Overcoming technophobia in poorly-educated elderly – the HELPS-seniors service learning program

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Abstract: Aging populations, increased incidence of chronic disease, technological advances, health-care consumerism, and rapidly escalating health care costs are driving health care into the home. Advances in the miniaturization and portability of diagnostic technologies, information technologies, remote monitoring, and long-distance care have increased the viability of home-based care. The ability of older adults to use e-health tools is a critical issue, because such tools could effectively enhance medical care for this population. However, fear of technology is more prevalent among older generations who did not grow up with computers, complicated acronyms or digital games. This paper introduces the Health Education Learning Program with Science for seniors (HELPS-seniors) program, which encourages subjects to use new self-management tools for technophobic elderly people. We then explain how to integrate HELPS-senior into a health professional service learning program, and how to train students to become empathetic and smart health promoters. The present findings support the development of service-learning projects within medical education to overcome the technophobia among the elderly.

Keywords: Elderly; technophobia; service learning; medical education

Introduction

Aged population and e-health technology

Over the last 150 years the combination of reduced infant mortality and increased life expectancy has led to a restructuring of population demographics across the developed world [1,2]. Population projections suggest that following the two post-war baby booms of the 20th century, populations in Asian countries will continue to rapidly age [3,4]. This trend is particularly acute in Taiwan. It took 125 years for France's elderly population (defined as individuals over the age of 65) to grow from 7% to 14%, as opposed to 65 years for the USA, and 45 years for both the UK and Germany. In Taiwan, the same phenomenon only took 25 years. In 2011, the Council for Economic Planning and Development's (CEPD) Department of Manpower Planning suggested that Taiwan is expected to surpass Japan as the world's "oldest" country [5].

Population aging, increased incidence of chronic disease, technological advances, health-care consumerism, and rapidly escalating health care costs are driving health care into the home. Patients with multiple chronic conditions or advanced chronic illness often suffer from mobility restrictions that make it impractical to provide them with frequent, intense oversight in an office setting. Increasing healthy life expectancy requires the introduction of support in the form of technological products and services. Advances in the miniaturization and portability of diagnostic technologies, information technologies, remote monitoring, and long-distance care have increased the viability of home-based care [6,7]. The ability of older adults to find and use e-health tools is a critical issue, because this population is more likely to want and need medical care that could be enhanced by the use of such tools.

Technophobia and health professional service learning

Late adoption of IT related products and services is a trend mostly observed in people who have misconceptions about technology, are technophobic or lack IT literacy. Technophobia can be caused by general anxiety or fear about science or mathematical problems. People who feel intimidated by these subjects are more likely to experience technology anxiety [8].

Previous studies have found that fear of technology is more prevalent in older generations who did not grow up with computers, complicated acronyms or digital games [9,10]. Social issues, such as the 'digital divide' have been found to be significant in the UK, where more than 9.2 million people (out of a population of 64 million) are still perceived as being resistant to using modern technologies. Given the near ubiquity of internet and electronic technologies in everyday life, there is an urgent need to enable older people to embrace the digital age [8].

Members of the younger generation must provide sustained support and help older individuals suffering from this phobia. They should try to be good mentors and reward small steps taken by technophobics to overcome their fears. This article introduces the Health Education Learning Program with Science for seniors (HELPS-seniors) which encourages the use of e-health tools by elderly people with technophobia, and low levels of science and health literacy. We then explain how to integrate HELPS-senior into a health professional service learning program, and how to train students to become empathetic and smart health promoters by using an inter-generation teaching model.

Although medical education has long recognized the importance of community service, most medical schools have not formally nor fully incorporated service learning into their curricula. To address this problem, we describe the initial design, development, implementation, and evaluation of a service-learning project within a first-year medical school course.

Chwen Chi Wang, a retired elementary school teacher with over 25 year's science education teaching experience, enrolled in Ph.D. program of National Taipei University of Education in 2009. She is Ph.D. candidate major in Science Education, and her current researches are focused on "health education learning program with science for seniors".

Jin Jong Chen, a MD graduated from National Yang Yang-ming University, received Ph.D. degree in sports medicine from University of Virginia in 1988. Then he joined the Faculty of National Sports College, Taiwan, as Director in the Graduate Institute of Sports Science. In 1989 he joined the Faculty of National Yang-ming University, where he now holds positions as Professor in the Department of Physical Therapy and Assistive Technology and Director of the Exercise and Health Science Research Center. His professional interests include sports medicine, mountain medicine, and health promotion, and his current researches are majorly focused on "active health promotion in the aged society". He is the President of Formosa Active Life Association and the President of Aerobic Fitness & Health Association of ROC.

