Comparison of Education and Income Levels of the Elderly in Relation to Self-directed Learning Through Technology to Foster Development in the 21st Century Aging Society

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Abstract

The purposes of the mixed-method study are twofold: 1) Investigate the factors and examine the levels of self-learning through technology among the elderly and 2) Explore the impact of educational background and income on self-directed learning through technology. A self-directed learning guideline was also developed to specifically address older adults' needs. The data were collected from 405 elders living in selected areas across Bangkok. The study employed purposive sampling, selecting five districts for data collection to represent the population effectively. Semi-structured interviews were conducted to triangulate the quantitative data. The results of a factor analysis showed that the factors for self-directed learning through technology among the elderly consisted of six factors: 1) Management skills, 2) Open-mindedness, 3) Self-development, 4) Self-reliance, 5) Discipline, and 6) Self-confidence. In addition, the average level of self-directed learning through technology among the elderly is high. The factor with the highest level is open-mindedness, followed by self-development and self-reliance, respectively. The results from One-way ANOVA analysis suggest that older adults with varying education levels demonstrate differences in management skills, open-mindedness, self-reliance, and self-confidence when engaging in self-directed learning through technology. Additionally, income levels significantly influence the use of technology for learning, with higher income providing better access to resources. The suggested guideline also recommends that organizations promote the importance of technology-based learning, encouraging older adults to recognize the benefits of self-directed learning to support the development of an aging society in the 21st century. These

will foster sustainable learning, promote self-sufficiency among the elderly, and enhance the aging society.

Keywords: self-directed learning; elderly; technology; aging society; twenty-first century

Introduction

Thailand fully transitioned into an aging society in 2024, when 20.67% of the Thai population was 60 and above (Bureau of Registration Administration, 2024). Thailand is expected to become a "fully aged society" by 2021, with the elderly population reaching 20%, and a "super-aged society" by 2035, with estimates indicating that the elderly will make up 30% of the total population. Addressing the challenges of a fully developed aging society shortly is a critical issue that requires attention and cooperation from all sectors at both the policy and operational levels. This also includes preparing individuals and developing systemic readiness to accommodate the aging society.

Advancements in medicine and shifts in lifestyle have enabled older adults to live longer, healthier lives. However, like other life stages, older adulthood requires adaptations in areas such as work, family, and health. A valuable way to navigate these transitions is through self-directed learning (Roberson & Merriam, 2005). The government has greatly emphasized education for the elderly to align with educational reform efforts. The key focus of the Act is on lifelong learning, which integrates formal, non-formal, and informal education, ensuring continuous development of quality of life throughout one's life. Despite having vast life experiences, work knowledge, and life skills, elderly individuals still need to keep learning to improve themselves, remain self-reliant, and stay updated with societal and national changes in the modern world (Ministry of Education, 2022). It is believed that if the elderly engage in lifelong learning and acquire knowledge, skills, and experience according to their needs, it will positively impact their personal development and the overall progress of society.

This research aims to examine the factors and levels of self-directed learning through technology among the elderly in Thailand to support the government's initiative to promote lifelong learning and enhance the potential of the elderly. The findings will propose guidelines for fostering sustainable learning, promoting self-sufficiency among the elderly, and enhancing the aging society.

Objectives

In order to fill the gaps and promote an aging society, this research has two main objectives:

1. Investigate the factors and examine the levels of self-learning through technology among the elderly

2. Explore the impact of educational background and income on self-directed learning through technology among the elderly.

The results will provide crucial insights for proposing appropriate self-directed learning guidelines for the elderly.

Literature Review

Self-directed Learning among Elderly

Knowles (1975) defined self-directed learning as a process in which individuals take the initiative to identify their own learning needs, either independently or with the help of others. This includes setting learning goals, sourcing learning materials, selecting appropriate learning strategies, and evaluating their learning outcomes. Guglielmino (1978) stated that self-directed learning is a learning process that can occur in various situations, depending on the learner's personal characteristics, such as attitude, beliefs, and abilities. Hiemstra (1994) also defined self-directed learning as a process in which learners take responsibility for planning, conducting, and evaluating their own learning. This characteristic exists in all individuals in every learning situation. It does not necessarily occur when the learner is isolated from others; learners can transfer their learning from one situation to another. Unlike traditional teaching methods focusing on delivering knowledge, self-directed learning fosters self-awareness and encourages personal exploration (Dahal & Bhat, 2023).

