eHealth literacy: Is it hindered by age?

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Abstract
Background: The world’s Internet penetration rate is increasing yearly; approximately 25% of the world’s population are Internet users. In Asia, Taiwan has the fifth highest Internet usage and has an Internet penetration rate higher than the world average. eHealth literacy is the ability to read, understand, and utilize online health information. eHealth literacy is gaining attention worldwide.

Objectives: This study uses “age” as a background variable, comparing the differences in eHealth literacy among college students and senior university students. To examine this issue further, this study also summarizes the college students’ and senior university students’ online health information experiences and performances. This study aims to explore the difference between eHealth literacy rates among college students and senior university students. It examined the differences in eHealth literacy among the senior university student (over age 55) and college students to gain an in-depth understanding of the differences that exist across age groups.

Methods: A mixed method approach was used, including questionnaire surveys. College students (aged 18–22) and senior university students (aged 55–72) were investigated. A total of 208 respondents—65 (31.25%) college students and 143 (68.75%) senior university students—were interviewed.

Results: There were significant differences in the overall eHealth literacy scores ($t_{207} = 2.98; P < .01$) and the functional eHealth literacy dimension ($t_{207} = 12.17; P < .001$). The findings showed gaps in eHealth literacy among the two groups. Most study participants believed that most online health information could be read and understood; however, they were doubtful when evaluating information quality, and noted that it was divided into subjective judgments and objective standards. College students preferred aesthetically pleasing health information, while senior university students focused on its promotion. Furthermore, the former often used websites for solving health problems, while the latter forwarded health information through communication software.

Keywords: EHealth literacy, Generation gap, College students, Senior university students, Mixed methods

Introduction
The Internet usage rate has generally increased, and the issue of eHealth literacy has become apparent

EHealth literacy is gaining an increasing amount of attention worldwide. Individuals
with eHealth literacy have better health capital and can further promote the overall health and competitiveness of the country. In 2017, the Taiwan Broadband Internet Usage Survey reported that 3,153 valid sample analysis results showed that individuals were used to having an Internet access rate of over 83%, of whom 84.7% agreed that “the use of the Internet has improved the quality of your life.” However, 55.9% disagreed that “the use of the Internet can increase your trust in information” [1]. Thus, even if individuals possessed little knowledge of eHealth information, it was still possible for them to take appropriate action.

**Different age groups exhibit unique eHealth literacy performances**

Given the popularity of the Internet, research has shifted focus toward the relevance of health literacy through the Internet; as a result, “eHealth Literacy,” as a field of research, has gradually received increased attention [6]. Eng [10] argues that eHealth literacy refers to the use of the Internet to access information to improve or promote health, while Norman and Skinner [4] further suggest that eHealth literacy refers to the use of the Internet to seek, understand, and evaluate health information and to use this information to address health problems. The connotation of eHealth literacy has three layers: the first layer is functionality, which refers to the basic ability to read health information. The second layer is interaction, which refers to more advanced knowledge of the choices available in health information, including knowledge required to understand, integrate, and use that information, and knowledge of a supportive interactive environment that provides health information and other skills. The third layer is criticality, which is a deeper analysis of health information, involving criticism of the information and its application to health and the response to that criticism, resulting in better control over living conditions [8,9].

**Related research on eHealth literacy**

eHealth literacy has the potential to positively support consumer health empowerment [5]. The Integrative Model of eHealth Use claims that macro-level disparities in social structure are connected to health disparities that arise as a result of micro-level factors such as eHealth literacy, motivation, and ability [6]. Few studies have explored the associations among individual factors such as gender, age, and major in relation to eHealth literacy [3,7], as cross-group comparisons have yet to be investigated empirically. In Taiwan, which among countries in Asia currently ranks fifth highest in Internet usage and has an Internet penetration rate of 65.90% [2], college students are one of the groups that access Internet health information more frequently than do other groups. The proportion of older people using Information and Communication Technology appears to be lower than that of other age groups, making it difficult to
breach this digital wall. This leads to the question examined in this study: Does eHealth literacy exist across the generation gap? Specifically, is there a difference between eHealth literacy rates among college students and senior university students? To answer these questions, this study examined the differences in eHealth literacy among the senior university student (people over the age of 55) and college students to gain an in-depth understanding of the differences that exist across age groups.