Integrating science and technology into a health promotion program for elderly

Low health literacy of the elderly

The process of aging itself inevitably causes a decline in the physiological function of the elderly population. In addition, elderly people frequently suffer from multiple chronic illnesses. The so-called chronic illness imperative is closely related to the aging of the population, since nearly 80-90% of adults over the age of 65 years have at least one chronic condition, and nearly 60-70% have two or more coexisting conditions [3, 11]. Care for patients with multiple chronic conditions accounts for the vast majority of medical expenditures [12,13].

Digital resources have been designed to help patients, consumers, and caregivers find health information, store and manage their personal health information, make decisions, and manage their health. Most e-heath tools are available on the Internet [14]. Some have interactive features that allow people to contact their health care providers directly or share information with other consumers and patients [15]. Elderly people have to be encouraged to interact with new appropriate technologies and should be provided with assistance in doing so. But they face unique issues related to physical and cognitive functioning that can make it difficult for them to find and use appropriate health information [16]. Improving health literacy is increasingly critical as information, choices, and decisions about health care and public health have become more complex. Among adult age groups, the group aged 65 and older are the least proficient in terms of health literacy skills [17]. This group also has the highest proportion of persons with health literacy defined as "below basic." Three decades of research studies have consistently found that health materials exceed the reading ability of the intended audiences [18].

HELPS-seniors concept development model

As shown in Fig. 1, HELPS-senior is based on the learning needs and characteristics of elderly and focuses on major health issues such as physical inactivity, obesity, and hypertension. Table 1 summarizes the science related concepts (SRC), health related concepts (HRC) and technological tools (TT) inherent in health promotion, such as encouraging walking.

In the Knowledge, Attitude and Practice Model (KAP), knowledge is the base, belief is a motivator, and the formation and changing of behaviors is the ultimate goal. We design a subjects-centered program that starts with lots of hand-on, engaging, game-like experiments to

inspire learning motivation, to improve subject knowledge, and overcome technophobia. We then introduce both SRC and HRC based on the subjects' individual responses to specially designed game-like experiments to avoid the need for subjects to take complicated technical notes or attend boring medical lectures. During a 5-meter walking test, we encourage subjects to walk as fast as possible for walking speed measurement, and observe individual walking patterns with different combinations of stride length and cadence. Finally, once subjects are familiar with SRC and HRC, they were encouraged to overcome technophobia and to use

information and communication technology (ICT) medical devices for monitoring personal health status.

HELPS-senior walking promotion program

Concept analysis

Most non-communicable diseases (NCDs) are strongly associated and causally linked with four particular behaviors: tobacco use, physical inactivity, unhealthy diet and the harmful use of alcohol. These behaviors lead to four key metabolic/physiological changes: raised blood pressure, overweight/obesity, hyperglycemia and hyperlipidemia. In terms of attributable deaths, the leading NCD risk factor globally is raised blood pressure (to which 13% of global deaths are attributed), followed by tobacco use (9%), raised blood glucose (6%), physical inactivity (6%), and overweight and obesity (5%) [19]. Physical activity (PA) plays an important role in the prevention and management of various chronic diseases including sedentary obesity, high blood pressure, and

cardiovascular disease [20,21,22], and results in a reduction in premature mortality and improvement in quality of life [23]. Walking is considered to be an ideal form of PA to promote and maintain health status in the general population. For most it requires no additional physical skills, and is achievable by all ages with little risk of injury [2425]. Pedometers can supply valuable information on the number of steps, distance travelled, time spent, and estimated energy expenditure [26]. Most such devices present a reliable and valid means for increasing and measuring physical activity, particularly as part of a walking program [27]. We developed an inquiry-based instructional module to promote walking among the elderly. This module was designed not only to promote health promotion but also to enhance scientific literacy.

