RGC Ref. No.:
UGC/FDS24/B08/21
(please insert ref. above)

RESEARCH GRANTS COUNCIL
COMPETITIVE RESEARCH FUNDING SCHEMES FOR THE LOCAL SELF-FINANCING DEGREE SECTOR

FACULTY DEVELOPMENT SCHEME (FDS)

Completion Report
(for completed projects only)

Submission Deadlines:
1. *Auditor's report with unspent balance, if any: within **six** months of the approved project completion date.*
2. *Completion report: within **12** months of the approved project completion date.*

Part A: The Project and Investigator(s)

1. Project Title

Investigating the Motivators and Obstacles of Mobile Health Apps Adoption and Continuance by Elderly: A Longitudinal Study using Extended Expectation-Confirmation Theory

調查影響老年人對流動健康應用程式的採用和延續性的動機和障礙：使用擴展期望確認理論的縱向研究

2. Investigator(s) and Academic Department(s) / Unit(s) Involved

Research Team	Name / Post	Unit / Department / Institution
Principal Investigator	Dr LEUNG Wilson Ka-Shing / Senior Lecturer	Division of Science, Engineering and Health Studies / PolyU SPEED
Co-Investigator 1	Dr FONG Ben Yuk-Fai / Professor of Practice	Division of Science, Engineering and Health Studies / PolyU SPEED
Co-Investigator 2	Dr CHEUNG Man-Lai / Senior Lecturer	Department of Marketing, International Business and Tourism / Manchester Metropolitan University, UK
Co-Investigator 3	Dr CHANG Ludwig Man-Kit / Assistant Professor	Department of Management, Marketing and Information Systems / Hong Kong Baptist University

Research Team	Name / Post	Unit / Department / Institution
Co-Investigator 4	Dr NG Mei-Lan / Principal Lecturer	Division of Business and Hospitality Management / PolyU SPEED
Others	Mr CHAN Chun-kit / Research Assistant	General Office / PolyU SPEED

3. Project Duration

	Original	Revised	Date of RGC / Institution Approval *(must be quoted)*
Project Start Date	01/01/2022	N/A	N/A
Project Completion Date	31/12/2023	N/A	N/A
Duration *(in month)*	24 months	N/A	N/A
Deadline for Submission of Completion Report	31/12/2024	N/A	N/A

4.3 Please attach photo(s) of acknowledgement of RGC-funded facilities / equipment.
N/A

Part B: The Final Report

5. Project Objectives

5.1 Objectives as per original application

Theoretical contributions:

1. To investigate the changes in elderly users' perceptions of using mobile healthcare applications (mHealth apps) based on an integration model of expectation-confirmation theory and diffusion of innovation theory with the technology-individual-environment framework across three different time points (i.e., pre-usage, usage, and post-usage).

2. At the pre-usage stage (t1), our model will predict how individual and environmental factors with the elderly users' expectation regarding the technological factors influence their initial acceptance of mHealth apps with the moderating effect of dispositional resistance to change.

3. At the usage stage (t2), our model will examine the effects of elderly users' expectation and their perceived performance regarding technological factors on user confirmation and satisfaction. Subsequently, how user satisfaction influences their continuance intention.

4. At the post-usage stage (t3), our model will examine how continuance intention affects elderly users' continuance usage with the moderating effect of mHealth apps usage habit.

Managerial contributions:

1. Focus group study: we will interview elderly users about their motivations and obstacles of using mHealth apps. Also, we will interview the staff from elderly service organizations about the difficulties of encouraging elderly people to adopt mHealth apps. The insights from the focus group interview can help the elderly service organizations and mHealth apps developers improve the adoption rate and promote its extensive usage.

2. Policy design: This research is the first to demonstrate the behavioral changes of using mHealth apps by elderly users in Hong Kong, which offer fresh insights for policymakers to design better policies for promoting elderly-related technology and make a wise investment.

3. Input to teaching: One major teaching area of our health studies program is about the impacts of healthcare technology on elderly health and their quality of life (e.g., SEHS2347 (Holistic Health of Older Adults: Concepts and Practice of Wellness), SEHS3271 (Breaking the Digital Divide for the Elderly through Service-Learning). The empirical results of this study can enrich our student knowledge about how to motivate elderly people to adopt healthcare technology in the courses above.