Advancements in medicine and lifestyle changes have led to older adults enjoying longer, healthier lives. However, like any other life stage, older adulthood demands work, family, and health adjustments. Self-directed learning is an effective approach to negotiating these transitions (Roberson & Merriam, 2005). The. Self-learning factors of the elderly for developing an aging society in the 21st century refer to the elements that influence the elderly in developing their knowledge, abilities, and skills through self-directed learning (Morrison & McCutcheon, 2019; Valente, 2006). These factors are crucial in creating a society where the elderly can actively

participate and live a high-quality life in the modern age. These factors may include: 1) access to technology, which is learning through online media or digital devices, allows the elderly to easily and quickly access information and learn new skills; 2) motivation to learn, which refers to the interest and inspiration to improve oneself drive the elderly to seek new knowledge eagerly; 3) learning environment which seems to be a supportive atmosphere, such as encouragement from family or community, makes self-directed learning easier; 4) social support and government policies which provide resources and opportunities for elderly learning, such as learning centers for the elderly or specific skill development courses. These factors are essential components that can help promote self-learning in the elderly and contribute to building a high-quality aging society in the 21st century.

Self-directed Learning via Technology among the Elderly

Currently, digital technology has become an integral part of the daily routines of the elderly, particularly in communication with family members. Whether through LINE or Facebook, these platforms help bridge the distance between older adults and their families. In addition to social media, the elderly use digital technology or the internet to keep up with news and gather information, allowing them to stay informed about current events (Tirakoat & Polnigongit, 2018). Thus, Digital technology has become a significant aspect of communication and information for the elderly. Moreover, technology plays a crucial role in enhancing the quality of life for older adults, enabling them to live more independently and actively (active aging). They can access and utilize various information technologies and innovations (Rodkhem & Chaiprasit, 2019). Kleechaya (2021) noted that elderly individuals who can use technology to enhance their capabilities have accumulated their identity, thoughts, knowledge, skills, and abilities over many years, and they can overcome technological barriers through self-learning and guidance from their children. Nochot (2021) found that retirees are increasingly aware of and skilled in using technology. E-books, for instance, contribute to enriching their reading experience, while applications and websites are utilized for travel information and planning (Kultida, 2022).

It is evident that the use of digital technology among the elderly is on the rise, driven by their acceptance of technology and a positive attitude towards its benefits, as well as the increasing ease of use (Watakit, 2024). Therefore, businesses should focus on developing digital products and services tailored to the elderly, as this demographic represents a significant and growing market, possessing substantial purchasing power for goods and services.

The Development of an Aging Society in the 21st Century

Developing an aging society in the 21st century brings challenges and opportunities (Walker, 2002). As life expectancy increases and birth rates decline in many regions, the proportion of older adults rises significantly (Lutz et al., 2008). This demographic shift impacts various sectors, including healthcare, economics, and social services. Aging societies face challenges such as increased demand for healthcare services, the need for age-friendly environments, and the potential for a shrinking workforce (Maestas et al., 2022). However, there are also opportunities, such as leveraging the experience and knowledge of older adults in the workforce and creating markets for products and services tailored to their needs. Policies to support active aging, enhance social inclusion, and promote lifelong learning can help mitigate some of the challenges associated with an aging population. Moreover, integrating technology, such as telehealth and digital communication tools, can improve the quality of life for older adults and help them maintain independence (Vincek et al., 2024).