Eysenbach and Köhler [11] explored the use of health information by Internet users and found that participants’ assessment of the quality of online health information included the authority, appearance, and layout of the source, advertising, readability, the presence (or absence) of links to other sites, site holder photos, contact boxes, website certification, content updates, quality badges, or other professional group support. There is limited literature on the experience of college students using online health information. Within that literature, studies have shown that college students possess functional and interactive health literacy and seem to underperform when it comes to the higher level of critical health literacy. Relevant studies have shown that college students are confident that they are able to find, read, and understand online health information [3,12]. However, a high proportion of these students are less assured in their ability to discriminate between high and low-quality health resources [12].

Increased age is a factor that is frequently associated with decreased levels of eHealth literacy. Older adults with chronic health conditions and those with lower levels of eHealth literacy were prone to unmet navigational needs, experiencing difficulties in finding online health information and being less assured in their searching abilities [13]. An investigation of Internet skills also found that older adults sometimes experienced problems when completing tasks that called upon operational and formal Internet skills [14]. This included difficulties in understanding orientation within a website and identifying and using the browser address bar. A survey that addressed the health information seeking behaviors of baby boomers and older adults found that an increase in age corresponded with a decrease in eHealth literacy scores [15]. However, in contrast to other research studies, the authors found that the respondents were largely confident regarding their ability to find and use Internet based health resources, although they were less confident in their ability to differentiate between high and low-quality resources.

This study uses “age” as a background variable, comparing the differences of eHealth literacy among college students and senior university students. To examine this issue
further, this study also summarizes the college students’ and senior university students’ online health information experiences and performances.

Methods

Recruitment

In this mixed methods study, the research process was divided into two phases. First, an eHealth literacy instrument (questionnaire) was used to investigate the participants’ current situation. In this first stage, two classes of college students in the general education program were assessed. In addition, three classes of senior university students (aged 55 or above) who were enrolled in a university-affiliated, formal, unaccredited, voluntary, lifelong learning program participated in this study. Data were collected from an urban university. Prior to the study, the program was reviewed and approved by the university’s institutional review board (ethics committee). Of the 208 respondents, 65 (31.25%) were college students and 143 (68.75%) were senior university students. The age range of the college students was 18–22, and the age range of senior university students was 55–72.

The second phase examined the answers to the questionnaire provided in the first phase to select prospective respondents as the second phase interviewees. This resulted in the selection of five college students and five senior university students as the interviewees. Interviews took place from January to February in 2017, with an interview time of about one hour for each.

Instrument

The eHealth Literacy Scale (eHLS) measures a student’s ability to seek, find, understand, and evaluate health information from electronic sources and to apply this knowledge to address or solve a health problem. The 12-item eHLS, developed by Chiang, Yang, and Hsu [16], includes the following three dimensions: functional (three items), interactive (four items), and critical eHealth literacy (five items). Respondents were asked to select an answer that most accurately described their eHealth literacy on a 5-point Likert scale, wherein 1 = strongly disagree and 5 = strongly agree. Cronbach’s alpha coefficient was calculated to determine the reliability of the Likert scale questionnaire; the overall reliability was .84.

One of the aims of this study was to try to capture the experience of the use of online
health information for college students and senior university students. To do so, this study examined the participants’ health literacy levels based on Nutbeam’s [17] three levels of health literacy and definitions of eHealth literacy from Hsu et al. [7] and Hsu et al. [3]. Semi-structured interviews were used to collect data. The interview outline included four items (see Table 1).