Basic science related physics concepts, such as distance, frequency, speed, and duration (time), were introduced and evaluated in terms of length of stride, number of steps, walking speed, and activity duration. We also illustrated the relationships among walking habit, walking speed, frailty, obesity, hypertension and mortality to promote science literacy and health literacy among users. Then, by demonstration and practice, we encouraged users to learn how to use the health bank system, including the USB pedometer, weight scale and blood pressure monitor. Fear can be overcome by improved knowledge. Individuals suffering from technophobia must be willing to share ideas, information and knowledge, but must begin by first admitting to their phobia. They should realize that their phobia is not something they should feel afraid or embarrassed about and that it is neither a disease nor a reflection of their intelligence.
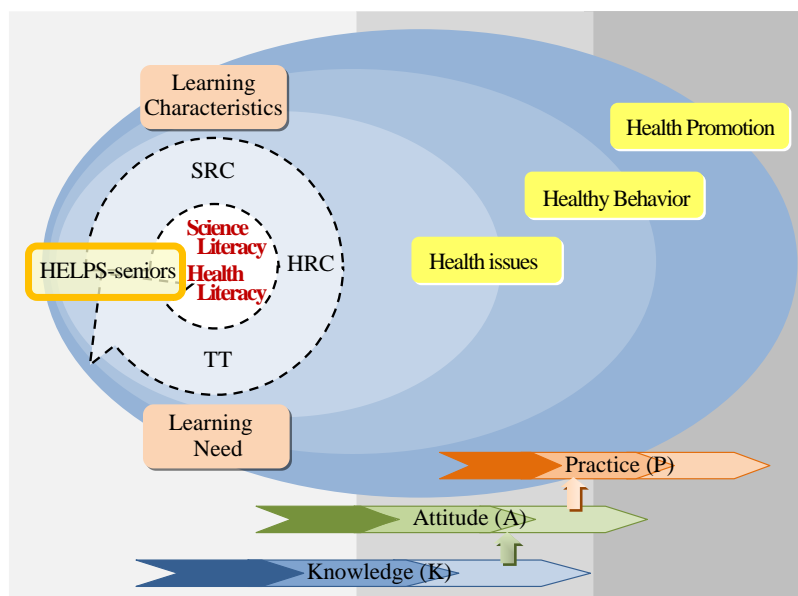

Figure 1. HELPS-seniors concept development model.

program concepts		
Concepts	Health- related concepts (HRC)	Sscience- related concepts (SRC)	Ttechnological tools (TT)
Walking	Stride length, cadence, walking distance, walking speed, steps, frailty	Length, distance, duration (time), velocity, frequency	Stopwatch, meter, USB pedometer, weight scale, blood pressure monitor, computer

Table 1. Concepts analysis of walking promotion program.

IT health promotion devices and service system

The proper implementation of telehealth programs can positively affect chronic disease care, along with home and hospice care. Physical inactivity, obesity, and hypertension are widely recognized as major modified risk factors. To address these issues, we introduce a USB health bank system, including a USB pedometer, weight scale and blood pressure monitor. The USB health bank requires no setup and is very easy to use. The user simply plugs the USB health bank into the measurement device (i.e., blood pressure meter or body weight scale) and initiates measurement. Measurement data are then automatically stored in the USB health bank. The software (PJDC) for viewing the data is pre-installed in the USB health bank. The user can view the data on any Windows-based computer without installing any additional programs. The USB health bank uses a 3-D sensor to track user movement and count steps; walking distance can then be estimated from step counts and stride length. This ease of use will encourage seniors to use the USB health bank.

A tilt-tolerant, silent tri-axis accelerometer is used as the USB pedometer, so subjects can carry it in a pocket or wear it clipped to their waistband. It uses a replaceable battery that lasts for months at a time. It counts steps, aerobic steps, distance, active calories burned, pitch (steps per minute) and time of day.

The USB connectivity of the electronic body weight scale and the blood pressure monitor with USB slot lets subjects save data including body weight, blood pressure and heart rate onto the USB pedometer. Subjects can download their data via the built-in USB stick to a PC or Mac and view their daily data graphs on the PC to track their progress over time (Fig. 2).

Effects of HELPS-seniors walking course

Twenty-two (6 males, 16 females) healthy elderly people (71.5 ± 5.2 y/o) were recruited from Taiwan's Beitou Community College as volunteers. All subjects had only 6-12 years of formal education and none had experience using a USB pedometer, telehealth programs or the Internet. The HELPS-senior walking course provided hand-on, engaging, game-like experiments to raise participants' learning motivation. To introduce the concepts of stride length and cadence, we asked subjects to mark their steps and record the walking durations when they walked at different paces for short durations. They were then asked to use a tape measure to measure the stride length (distance), use a stopwatch to measure time,

Figure 2. USB health bank system architecture diagram.

Figure 3. Tracking long-term of physiological data on PC.

and count the steps to calculate cadence (frequency).