Conceptual Framework

Figure 1: The conceptual framework of comparative analysis of education and income levels of the elderly in relation to self-directed learning through technology

Personal factors

– Educational background

– Income

Self-directed Learning through Technology of Elderly
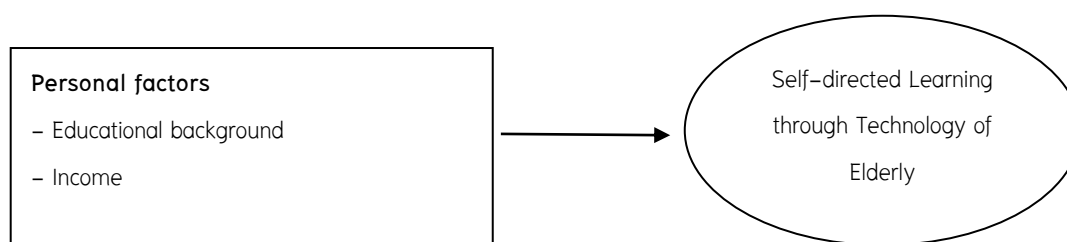
Research Methodology

This research is a mixed-method study conducting both qualitative and quantitative approaches. A questionnaire was used to collect quantitative data. In addition to the quantitative results, qualitative research was conducted to enhance confidence in the evaluation outcomes. Semi-structured interviews were conducted face-to-face with five older adults from each district, randomly selected and agreed to participate in the study. The older adults were asked about the factors influencing self-directed learning through technology and how different educational

backgrounds and income levels affect learning. Data from the interviews were collected as detailed supplementary opinions, providing further insights.

Population and samples

The population for this research consisted of individuals aged 60 and above in Bangkok, totaling 1,281,397 people. The sampling method used is purposive sampling, where five districts were selected as data collection areas to represent the population effectively. Each district has a different location spread across Bangkok, including Don Mueang, Lat Krabang, Bang Na, Thawi Watthana, and Phaya Thai (Bureau of Registration Administration, 2024). Data will be collected from all these areas – two in central Bangkok districts and three in the suburbs, with a total sample size of 400 individuals (Yamane, 1967).

The data were collected from the sample group in selected areas across Bangkok, including Don Mueang, Lat Krabang, Bang Na, Thawi Watthana, and Phaya Thai. Since the sample group consisted of elderly individuals, data were collected in locations where they were likely present, such as hospitals, shopping malls, and public parks. Before collecting data, the researcher obtained ethics approval for human research. Participants were then explained the study and asked to complete an Informed Consent Form, which informed them of their right to decline participation during the data collection.

Research Instrumentation

The questionnaire consisted of two parts: 1) general information about the respondents and 2) a survey measuring the self-directed learning factors regarding the use of technology. A total of 52 items using a five-point Likert scale were adapted from Fisher (2010) to explore the factors of self-learning through technology among the elderly. Three experts evaluated the questionnaire for its appropriateness and accuracy. The IOC scores for the questions were 0.93, indicating acceptance. Then, some items were recommended to be edited, and some unclear words were revised based on their recommendations. After adjustments, the revised questionnaire was tested for reliability during the pilot process. The questionnaire was distributed to 30 older adults living in Bangkok and being recommended by colleagues who agreed to participate. The elderly participants involved in the pilot test were excluded from the main study. After collecting the responses, the data were analyzed to assess reliability using Cronbach's alpha, and the value of this questionnaire was 0.965, which was accepted to use (Taber, 2018).

Data Analysis

Once the data collection was completed, the gathered data from the questionnaires were analyzed using a statistical package. Personal information, including general characteristics of the respondents, such as gender, age, education level, and income, was collected using descriptive statistics using frequency, mean, and standard deviation. Next, Exploratory Factor Analysis was used to identify the components of self-directed learning among the elderly. In order to investigate personal factors of the elderly that influence self-directed learning, One-way ANOVA was employed.

Research Results

1. Analysis of Personal Factors of Respondents

The results of the basic data analysis show the characteristics and number of respondents. Out of 405 respondents, the majority were female, most had a primary school education, were married, and earned less than or equal to 15,000 baht.

The results of a factor analysis are shown in 2 to investigate the factors of self-learning through technology among the elderly.

2. Factor Analysis

According to the factor analysis of self-directed learning through technology among 405 elderly people, six factors were extracted, explaining 57.086% of the total variance: Factor 1 (Management Skills), Factor 2 (Open-Mindedness), Factor 3 (Self-Development), Factor 4 (Self-Reliance), Factor 5 (Discipline), and Factor 6 (Self-Confidence).