5.2 Revised objectives

Date of approval from the RGC: N/A

Reasons for the change: N/A

5.3 Realisation of the objectives

(Maximum 1 page; please state how and to what extent the project objectives have been achieved; give reasons for under-achievements and outline attempts to overcome problems, if any)

The first theoretical objective was achieved by establishing a three-wave longitudinal research model—pre-usage, usage, and post-usage—to investigate changes in elderly users' perceptions of mobile healthcare applications (mHealth apps). A comprehensive literature review on elderly healthcare technology was conducted to enhance our proposed research models in the initial proposal. The refined models are grounded in several theories, including expectation-confirmation theory, diffusion of innovation theory, task-technology fit theory, and innovation resistance theory (Appendices 1-3). Additionally, we developed surveys for each of the three stages (Appendices 4–6).

The second, third, and fourth theoretical objectives were met through data collection from older adults via a survey company, yielding 1,081 valid samples. Of these, 479 valid samples were used for exploratory factor analysis (EFA) (Appendices 7), and 602 valid samples were used for partial least squares structural equation modeling (PLS-SEM) at the pre-usage stage (Time 1 – Nov 2022) (Appendix 8). We collected valid 329 samples at the usage stage (Time 2 – Jan 2023) and 235 valid samples at the post-usage stage (Time 3 – April 2023). We employed both qualitative and quantitative methodologies for data collection and analysis to identify the key motivators and barriers to the initial adoption of mHealth apps among the elderly as well as explain their patterns of mHealth app usage over time based on a longitudinal dataset (Appendices 9 and 10).

This project also outlines three managerial objectives. The first managerial objective was achieved through a qualitative study aimed at addressing a gap in the existing literature regarding the measurement of how well mHealth app functionalities support users' healthcare-related needs. While the literature discusses common health issues faced by the elderly, there is limited research systematically measuring the health-related tasks older adults typically perform, let alone the development of measurement scales to assist them in managing these tasks through mHealth apps. To address this, we conducted face-to-face interviews with 21 older adults aged 60 and above at two local elderly service centers in August 2022. This qualitative approach helped us understand how effectively mHealth apps support users in managing these tasks and the challenges they face in using them (Appendix 7).

The second managerial objective was met by providing recommendations to policymakers and NGOs. We identified key motivators and barriers to the use of mHealth apps from Time 1 to Time 3. Our recommendations were disseminated through journals, books, and conferences (Appendices 11-15).

The third managerial objective was accomplished by addressing the challenges of elderly technology adoption and the impacts of mHealth apps on well-being in our case study discussions and service-learning courses. Teaching materials based on findings from Time 1,

Time 2, and Time 3 were delivered to students in September 2021 and September 2023, respectively (Appendices 17-18). In addition, we also provided video demonstrations of using mHealth apps (Appendix 19) and mHealth app usage guides for one local elderly service organization and their elderly members (Appendices 20-23).

5.4 Summary of objectives addressed to date

Objectives *(as per 5.1/5.2 above)*	**Addressed** *(please tick)*	**Percentage Achieved** *(please estimate)*
<u>Theoretical contributions:</u> 1. To investigate the changes in elderly users' perceptions of using mobile healthcare applications (mHealth apps) based on an integration model of expectation-confirmation theory and diffusion of innovation theory with the technology-individual-environment framework across three different time points (i.e., pre-usage, usage, and post-usage).	Research Model Development ✓ (Jan – Sep 2022) **(Appendices 1 to 3: Theoretical Frameworks)** Pre-usage stage Time 1: Online survey development (Mar – Aug 2022) ✓ **(Appendix 4: Pre-usage stage (Time 1) Questionnaire)** Data Collection (Nov 2022) ✓ Data analysis (Feb 2023) ✓ Usage stage Time 2: Online survey development (Mar – Aug 2022) ✓ **(Appendix 5: Usage stage (Time 2) Questionnaire)** Data Collection (Jan 2023) ✓ Data analysis (May 2023) ✓ Post-usage stage Time 3: Online survey development (Mar – Aug 2022) ✓ **(Appendix 6: Post-usage stage (Time 3) Questionnaire)** Data Collection (Apr 2023) ✓ Data analysis (May 2023) ✓	Achieved 100%