A six-item walking-related human health cognition (HHC) test was conducted before and after the intervention, and evaluated by t-test. A semi-structured questionnaire and individual interviews were also conducted to explore the user acceptance and feasibility of the program.

Results in Table 2 show that the scientific literacy of all subjects was significantly improved. After a single 90 minute intervention, subjects demonstrated significant improvements on total score of the HHC test (3.09±1.02 vs. 5.14±1.21, P<.001) for knowing (P<.001), applying (P<.001) and reasoning (P<.001). Moreover, the feature "learn by doing (exercising or practicing)" improved their conceptual understanding of distance, duration, frequency and speed. The results revealed that the science-inquiry-based instructional module program was a feasible and effective means of improving human health cognition for healthy elderly people with a high degree of autonomy in assisted living facilities. In addition, individual semi-structured interviews were conducted with participants who finished the course, and all 22 subjects indicated they found the module to be enjoyable and applicable to their lives. All subjects reported finding the module to be "helpful" or "very helpful".

Once the subjects understood the importance of physical activity and could quantify walking-related concepts such as stride length and cadence, we further introduced the use of USB pedometer technology products as a convenient means of recording the number of steps, distance walked and calories burned. Plugged the USB health bank into a PC automatically displays cadence, activity time and lifestyle information, helping the subjects to overcome their technophobia and accept this wearable technology product and computer technology.

score dimensions	pre		post		
	M	*SD*	*M*	*SD*	*p*
Total	3.09	1.02	5.14	1.21	.000
Knowing	1.36	.73	1.73	.46	.002
Applying	1.18	.59	1.91	.29	.000
Reasoning	.55	.51	1.50	.67	.000

Table 2. Effects of HELPS-seniors walking course on science literacy.

Integrating HELPS-seniors walking course into a service learning program

Importance of service learning programs for medical education

Service rests at the core of the medical profession which aspires to train physicians committed to improving the health of the community and serving the public [28]. Medical students often identify medicine's service orientation as a primary reason for choosing a career in medicine [29]. Medical education is part of the higher education continuum and, while service learning has longstanding pedagogical roots in K-12 and higher education, the integration of service learning into medical education has largely taken place over the last decade [30]. Therefore, we adapted HELPS-seniors as a medical professional service learning program for medical students to address two important needs: (1) the education and development of students, and (2) the provision of increased resources to serve individuals and communities, primarily in underserved areas such as elderly communities [31].

Preparation stage

In the preparation stage, medical students enrolled in this HELPS-seniors service learning program had to take 8 hours of lectures, including (1) Epidemiology of frailty, disability & dementia, (2) Characteristics and learning needs of the elderly, (3) USB health bank system instruction/ Introduction of therapeutic insole, and (4) Introduction of GIS system/ Introduction of the "OurCityLove Friendly Restaurant Guide Taipei" APP (Table

3). "The APP targets people with disabilities, parents with strollers, and senior citizens and their families who frequently have trouble finding accessible restaurants. Smartphone access to this APP will enhance the motivation of elderly people to use IT devices and encourage them to eat better and engage in physical activity.

The importance of preventive medicine strategies, such as active aging and aging in place, were emphasized to instruct students in planning health science courses to promote health literacy among the elderly. Technology related to e-health and transportation, such as wearable devices, physiological monitors, geographic information systems, the friendly restaurant APP and therapeutic insoles, were demonstrated and practiced to prepare students for intergeneration learning with elderly people.

Services stage and Reflection/demonstration stage

After 4 weeks (8 hours) of training and a mid-term examination for certification, medical students studied with seniors recruited from in the inter-generation HELPS-seniors program to gain first-hand experience with the learning characteristics and motivation of elderly people. Students were required to become familiar with the teaching materials and guidance techniques for educating elderly people about the effects of physical activity, blood pressure monitoring and body weight on health.