Table 1 Factor 1: Management Skills

No.	Item	Factor loading
5	Learning through technology has improved my management skills.	.750
4	Learning through technology has enabled me to manage my time effectively.	.712
6	Learning through technology allows me to set strict time frames.	.708
7	Learning through technology enables me to plan my own learning.	.692
10	Learning through technology allows me to learn systematically on my own.	.637
3	Learning through technology enables me to solve problems and solve puzzles.	.616
8	Learning through technology makes me enjoy self-directed learning.	.581
1	Learning through technology helps me to plan for problem-solving.	.572

No.	Item	Factor loading
11	Learning through technology allows me to stay focused on the problem.	.518
2	Learning through technology helps me prioritize my tasks.	.509
14	Learning through technology allows me to evaluate new ideas critically.	.487
15	Learning through technology makes me enjoy setting my own learning goals.	.468
12	Learning through technology often allows me to review my previous working methods.	.449

From Table 1, Factor 1 comprises a set of 13 items that indicate their relevance to the management skills of self-directed learning through technology among older adults. A factor loading accompanies each item, quantifying how strongly each question correlates with this factor. The highest factor loadings are found in Item 5 (Factor loading = .750), Item 4 (Factor loading = .712), and Item 6 (Factor loading = .708), respectively.

Table 2 Factor 2: Open-mindedness

No.	Item	Factor loading
18	Learning through technology makes me open to receiving advice from others.	.737
19	Learning through technology allows me to learn from my own mistakes.	.712
20	Learning through technology helps me adjust my behavior when presented with proven facts.	.689
22	Learning through technology allows me to be open to new opinions.	.687
21	Learning through technology allows me to embrace new learning opportunities.	.686
17	Learning through technology enables me to seek help when necessary.	.641
23	Learning through technology allows me to ask for help when encountering a problem I cannot solve.	.623
13	Learning through technology makes me want to understand the cause of the problem.	.574
16	Learning through technology makes me willing to change my mindset	.516
9	Learning through technology makes me believe that the role of a teacher/ speaker/ instructor is to express the knowledge they possess.	.468
39	Learning through technology encourages me to gather accurate information before making a decision.	.427

From Table 2, Factor 2 comprises a set of 11 items that indicate their relevance to the open-mindedness of self-directed learning through technology among older adults. A factor loading accompanies each item, quantifying how strongly each question correlates with this factor. The highest factor loadings are found in Item 18 (Factor loading = .737), Item 19 (Factor loading = .712), and Item 20 (Factor loading = .689), respectively.

Table 3 Factor 3: Self–Development

No.	Item	Factor loading
36	Learning through technology makes me enjoy learning new information.	.736
35	Learning through technology makes me want to learn new information.	.732
33	Learning through technology instills in me a desire to learn.	.723
32	Learning through technology makes me enjoy learning.	.716
34	Learning through technology makes me enjoy challenges.	.641
31	Learning through technology boosts my confidence in my ability to find information.	.475

From Table 3, Factor 3 comprises a set of 6 items that indicate their relevance to the self–development of self–directed learning through technology among older adults. A factor loading accompanies each item, quantifying how strongly each question correlates with this factor. The highest factor loadings are found in Item 36 (Factor loading = .736), Item 35 (Factor loading = .732), and Item 33 (Factor loading = .723), respectively.

Table 4 Factor 4: Self–Reliance

No.	Item	Factor loading
49	Learning through technology makes me enjoy making decisions on my own.	.662
51	Learning through technology allows me to take control of my own life.	.614
48	Learning through technology makes me need only a little assistance in finding information.	.599
46	Learning through technology gives me confidence that I can continue to learn independently.	.585
47	Learning through technology enables me to find information on my own.	.577
50	Learning through technology makes me enjoy setting my own goals.	.559

From Table 4, Factor 4 comprises a set of 6 items that indicate their relevance to the self–reliance of self–directed learning through technology among older adults. A factor loading accompanies each item, quantifying how strongly each question correlates with this factor. The highest factor loadings are found in Item 49 (Factor loading = .662), Item 51 (Factor loading = .614), and Item 48 (Factor loading = .599), respectively.