Objectives *(as per 5.1/5.2 above)*	**Addressed** *(please tick)*	**Percentage Achieved** *(please estimate)*
Theoretical contributions: 2. At the pre-usage stage (t1), our model will predict how individual and environmental factors with the elderly users' expectation regarding the technological factors influence their initial acceptance of mHealth apps with the moderating effect of dispositional resistance to change.	Pre-usage stage Time 1: Online survey development (Mar – Aug 2022) ✓ **(Appendix 4: Pre-usage stage (Time 1) Questionnaire)** Data Collection (Nov 2022) ✓ Data analysis (Feb 2023) ✓	Achieved 100%
Theoretical contributions: 3. At the usage stage (t2), our model will examine the effects of elderly users' expectation and their perceived performance regarding technological factors on user confirmation and satisfaction. Subsequently, how user satisfaction influences their continuance intention.	Usage stage Time 2: Online survey development (Mar – Aug 2022) ✓ **(Appendix 5: Usage stage (Time 2) Questionnaire)** Data Collection (Jan 2023) ✓ Data analysis (May 2023) ✓	Achieved 100%
Theoretical contributions: 4. At the post-usage stage (t3), our model will examine how continuance intention affects elderly users' continuance usage with the moderating effect of mHealth apps usage habit.	Post-usage stage Time 3: Online survey development (Mar – Aug 2022) ✓ **(Appendix 6: Post-usage stage (Time 3) Questionnaire)** Data Collection (Apr 2023) ✓ Data analysis (May 2023) ✓	Achieved 100%
Managerial contributions: 1. Focus group study: we will interview elderly users about their motivations and obstacles of using mHealth apps. Also, we will interview the staff from elderly service organizations about the	Focus group interview ✓ (Jul-Aug 2022) Focus group summary report ✓ (Oct 2022) **(Appendix 7: Results of the qualitative study from Time 1)**	Achieved 100%

Objectives *(as per 5.1/5.2 above)*	**Addressed** *(please tick)*	**Percentage Achieved** *(please estimate)*
difficulties of encouraging elderly people to adopt mHealth apps. The insights from the focus group interview can help the elderly service organizations and mHealth apps developers improve the adoption rate and promote its extensive usage.		
Managerial contributions: 2. Policy design: This research is the first to demonstrate the behavioral changes of using mHealth apps by elderly users in Hong Kong, which offer fresh insights for policymakers to design better policies for promoting elderly-related technology and make a wise investment.	Policy design (Sep 2022 – Dec 2023) ✓ We made practical suggestions for the government and elderly service centers based on our longitudinal model results **(Appendix 11 – peer-reviewed journal 1, Appendix 12 – MAG 2022 Conference, Appendix 13 – AM conference 2023, Appendix 14 – AM conference 2024, Appendix 15 – PACIS conference 2024)**	Achieved 100%
Managerial contributions: 3. Input to teaching: One major teaching area of our health studies program is about the impacts of healthcare technology on elderly health and their quality of life (e.g., SEHS2347 (Holistic Health of Older Adults: Concepts and Practice of Wellness), SEHS3271 (Breaking the Digital Divide for the Elderly through Service-Learning)). The empirical results of this study can enrich our	Pre-usage stage Time 1: Input to Teaching (Sep – Dec, 2022) ✓ Usage stage Time 2 and Post-usage stage Time 3 Input to Teaching (Sep – Dec, 2023) ✓ **(Appendix 17 – Input to Teaching Notes – 1, Appendix 18 – Input to Teaching Notes – 2, Appendix 19 – Video Demonstrations of using mHealth Apps, Appendix 20-23: mHealth app usage guides)**	Achieved 100%

Objectives *(as per 5.1/5.2 above)*	**Addressed** *(please tick)*	**Percentage Achieved** *(please estimate)*
student knowledge about how to motivate elderly people to adopt healthcare technology in the courses above.		