We recruited 26 senior assisted-living residents to participate as subjects in the student service-learning program. All subjects had only 6-12 years of formal education and none had experience using a USB pedometer experience or the Internet. To evaluate the

Stage /week	Participants	Course Title	Teaching hrs
Preparation stage（4weeks—8hours）			
First week	medical students	Epidemiology of frailty, disability & dementia	2 hrs
Second week	medical students	Characteristics and learning needs of the elderly	2 hrs
Third week	medical students	USB health bank system instruction Introduction of therapeutic insole	2 hrs
Fourth week	medical students	Introduction of GIS system Introduction of friendly restaurant APP	2 hrs
Services stage（4weeks—8hours）			
Fifth week	students/elderly	Ice breaking	2 hrs
Sixth week	students/elderly	USB pedometer/ instruction	2 hrs
Seventh week	students/elderly	US USB health bank system instruction	2 hrs
Eighth week	students/elderly	Orientation activities	2 hrs
Reflection/demonstration stage（Final week）			
Ninth Week	students/elderly	Panel Report / **reflection** / demonstration	2hrs

Table 3. HELPS-seniors service learning program for medical students.

effects of the HELPS-seniors on science literacy, health literacy and health conditions of the elderly subjects, all subjects were asked to complete four questionnaires before and after the 4 week program: A 32-item science literacy questionnaire, a 47-item health literacy questionnaire (HLS-EU) [31], a depression questionnaire(CES-D 10) [32], and a quality of life questionnaire (SF-12) [33].

We modified the original 90 minute HELPS-seniors walking course into a 4 week service stage HELPS-seniors service learning program including an ice breaking introductory session, USB pedometer/ instruction, USB health bank system instruction and orientation activities. During the ice breaking, medical students introduced themselves and the importance of healthy behavior to the elderly participants. Hands-on, game-like experiments were conducted to engage participants' interest and learning motivation. Medical students taught the participants how to wear the USB pedometer, to plug it into the measurement device (blood pressure meter or body weight scale), and to conduct the measurement. After the ice-breaking, the participants were encouraged to wear the USB pedometer continuously for one week to record their physical activity.

During the USB pedometer instruction section, medical students taught the participants how to plug in their USB pedometer, to activate the pre-installed software (PJDC), and to view their USB pedometer data on a Windows-based computer. The USB health bank uses a 3-D sensor to track user movement and calculate step counts; the distance can then be estimated based on step counts and stride length (assuming a fixed stride length). The speed can be estimated based on steps-per-minute and stride length. After collecting a week's worth of physical activity data, the medical students reviewed the data with the participants to discuss their daily activity, activity patterns, and energy expenditure. Based on

participants were instructed ob how to correctly and autonomously measure their body weight, measure blood pressure, and track longitudinal physiological data on the PC . Students introduced participants to the "OurCityLove Friendly Restaurant Guide Taipei" APP to encourage better eating and increased physical activity. Participants were guided through an orienteering activity which integrated walking, GPS map reading, and neighborhood exploration to encourage adoption of an active aging lifestyle. Students also provided participants with intensive one-on-one hands-on practice using the USB health bank system.

Results summarized in Table 3 show that the science literacy, health literacy and health condition (i.e., mental health and quality of life) of the participants improved significantly over the course of the 4 week HELPS-seniors program. Significant improvement was also found in terms of the medical students' attitudes, knowledge, and skills related to community health, resources, and service. The success of a program is measured not only by what the students learned but also by the utility of the students work to those served.
Interacting with the elderly participants helped students overcome stereotyped impressions that elderly people are difficult to communicate with an unwilling to learn. Students agreed that such service-learning courses can effectively decrease technophobia among elderly people and reduce the intergeneration health literacy gap.

Discussion and Conclusion

This article focuses on developing an effective and feasible program to help poorly-educated elderly people overcome technophobia and reduce risk factors related to chronic diseases through the use of a USB health bank system. Chronic illnesses are now the leading cause of

score	pre		post		
dimensions	*M*	*SD*	*M*	*SD*	*p*
Science literacy	22.48	5.66	29.81	3.42	.000
Health literacy	40.77	5.44	42.58	4.26	.028
10-item CES-D	4.48	4.68	2.52	3.97	.007
QOL (SF-12) PCS	45.48	8.56	48.69	7.30	.021
QOL (SF-12) MCS	50.75	8.20	54.18	5.85	.011

Table 4. Effects of HELPS-seniors service learning program.

individual physical activity, body weight and blood pressure, students provided each participant with an individualized exercise prescription and life style modification recommendation.
During the USB health bank system instruction section,

death in Taiwan [11]. Particularly among the elderly, it can be very difficult to change risk factors related to chronic disease such as physical inactivity, obesity, and hypertension. Figure 3 summarizes the results of previous studies and our HELPS-seniors program to illustrate

possible relationships among aging, education, technophobia, health literacy, health behaviors, chronic disease risk factors, health conditions and medical costs.

