question to End the Interview:

12. What factors that helped or hindered your adoption of mobile technology did I miss?

Appendix G: Overview of the Mobile Adoption and the Older Adult Interview Protocol

The interviews will be used to provide an in-depth look at the adoption factors and attitudes that lay behind the adoption. The interview will follow the data that have been obtained in the survey.

Introduction to Interview

The introduction to the interview will review the process of the interview and key elements of the signed release form. The introduction will state the time required for the interview and why the participants were chosen.

Research Questions:

The questions asked in the interview are directly related to the research questions. Each question in the interview will be listed below with the associated research question. The research questions are

Research Question 3: How do older adults describe the discrete factors that affect their adoption as they relate to ease of use and usefulness of mobile technology in the emergency communications workplace?

Research Question 4: How do older adults describe the discrete factors that affect their adoption as they relate to ease of use and usefulness of mobile technology in the emergency communications workplace? Do the interviewed older adults have suggestions to enhance the usefulness or ease of use of mobile technology?

Within each factor discussed (Research Question 3), the probes will focus on the impact of the factors (Research Question 4).

Demographic factors (Research Question 3)

1. Briefly describe what mobile technology devices you have used? (Research Question 3)

Probes: (Research Question 4)

Why did you use these devices?

Which did you find useful, which weren't useful?

2. How comfortable are you with the mobile technology devices that you currently use? (Research Question 3)

Probes: (Research Question 4)

What helped you become comfortable or led to your discomfort?

Social Factors (Research Question 3)

1. Do your friends use mobile technology devices? Why do they use them? (Research Question 3)

Probes: (Research Question 4)

Are any friends or family members encouraging your mobile technology use? How?

Are friends or family discouraging the adoption of mobile technology? How?

2. Do your colleagues use mobile technology at work? How is it used at work? (Research Question 3)

Probes: (Research Question 4)

Are any colleagues encouraging your mobile technology use? How?

Are any colleagues discouraging the adoption of mobile technology? How?

Factors Based on Stage of Adoption (Research Question 3)—Using Innovator as an Example

1. Why did you find mobile technology worth your time and energy to learn and use? (Research Question 3)

Probes: (Research Question 4)

Why were you so eager to use mobile technology?

Did your experience match your expectations?

What were the initial use cases that you anticipated?

2. Do you think that mobile technology would be a useful technology for learning? Why or why not? (Research Question 3)

Probes: (Research Question 4)

How could you use mobile technology for learning?

What experiences have you had or observed?

Work Factors (Research Question 3)

Does mobile technology help you at work? (Research Question 3)

Probes: (Research Question 4)

Where does it help and where does it cause problems?

Does mobile technology pass the “usefulness test” for you in your work area? Why and how?

Have you or your colleague’s encountered resistance to the use of mobile technology at work?

Probes: (Research Question 4)

Is your management supportive, resistant, or neutral to mobile technology?

What actions led you to that conclusion?

Is innovation and experimentation supported at your workplace?

Probes: (Research Question 4)

Is your workplace a supporting your adoption of mobile technology?

How and Why?

Ease of Use Factors (Research Question 3 and 4)

1. Does your workplace provide training in the use of mobile technology?

Probes: (Research Question 4)

How do or did you learn the way mobile technology could help you at work?

Where did you learn to use mobile technology?

Was this help important, useful, or needed?

How easy is it or was it for you find uses for mobile technology in work and life projects?

Probes: (Research Question 4)

Why did you find it easy?

Why did you find it hard?

What factors drove you to either perception?

Question to End the Interview:

What factors that helped or hindered your adoption of mobile technology did I miss? (Research Questions 3 and 4)

Appendix H: Letter of Cooperation From the Group Owner, Bill Betcher, Vice President of Marketing, Everbridge, Inc.

Bill Betcher
24 Harwell Avenue
Lexington, MA 02421

September 8, 2014

Dear William Scerra

Based on my review of your research proposal, I give permission for you to conduct the study entitled Factors Impacting the Adoption of Mobile Technology by Older Adults in Emergency Communications within the Everbridge Incident Management and Emergency Notification LinkIn Group. As part of this study, I authorize you to add entries, email to the group's mail list, survey, interview, and member check results with the LinkedIn group participants. Individuals' participation will be voluntary and at their own discretion.

We understand that our organization's responsibilities include: access to the LinkedIn group's mail list. We reserve the right to withdraw from the study at any time if our circumstances change.

I confirm that I am authorized to approve research in this setting.

I understand that the data collected will remain entirely confidential and may not be provided to anyone outside of the research team without permission from the Walden University IRB.

Sincerely,

Bill Betcher
Vice President of Marketing, Everbridge, Inc.

Appendix I: Perceived Usefulness Tables

Table I1

MDIS Survey Question 3.1: Perceived Usefulness—Colleagues and Mobile Use

Many of my colleagues use mobile and it helps me work with them.			
Stage of adoption	Mean	Median	Mode
Innovator	4.4	5.0	5.0
Early adopter	4.1	4.0	4.0
Early majority	4.3	4.0	4.0
Late majority	3.4	3.0	3.0

Note. $N = 85$.

Table I2

MDIS Survey Question 3.3: Perceived Usefulness—Why Mobile Is Beneficial

I would be able to explain why using mobile may or may not be beneficial.			
Stage of adoption	Mean	Median	Mode
Innovator	4.5	5.0	5.0
Early adopter	4.2	4.0	4.0
Early majority	4.2	4.0	4.0
Late majority	3.8	4.0	4.0

Note. $N = 85$.