6. Research Outcome

6.1 Major findings and research outcome
(Maximum 1 page; please make reference to Part C where necessary)

This study examined the evolving perceptions of elderly users regarding mobile healthcare applications (mHealth apps) at three time points: pre-usage, usage, and post-usage. Insights gained are intended to help app developers improve the sustainability and usability of mHealth apps for the elderly. Data were collected in three waves through a survey company, totaling 1,081 samples: 479 for exploratory factor analysis (EFA) and 602 for partial least squares structural equation modeling (PLS-SEM) at the pre-usage stage (Time 1), 329 at the usage stage (Time 2), and 235 at the post-usage stage (Time 3).

Our mixed-methods approach identified both barriers and motivators for mHealth app usage among older adults. Initially, we developed a new measure, "Health Task Management Support," to evaluate the support provided by mHealth apps for health-related tasks (Appendix 7). This measure identified key functions that older adults seek in mHealth apps, confirmed through EFA with 479 samples at Time 1.

Quantitative analysis at Time 1 revealed that health task management support dimensions—medical, dietary, and exercise task support—positively influenced perceived usefulness (Appendix 8). Perceived complexity and resistance to change were found to increase technology anxiety, while perceived usefulness and technology anxiety influenced adoption intention.

Table 3 analyzes data from 235 participants across three rounds and shows that initial expectations of mHealth app functions (Time 1) did not impact user satisfaction (Time 2). However, the actual performance of mHealth app functions (Time 2) significantly influenced user confirmation and satisfaction (Time 2) after a period of use. User satisfaction positively affected continuance intention, which subsequently impacted continued usage at Time 3 (Appendix 9).

Further, another longitudinal model based on the samples of 329 demonstrated that the characteristics of health tasks, mHealth app technology, and elderly users' health styles (Time 1) significantly affected perceived task-technology fit and health style-technology fit (Time 2). Both fit factors significantly impacted actual usage, which in turn affected continuance intention (Appendix 10).

We extend our gratitude for the funding support provided. Our research outcomes include a peer-reviewed article published in the Q1 journal "Internet Research," which has an impact factor of 7.9 (Appendix 11). Additionally, we presented four abstracts/papers at international conferences (e.g., MAG2022, AM2023, AM2024, and PACIS2024) (Appendix 12-15), with one receiving a best paper award (Appendix 16). We have duly acknowledged the funding support from the RGC in all our publications.

Moreover, we have shared our findings with students (Appendices 17-18) and provided video demonstrations of using mHealth app (Appendix 19) and mHealth app usage guides (Appendices 20-23) and to a local elderly service organization and their elderly members as well as to. We are pleased to report that we have met all the stipulated objectives for theoretical and managerial contributions.

6.2 Potential for further development of the research and the proposed course of action *(Maximum half a page)*

Based on the insights gleaned from our research findings, we propose two potential avenues for future investigation. Firstly, we observed that elderly users benefit significantly from having assistance when learning to use mHealth apps. This support can come from family members, friends, caregivers, or community volunteers who help them navigate the functionalities of these applications. Future research should focus on strategies to minimize the cognitive effort required for elderly users to learn how to use mHealth apps. Additionally, studies could explore the effectiveness of peer-led training programs or the role of social support networks in enhancing the adoption and sustained use of mHealth apps among older adults.

Secondly, an experimental study could be conducted to examine the long-term effects of mHealth app usage on the health conditions of elderly individuals. Such a study would involve tracking participants over an extended period to monitor changes in their health metrics, such as blood pressure, blood sugar levels, physical activity, and mental well-being.

Furthermore, we intend to draft a manuscript that explores the impacts of mHealth apps on the physical and psychological well-being of elderly individuals, utilizing our longitudinal dataset. Our goal is to submit this manuscript to esteemed journals within the Information Systems field, such as Information Technology & People or Internet Research.

7. Layman's Summary

(Describe in layman's language the nature, significance and value of the research project, in no more than 200 words)

Our research project investigated how elderly individuals perceive and use mobile healthcare applications (mHealth apps) over three different time points: before using the apps, while using them, and after using them. This study is crucial as it aims to help app developers create more user-friendly mHealth apps tailored for older adults.