Table 5 Factor 5: Discipline

No.	Item	Factor loading
42	Learning through technology helps me become more organized in my work.	.674
38	Learning through technology instills discipline in me.	.624
43	Learning through technology allows me to assess my own abilities.	.582
45	Learning through technology makes me take responsibility for my own decisions and actions.	.531
40	Learning through technology helps me manage things effectively.	.521
44	Learning through technology makes me enjoy setting criteria to assess my own abilities.	.504
24	Learning through technology makes me responsible.	.430
41	Learning through technology makes me a more logical thinker.	.417

From Table 5, Factor 5 comprises a set of 8 items that indicate their relevance to the discipline of self-directed learning through technology among older adults. A factor loading accompanies each item, quantifying how strongly each question correlates with this factor. The highest factor loadings are found in Item 42 (Factor loading = .674), Item 38 (Factor loading = .624), and Item 43 (Factor loading = .582), respectively.

Table 6 Factor 6: Self-Confidence

No.	Item	Factor loading
26	Learning through technology raises my expectations.	.698
27	Learning through technology sets my personal standards high.	.692
28	Learning through technology boosts my confidence in my own abilities.	.521
29	Learning through technology makes me aware of my own limitations.	.444

From Table 6, Factor 6 comprises a set of 4 items that indicate their relevance to the self-confidence of self-directed learning through technology among older adults. A factor loading accompanies each item, quantifying how strongly each question correlates with this factor. The highest factor loadings are found in Item 26 (Factor loading = .698), Item 27 (Factor loading = .692), and Item 28 (Factor loading = .521), respectively.

Descriptive statistics were employed to examine the levels of self-learning through technology among the elderly.

Table 7 Levels of self–directed learning through technology

No.	Factors	MEAN	S.D.	Interpretation
1	Average level of management skills	4.06	0.525	High
2	Average level of open–mindedness	4.32	0.471	High
3	Average level of self–development	4.16	0.592	High
4	Average level of self–reliance	4.08	0.576	High
5	Average level of discipline	4.07	0.726	High
6	Average level of self–confidence	3.98	0.610	High
	The average level of self–learning factors	4.11	0.583	High

Table 7 shows that the average level of self–directed learning through technology among the elderly is 4.11 (S.D. = 0.583), which is high. The factor with the highest level is open–mindedness (mean = 4.32, S.D. = 0.471), followed by self–development (mean = 4.16, S.D. = 0.592) and self–reliance (mean = 4.08, S.D. = 0.576).

A one–way ANOVA was employed to explore the impact of educational background and income on self–directed learning through technology among elderly individuals.

Table 8 Comparison of self–directed learning levels of the elderly by educational level

Factors of Self–Directed Learning		SS	df	MS	F	Sig
Management Skills	Between Groups	16.131	6	2.688	2.534	0.020
	Within Groups	422.192	398	1.061		
	Total	438.323	404			
Open–mindedness	Between Groups	37.618	6	6.270	6.874	0.000
	Within Groups	363.021	398	0.912		
	Total	400.639	404			
Self–Development	Between Groups	5.416	6	0.903	0.791	0.577
	Within Groups	454.063	398	1.141		
	Total	459.479	404			
Self–Reliance	Between Groups	24.182	6	4.030	4.061	0.001
	Within Groups	394.977	398	0.992		
	Total	419.159	404			
Discipline	Between Groups	2.457	6	0.410	0.346	0.912
	Within Groups	470.666	398	1.183		
	Total	473.124	404			
Self–Confidence	Between Groups	20.058	6	3.343	3.360	0.003
	Within Groups	395.953	398	0.995		
	Total	416.011	404			

Table 8 shows that the level of self-directed learning among the elderly is divided by educational level in management skills, open-mindedness, self-reliance, and self-confidence, which has significant statistical differences at the .05 level. At the same time, there was no significant level regarding self-development and discipline.