elderly participants. Results of our pilot study indicate that the program significantly improved the subjects' science literacy, health literacy and life quality.
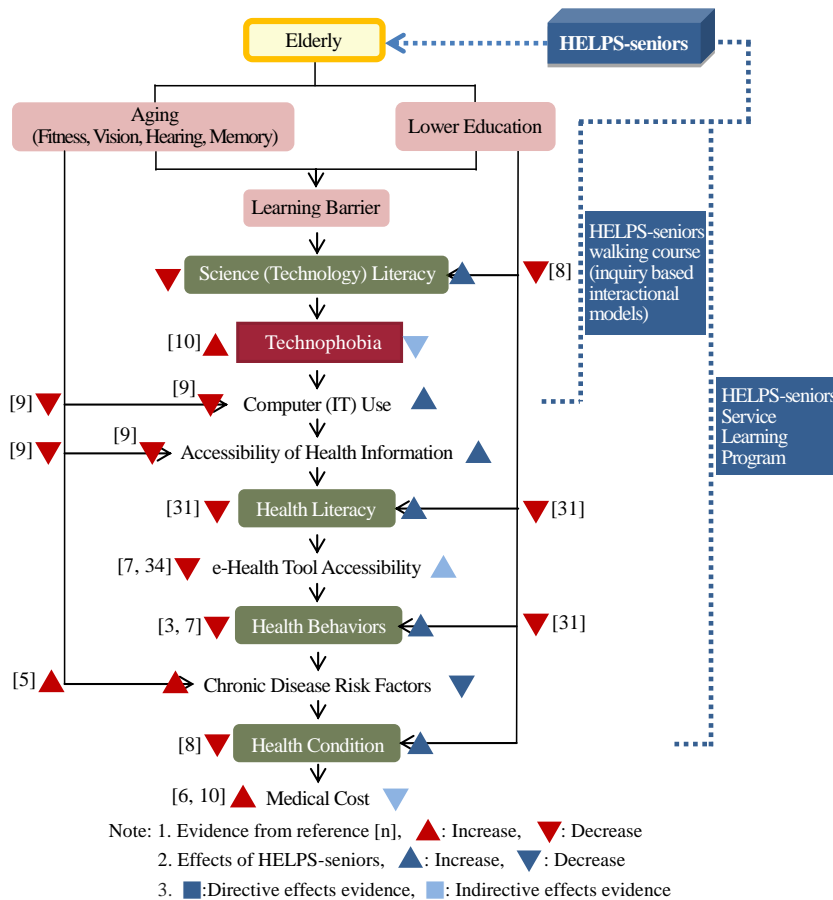

Note: 1. Evidence from reference [n], ▲: Increase, ▼: Decrease
2. Effects of HELPS-seniors, ▲: Increase, ▼: Decrease
3. ■: Directive effects evidence, ■: Indirective effects evidence

Figure 4. Aging, education, technophobia, and health related.

Through emphasizing "learning by doing", the HELPS-seniors walking course effectively reduces technophobia and encourages participants to adopt wearable technology products and computer technologies. Poorly-educated elderly people tend to have higher barriers to learning and increased technophobia. The single 90 minute HELPS-seniors walking course was found to improve subjects' science literacy, to reduce their fear of IT , and to instill positive attitudes towards using the USB health bank system application. The easy-to-use USB health bank requires no setup, does not need to be paired with other devices and has no wireless connection, making it user-friendly for elderly people.

The improvement of health and science literacy is critical to enhancing the knowledge and attitudes of elderly people, and thus raising their self-confidence in practice. We attempted to integrate walking-related science concepts (distance, frequency, and speed), physical functions (walking speed and endurance), and wearable devices (USB pedometer) in our HELPS-seniors service learning to enhance the physical inactivity of

Integrating service-learning activities in medical education can help meet community needs and enhance student public health education. Service learning is different from field study, internships and practice in that the student is not just an observer but also an active participant. As generated by community-based higher educational initiatives, service learning in medical education has contributed to the restructuring of clinical education components of the medical curriculum as well as the establishment of partnerships between medical schools and the communities they serve. Previous studies have found that telehealth programs can enhance chronic disease care, and home and hospice care. More than 95% of the studies reported significant improvements in the caregivers' outcomes and that caregivers were satisfied and comfortable with telehealth [34].

The present findings support the continued development and evaluation of service-learning projects within medical school training programs to overcome technophobia among the elderly. Future work will continue to develop HELPS to address urgent issues such as hearing and vision loss. A hearing HELPS module has

been developed which integrates sound science, hearing testing, and hearing aid introduction.

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