<table>
<thead>
<tr>
<th>Focus point</th>
<th>Open questions</th>
</tr>
</thead>
</table>
| Access experience of online health information [7] | 1. What kind of online health literacy are you more interested in?  
2. What kind of source of online health information are you more interested in? |
| Literacy experience of online health information [3] | 3. How are your Internet health information reading experiences?  
4. How do you assess the correctness of health information? What is the assessment principle? |

Data analysis

Descriptive statistics and t-tests were conducted to understand the effect of age on eHealth literacy. In addition, for qualitative data analysis this study employed the constant comparative method developed by Strauss and Corbin [18]. First, the researchers conceptualized and developed a protocol to ensure open coding. Next, the analysis applied the concept of higher extraction level for the “category,” setting forth the nature of concepts of similar content together into a class. Finally, the axial coding, through the classification, comparison, and induction, analyzed the sub-category and the main category together. In order to facilitate the classification and analysis of research data, the first column identified the participant, i.e., A (college student) and B (senior university student), the second column identified the interview number, and the third column identified an encoded serial number (e.g., A-1-2).

Results

Study 1: Quantitative analysis of eHealth literacy—a comparison of eHealth literacy between age groups
There was a significant difference in the overall eHealth literacy scores between the college students and senior university students ($t_{207} = 2.98; P < .01$) with the overall scores of college students (mean = 43.78) being higher than those of the seniors (mean = 40.93). In the functional eHealth literacy dimension ($t_{207} = 12.17; P < .001$), the college students’ scores (mean = 11.43) were higher than those of the seniors (mean = 8.08). However, there was no significant difference between interactive and critical eHealth literacy (see Table 2).

<table>
<thead>
<tr>
<th>Factor</th>
<th>College student Mean</th>
<th>College student SD</th>
<th>Senior university Mean</th>
<th>Senior university SD</th>
<th>t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>functional eHealth literacy</td>
<td>11.43</td>
<td>1.94</td>
<td>8.08</td>
<td>1.56</td>
<td>12.17</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>interactive eHealth literacy</td>
<td>14.50</td>
<td>2.67</td>
<td>14.60</td>
<td>2.52</td>
<td>-0.263</td>
<td>&gt; .05</td>
</tr>
<tr>
<td>critical eHealth literacy</td>
<td>17.81</td>
<td>3.74</td>
<td>18.18</td>
<td>3.28</td>
<td>-0.71</td>
<td>&gt; .05</td>
</tr>
<tr>
<td>eHealth literacy</td>
<td>43.78</td>
<td>6.68</td>
<td>40.93</td>
<td>5.10</td>
<td>2.98</td>
<td>&lt; .01</td>
</tr>
</tbody>
</table>

$N^1 = 65; N^2 = 143$

**Study 2: Qualitative analysis of eHealth literacy—study participants’ experiences and performance reading online health information**

*Finding One: College students’ information sources from online health information to meet beauty, weight loss, fitness, and other needs were divided into fixed and non-fixed web pages*

The initial motivation for college students to access online health information was to meet the needs of beauty, weight loss, fitness, and so on.

Before, in high school, I had a face full of acne and now have pockmarks. Now, at University, my friends always pay special attention to their appearance, so I pay special attention to my beauty. (A-5-31)

Girls always want to have a good body shape . . . you may see someone post on the Internet about how they succeeded in losing weight. When we see a successful experience in which someone loses weight quickly, no matter whether it is true or not, we want to learn from them. (A-3-28)