Table 9 Comparison of self-directed learning levels of the elderly by income

Factors of Self-Directed Learning		SS	df	MS	F	Sig
Management Skills	Between Groups	23.130	3	7.710	7.446	0.000
	Within Groups	415.194	401	1.035		
	Total	438.323	404			
Open-mindedness	Between Groups	2.029	3	0.676	0.680	0.564
	Within Groups	398.610	401	0.994		
	Total	400.639	404			
Self-Development	Between Groups	3.876	3	1.292	1.137	0.334
	Within Groups	455.603	401	1.136		
	Total	459.479	404			
Self-Reliance	Between Groups	6.307	3	2.102	2.042	0.107
	Within Groups	412.852	401	1.030		
	Total	419.159	404			
Discipline	Between Groups	2.663	3	0.888	0.756	0.519
	Within Groups	470.461	401	1.173		
	Total	473.124	404			
Self-Confidence	Between Groups	0.679	3	0.226	0.218	0.884
	Within Groups	415.332	401	1.036		
	Total	416.011	404			

Table 9 shows that the level of self-directed learning among the elderly divided by income regarding management skills has significant statistical differences at the .05 level. There was no significant level regarding open-mindedness, self-development, self-reliance, discipline, and self-confidence.

While the data were collected, five elders from each selected district were interviewed. Each district has a different location spread across Bangkok, including Don Mueang, Lat Krabang, Bang Na, Thawi Watthana, and Phaya Thai. Then, the quantitative and qualitative data were collected in order to propose guidelines suitable for the elderly as follows:

1. Learning via technology affects self-directed learning among the elderly since the elders revealed that there were 6 factors of self-directed learning through technology: 1) Management skills, 2) mindedness, 3) Self-development, 4) Self-reliance, 5) Discipline, and 6) Self-confidence. Importantly, the self-directed learning level through the technology of the elderly is at a high level.

As the elder A mentioned,

> *When using technology, I perceived that I learned systematically and enjoyed learning with myself. Technology also helped me to plan for problem-solving.*

In addition, the elder B stated,

> *Using technology led me open to new world. I was open and confident to learn because it helped me better in focusing on daily problems and solutions. Moreover, learning via technology was an important mechanism for developing myself after I retired.*

The elder C also revealed,

> *Learning through technology, such as using applications and watching news, helped me easily find information on my own, be open to new opinions, and think more logically. It was the easiest way of learning when I did my housekeeping work. I could learn new things by myself when I was working.*

2. The quantitative data on the level of self-directed learning among the elderly divided by education level and income, together with qualitative data from the interview, revealed insight into the increase in the learning level in the 21st century. It can be implied from the One-way ANOVA analysis that there was a significant difference in self-directed learning through technology regarding education levels in management skills, open-mindedness, self-reliance, and self-confidence factors. In addition, it is shown that there was a significant difference in self-directed learning through technology regarding income ranges in the management skills factor.

As the elder E mentioned,

> *Learning via technology might be affected by educational background. For instance, older people who can read and write, especially in English well, seemed to be open and confident about learning because*

they were not afraid of content online. They could read and understand the details of what they read.

In addition, the elder D stated,

Searching for information via technology, such as important government policies, helped me better manage my life. I needed to learn systemically since I had a limited budget for an Internet package. So, income might affect the opportunities to learn from technology.

Discussion

The results of the study of self-directed learning through technology among 405 elderly were consistent with Morrison & McCutcheon (2019), Roberson & Merriam (2005), and Valente (2006), who revealed that self-directed learning serves as an effective means to navigate the transitions of life stages among elderly and the factors influencing self-directed learning among the elderly are essential for developing their knowledge, abilities, and skills, contributing to the advancement of an aging society in the 21st century. Elders increasingly use digital technology and the internet to stay updated on news and gather information, a form of self-directed learning to help them remain informed about current events. (Tirakoat & Polnigongit, 2018). Furthermore, technology is essential in improving the quality of life for older adults, allowing them to live more independently and actively (Rodkhem & Chaiprasit, 2019). Unlike traditional teaching methods focusing on delivering knowledge, self-directed learning promotes self-awareness and personal discovery (Dahal & Bhat, 2023). Self-directed learning positively influences elders by fostering independence, enhancing confidence, and promoting lifelong learning (Vincek et al., 2024). By taking control of their learning processes, elders can pursue interests at their own pace, adapt to changing circumstances, and acquire new skills that enhance their daily lives. Additionally, it encourages critical thinking and problem-solving, leading to greater engagement and fulfillment in their activities.