Table I3

MDIS Survey Question 3.2: Perceived Usefulness—Results of Using Mobile for Work

The results of using mobile for work are apparent to me.			
Stage of adoption	Mean	Median	Mode
Innovator	4.5	5.0	5.0
Early adopter	4.4	4.0	4.0
Early majority	4.2	4.0	4.0
Late majority	4.0	4.0	4.0

Note. $N = 85$.

Table I4

MDIS Survey Question 3.3: Perceived Usefulness—Compatibility With Learning

Using mobile is compatible with most aspects of my learning.			
Stage of adoption	Mean	Median	Mode
Innovator	4.1	4.0	4.0
Early adopter	3.8	4.0	4.0
Early majority	3.7	4.0	3.0
Late majority	3.7	4.0	4.0

Table I5

MDIS Survey Question 3.4: Perceived Usefulness—Fits Well With Work Activities

Using mobile fits well with my work activities.			
Stage of adoption	Mean	Median	Mode
Innovator	4.3	5.0	5.0
Early adopter	4.3	4.0	4.0
Early majority	4.4	4.0	4.0
Late majority	3.8	4.5	5.0

Note. $N = 85$.

Table I6

MDIS Survey Question 3.5: Perceived Usefulness—Compatible With Organization's Needs

Using mobile is compatible with organization's needs.			
Stage of adoption	Mean	Median	Mode
Innovator	4.5	5.0	5.0
Early adopter	4.3	4.0	4.0
Early majority	4.4	4.5	5.0
Late majority	4.7	5.0	5.0

Table I7

MDIS Survey Question 3.6: Perceived Usefulness—Compatible With Work Resources

Using mobile is compatible with the resources I am currently using in my work.			
Stage of adoption	Mean	Median	Mode
Innovator	4.4	4.0	4.0
Early adopter	4.1	4.0	4.0
Early majority	4.3	4.0	4.0
Late majority	4.0	4.0	4.0

Note. N = 85. One early adopter answered N/A.

Table I8

MDIS Survey Question 3.8: Perceived Usefulness—What Management Thinks

In terms of using mobile, it is important to me to consider what my management thinks.			
Stage of adoption	Mean	Median	Mode
Innovator	3.9	4.0	4.0
Early adopter	3.4	4.0	4.0
Early majority	3.6	4.0	5.0
Late majority	3.8	4.0	4.0

Note. N = 85. One early adopter answered (N/A).

Table J1

MDIS Survey Question 4.8: Perceived Ease of Use—Comfortable Using Mobile

I feel (would feel) comfortable using mobile.			
Stage of adoption	Mean	Median	Mode
Innovator	4.5	5.0	5.0
Early adopter	4.5	4.5	5.0
Early majority	4.1	4.0	4.0
Late majority	3.7	4.0	4.0

Note. Two early adopters answered N/A, two early majority answered N/A.

Table J2

MDIS Survey Question 4.7 Perceived Ease of Use—Compatibility

Mobile is (would be) compatible with my level of technology expertise and experience.			
Stage of adoption	Mean	Median	Mode
Innovator	4.3	4.0	4.0
Early adopter	4.3	4.0	4.0
Early majority	3.9	4.0	4.0
Late majority	3.8	4.0	4.0

Note. N = 85. One early adopter answered N/A

Table J3

MDIS Survey Question 4.4: Perceived Ease of Use—Learning to Use

Learning to use mobile technology is (would be) easy for me.			
Stage of adoption	Mean	Median	Mode
Innovator	4.3	4.0	4.0
Early adopter	4.2	4.0	4.0
Early majority	3.7	4.0	4.0
Late majority	3.0	3.0	2.0

Table J4

MDIS Survey Question 4.5: Perceived Ease of Use—Quick to Learn and Easy to Use

I am (would be) able to use mobile communication tools quickly and easily for my learning.			
Stage of adoption	Mean	Median	Mode
Innovator	4.0	4.0	4.0
Early adopter	4.0	4.0	4.0
Early majority	3.6	4.0	4.0
Late majority	3.0	3.0	4.0

Table J5

MDIS Survey Question 4.3: Perceived Ease of Use—Innovation and Experimentation

Innovation and experimentation are encouraged at my institution.			
Stage of adoption	Mean	Median	Mode
Innovator	4.0	4.0	4.0
Early adopter	3.6	4.0	4.0
Early majority	3.7	4.0	4.0
Late majority	3.3	4.0	4.0

Note. One early adopter answered N/A, one early majority answered N/A

Table J6

MDIS Survey Question 4.6: Perceived Ease of Use—Easy to Remember

It is (would be) easy for me to remember how to perform tasks in mobile.			
Stage of adoption	Mean	Median	Mode
Innovator	3.9	4.0	4.0
Early adopter	4.1	4.0	4.0
Early majority	3.9	4.0	4.0
Late majority	3.3	3.5	4.0

Note. One early adopter answered N/A.

Table J7

MDIS Survey Question 4.2: Perceived Ease of Use—Management Encouragement

My management supports/encourages the use of mobile.			
Stage of adoption	Mean	Median	Mode
Innovator	3.7	4.0	3.0
Early adopter	3.8	4.0	4.0
Early majority	3.7	4.0	4.0
Late majority	4.2	4.0	4.0

Note. One early adopter answered N/A, one early majority answered N/A.

Table J8

MDIS Survey Question 4.1: Perceived Ease of Use—Professional Development

My institution provides professional development activities to help employees learn and use mobile.			
Stage of adoption	Mean	Median	Mode
Innovator	3.4	3.0	2.0
Early adopter	2.9	3.0	3.0
Early majority	2.7	3.0	2.0
Late majority	2.8	2.0	2.0