Furthermore, the online health information retrieval methods of college students can be divided into fixed and non-fixed web pages, that were used for two different
purposes. A fixed, habitual behavior of college students was to retrieve health information from static webpages or magazines, browsing health knowledge, or seeking suitable skin care products for themselves, rather than solving practical health problems. On the other hand, they also gathered health information from non-fixed pipelines aims to solve health problems that were of immediate concern. Often, when respondents were aware of health problems, they would conduct online health information retrieval, looking up information about, for example, acne, weight loss, treatment of colds, gastrointestinal care, medical topics (such as new flu prevention), cancer diet, and so on. Data revealed that respondents searched using search engines and entered keywords but did not use search techniques like Boolean logic. Respondents often looked only at the first search result. If there were many websites retrieved, there was a greater possibility that respondents would find a page with an appropriate answer or a webpage that was familiar to them. If there were links on the page to other pages, they would click those links. However, if the health message of the interviewee was based on personal experience, there were limitations to searching for this kind of individual-oriented experience. Such Internet health information was offered only as a reference and has little influence on actual implementation.

The most commonly used site is the occasional Yahoo news health section, on things like healthcare, healthy food, health exercises, and clicking on links to help with acupuncture points and the like, such as ah-shi acupuncture points for the eye. (A-2-64)

I often use Yahoo or Google and get many results from forums . . . Just by looking at a forum or seeing someone share an experience, message-board posts can only be used as reference points that are not easy for individuals to adopt. Because everyone has a different living environment and because the retrieved information can’t be used for all situations. (A-4-73)

Respondents were mostly interested in reading online health information. When browsing health information, most of information available online was not sufficiently clear or too specialized. In addition, most respondents asserted that they understood the health information on the Internet, but some proper nouns, foreign languages, and various ways in which data were presented made it difficult for some respondents to understand and learn from negative outcomes.

Most of the online health information is easy to understand, it does not appear like a book that is written very professionally and difficult to read.
Getting information from the Internet is very convenient, you can quickly know the information and it will not be difficult. (A-1-41)

Furthermore, the criteria for assessing the quality of online health information can be divided into two categories: subjective judgment and objective form. Subjective judgment is based on the cognitive judgment of the respondents; thus, they used their own pre-knowledge to evaluate health information. Some would take the initiative by seeking others’ advice to confirm the quality of online information, specifically by cross validating through different pages or asking professionals (doctors, pharmacists, medical friends, and relatives, etc.) directly to arrive at a more credible conclusion.

There is some very obviously illogical [information that] I will not go to, or only with the mind to question it. For example, burn soy sauce, or wipe pepper on your skin for weight loss, but you would think that this will only hurt your skin. (A-5-35)

On the other hand, the objective form refers to the quality assessment of respondents from the external form of online health information. In addition, some of the respondents would direct their attention toward the sources used by the specific Internet source, focusing in particular on “update time,” “certification mark,” “whether it was an official website,” “the number of visitors,” “whether there are small ads,” and so on.

Reading numbers, small ads . . . If the site appears with too many small ads, that is, with commercial action, [with an intent] to sell some things, I will not accept him. (A-3-98)

I will check information from whichever accredited institution, with certification or not. Between information available for 2005 and 2009, I would rather believe information from 2009, because it is relatively new. The content is really a relatively large problem; I will pay attention to the source . . . If it is just the Central Research Institute meeting with a doctor, I will ask that day to see that . . . that perspective? (A-2-91)

Finding Two: Senior university students often obtained online health information through communication software and the information was mostly about diet and nutrition, health and wellness, and exercise and fitness
Online health information used by senior university students was mostly concerned with “diet and nutrition,” “health and wellness,” and “exercise and fitness.”

Before, when I was working, I was often busy when I ate, so I did not pay attention to nutrition, had no time to exercise, causing me to be physically ill often, and also susceptible to catching a cold, and now after retirement, I pay special attention to diet and health issues. (B-3-5)

In addition, senior university student participants had access to a communications software group, enabling them to access online health information via group sharing.

We have a Line group in the class, every day we share messages, last month a student was sick and suddenly died. We are already into old age, so we all attach great importance to health problems, and if we do not maintain our health, we will soon meet God. So, we have a bunch of health messages every day to share with each other, every day mobile phone messages to forward. (B-5-11)

I am now sixty years old, after the age, began to face the “old, sick, dead” life must go through, when you hear friends around who get sick and then survive, they become more self-alert. Computers are used less now, as mobile phones are most convenient, I now have time to draw . . . we often use communication software to share health information to friends and relatives, in the hope that people can keep healthy. (B-4-15).