The results from One-way ANOVA analysis imply that the elderly from different educational levels reflected that self-directed learning through technology makes them different in management skills, open-mindedness, self-reliance, and self-confidence. Learning through technology may be influenced by an individual's educational background because those with higher levels of education often have better access to resources and are more comfortable navigating digital platforms. They may possess stronger literacy and critical thinking skills, making

understanding and engaging with online content easier. Additionally, educational experiences can shape one's attitudes toward learning, fostering a greater willingness to explore and utilize technology for self-directed learning (Hase & Kenyon, 2000; Lai, 2014). Thus, it can be implied that the elderly from various income ranges demonstrated that self-directed learning through technology influences their management skills differently because income often affects access to resources, educational opportunities, and technological tools (Li, 2023). Those with higher incomes may have greater access to training and support, enabling them to develop stronger management skills. In contrast, lower-income individuals might face barriers that limit their ability to engage with technology effectively, impacting their skill development.

The study recommended that relevant organizations promote awareness of the importance of technology-based learning to support the development of an aging society in the 21st century. Furthermore, arranging community educational events and hosting exhibitions on effective technology-based learning will enable older adults to appreciate the importance of self-directed learning. The income of the elderly is a significant factor that can hinder their ability to engage in self-directed learning through technology. Therefore, relevant organizations should support internet access and create online learning resources specifically for older adults. These guidelines will lead to sustainable learning, enabling older adults to become self-sufficient and further advance the aging society in the 21st century.

New Knowledge from Research

The new knowledge gained from this research is the proposed guideline, which can be summarized into a framework as follows:

Figure 2: The concept of the proposed guideline
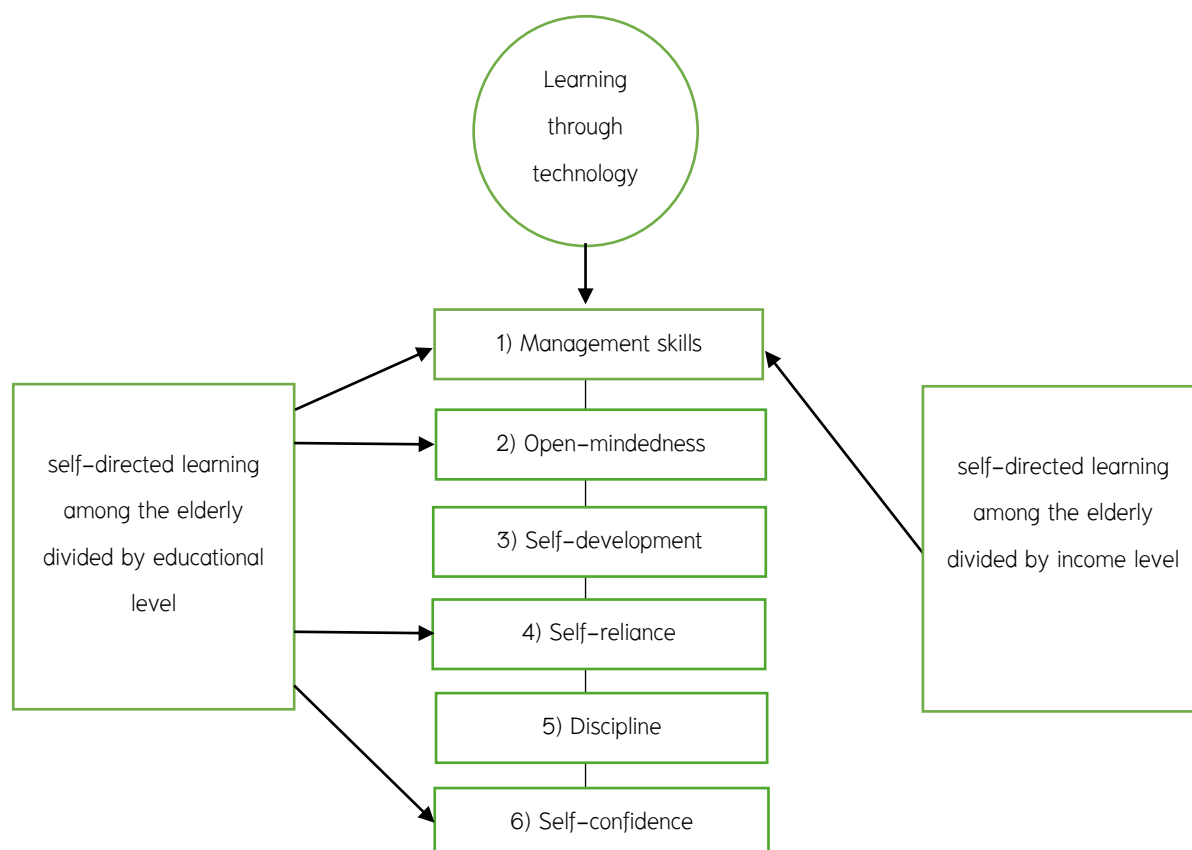
According to Figure 2, it can be implied that the elderly from different educational levels reflected that learning with self-directedness through technology makes them different in management skills, open-mindedness, self-reliance, and self-confidence. Learning via technology may be influenced by educational background. For instance, educated older people can read and write easily and seem open and confident in learning because there is probably no difficulty in understanding the content. It makes them read and understand the details of what they read easily. Additionally, it is evident that the elderly from different income ranges reflected that learning with self-directedness through technology makes them different in management skills. Hence, income may influence the use of technology for learning. Higher-income levels often provide access to better resources and technology, leading to more opportunities for effective