We collected data from over 1,000 elderly participants through surveys, analyzing their responses to understand what motivates them to use these apps and what barriers they face. Our mixed-methods approach revealed that older adults value apps that support their medical, dietary, and exercise tasks. However, they often find these apps complex and experience anxiety about using new technology.

The namely developed measurements, health task management support, are used to evaluate how well mHealth apps support health-related tasks, which helped us identify key features that older adults seek. Our findings showed that the actual performance of mHealth apps significantly influences user satisfaction and their intention to continue using the apps.

Our research has practical implications, providing recommendations to improve mHealth apps and supporting materials for elderly users. Additionally, our findings have been shared through academic publications, contributing to the broader understanding of technology adoption among the elderly.

Part C: Research Output

8. Peer-Reviewed Journal Publication(s) Arising Directly From This Research Project

(Please attach a copy of the publication and/or the letter of acceptance if not yet submitted in the previous progress report(s). All listed publications must acknowledge RGC's funding support by quoting the specific grant reference.)

The Latest Status of Publications				Author(s) *(denote the corresponding author with an asterisk*)*	Title and Journal / Book *(with the volume, pages and other necessary publishing details specified)*	Submitted to RGC *(indicate the year ending of the relevant progress report)*	Attached to this Report *(Yes or No)*	Acknowledged the Support of RGC *(Yes or No)*	Accessible from the Institutional Repository *(Yes or No)*
Year of Publication	**Year of Acceptance** *(For paper accepted but not yet published)*	**Under Review**	**Under Preparation** *(optional)*						
2024	2024	2024	N/A	Dr. LEUNG Wilson Ka-Shing Dr. Sally P.M. Law Dr. Man Lai Cheung Dr. Man Kit Chang Mr. Chung-Yin Lai Dr. Na Liu*	Leung, W.K.S., Law, S.P.M., Cheung, M.L., Chang, M.K., Lai, C.-Y. and Liu, N. (2024), "From resistance to acceptance: developing health task measures to boost mHealth adoption among older adults: mixed-methods approach and innovation resistance", *Internet Research*, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/INTR-02-2024-0327	No	Yes (Appendix 11)	Yes	Yes

9. Recognized International Conference(s) In Which Paper(s) Related To This Research Project Was / Were Delivered
(Please attach a copy of each conference abstract)

Month / Year / Place	**Title**	**Conference Name**	**Submitted to RGC** *(indicate the year ending of the relevant progress report)*	**Attached to this Report** *(Yes or No)*	**Acknowledged the Support of RGC** *(Yes or No)*	**Accessible from the Institutional Repository** *(Yes or No)*
07/2023 UK	Investigating the adoption intention of mobile health applications in Hong Kong Ageing Population: The moderating role of Technology Anxiety	Academy of Marketing Conference 2023	No	Yes (Appendix 13)	Yes	Yes
11/2022 Bangkok, Thailand	mHealth apps adoption among elderly people: Qualitative study using theory task-technology fit	MAG 2022 Conference	Yes	Yes (Appendix 12)	Yes	Yes

10. Whether Research Experience And New Knowledge Has Been Transferred / Has Contributed To Teaching And Learning
(Please elaborate)

We introduced our students to the benefits of using mHealth apps and the challenges elderly individuals face in adopting them. Additionally, we shared our research findings with them during our courses (Appendices 17 and 18).

11. Student(s) Trained
(Please attach a copy of the title page of the thesis)

Name	**Degree Registered for**	**Date of Registration**	**Date of Thesis Submission / Graduation**
N/A			

12. Other Impact

(e.g. award of patents or prizes, collaboration with other research institutions, technology transfer, teaching enhancement, etc.)

The paper submitted and presented in MAG 2022 Conference has been awarded the Best Paper Award (Appendix 16).

13. Statistics on Research Outputs

	Peer-reviewed Journal Publications	**Conference Papers**	**Scholarly Books, Monographs and Chapters**	**Patents Awarded**	**Other Research Outputs (please specify)**	
No. of outputs arising directly from this research project	1	4	N/A	N/A	Type	No.
					N/A	N/A

14. Public Access Of Completion Report

(Please specify the information, if any, that cannot be provided for public access and give the reasons.)

Information that Cannot Be Provided for Public Access	**Reasons**