learning. Conversely, lower-income people can limit access, affecting their ability to utilize technology for educational purposes.

Therefore, it is recommended that relevant organizations promote awareness of the importance of technology-based learning to support the development of an aging society in the 21st century. Additionally, organizing community educational activities for older adults and hosting exhibitions on effective technology-based learning will help older adults recognize the value of self-directed learning since they are open-minded to learning by themselves. The income of the elderly seems to be a significant factor that can hinder their ability to engage in self-directed learning through technology. Therefore, relevant organizations should support internet access and create online learning resources specifically for older adults. These guidelines will lead to sustainable learning, enabling older adults to become self-sufficient and further advancing the aging society in the 21st century

Conclusion

The mixed-method study has three main objectives: 1) to explore the factors and examine the levels of self-learning through technology among the elderly; 2) to evaluate the impact of educational background and income on learning; and 3) to propose guidelines for effective self-directed learning tailored to the elderly.

In addressing the first objective, factor analysis identified six key components of self-directed learning through technology: 1) management skills, 2) open-mindedness, 3) self-development, 4) self-reliance, 5) discipline, and 6) self-confidence. The findings also indicated that the overall level of self-directed learning among the elderly was high, with open-mindedness being the most significant factor, followed by self-development and self-reliance.

For the second objective, One-way ANOVA analysis highlighted significant differences in self-directed learning related to education levels, particularly in management skills, open-mindedness, self-reliance, and self-confidence. Income levels also had a notable effect on management skills.

In relation to the final objective, the guideline was proposed to enhance awareness of the importance of technology-based learning, thereby supporting the development of an aging society in the 21st century.

Suggestion

Investigating the factors of self-directed learning through technology among the elderly benefits the elders, their family members, and relevant organizations. Family members can use this data to promote technology-based learning for older adults in the family. The relevant organizations can apply the information or guidelines to promote awareness of the importance of technology-based learning to support the development of an aging society in the 21st century. The results will lead to sustainable learning, enabling older adults to become self-sufficient and further advancing the aging society in the 21st century.

The current study has revealed certain findings; however, it is important to emphasize that these results are derived from a limited sample size. Therefore, additional research should be conducted with a larger and more diverse group of elders or in various geographical regions to confirm and build on these findings. Furthermore, exploring digital literacy among the elderly could enhance understanding and address gaps in the digital transformation study. A broader research scope may uncover significant insights and offer a more comprehensive understanding of the topic.

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