Based on the above, the majority of senior university students had retired from work and had more time to pay attention to their health, focusing more on their “diet and nutrition,” “health and wellness,” and “exercise and fitness.” Their major source of information was mobile communication software through which they shared health messages.

Finding Three: Senior university students had the ability to read but less critical ability

Most of the respondents felt they had no problem with reading comprehension. However, most of the senior university students observed that they had difficulty discriminating correctness in the different views of online health information. Therefore, they thought that most health information was not very reliable as a reference.
There are a lot of opportunities to share health information, reading comprehension is not a problem. I am also interested in the content, but some of the information overlaps and I cannot tell the accuracy, so the reference value is reduced. And I have to follow the practice of health information. But the effect is not as favorable as the health information, so for these messages, after reading the reference (because they do not know if it is entirely correct), the effect is more difficult to control. (B-3-45)

Senior university students primarily based their assessment of information accuracy on both subjective judgment (such as individual experience or prior knowledge) and objective standards (such as original sources, publication date, or professional authorship). These respondents used implicit perceptions of their own experience and subjective judgments as well as explicit perceptions, such as information from experts and cross-validation of information from credible institutions.

Online health information needs to be cross verified for correctness through different channels, such as: seeking medical information, or asking a medical professional (B-1-71).

Discussion

The performance of eHealth literacy among college students and senior university students differs

In the overall assessment of eHealth literacy, traditional college students scored higher than did senior university students. The results indicate that eHealth literacy varies across generations. Because eHealth literacy has multiple levels [16], where the first layer, functionality, is basic reading ability; the second layer, interaction, is advanced knowledge; and the third layer, criticality, is a deeper analysis and ability to form judgments [8]. This may be explained by the concept of cognitive dimensions, because functional and critical eHealth literacy involves higher levels of ability that require longer periods of cognitive training to develop. In this study, college students were better educated than were senior university students. This may be because college students had received cognitive training over an extended period of time. Ergo, it was likely that the level of educational attainment for these college students would be high, and consequently eHealth literacy levels would also be high [19]. Accordingly, college students had higher scores in eHealth than senior university
The experience of access and literacy with respect to online health information exists individually in unique contexts

This study found that college students and senior university students accessed online health information differently. College students accessed online information from websites and focused mostly on “beauty,” “weight loss,” and “fitness.” Those topics typically concern physical appearance. Senior university students accessed online health information generally through communication software, enabling them to share more health information. The health information senior university students tended to access included information about diet and nutrition, health and wellness, and exercise and fitness.

Moreover, most of the study participants had expressed the belief that most of the online health information could be read and understood; however, when evaluating the quality of information, they were generally doubtful. Participants pointed out that the quality of online health information is divided into subjective judgment and an objective form of the standard. However, some participants from both groups suggested that in the era of information explosion, it is not easy to choose and determine the accuracy of the information; thus, the participants tended to take a skeptical attitude if they were closely related to the message, and would then find additional resources to verify, through multi-party comparison, in order to enrich their knowledge and understanding of a topic. This finding is similar to the findings in the study by Hsu et al. [3]. This may be explained by Uncertainty Management Theory (UMT) [20]. A prominent communication uncertainty framework has been applied to appraise the associations between online health information seeking and uncertainty management [21,22]. A central tenet of UMT proposes that uncertainty is not necessarily a negative or positive experience, but that an individual will appraise the meaning of uncertainty, and the resulting emotional response will determine whether the uncertainty is evaluated as negative, positive, or neutral. The uncertainty evaluation will influence an individual's behaviors in managing their uncertainty. For example, individuals for whom uncertainty is an undesirable or negative state may seek health information to augment their knowledge and thereby lessen their state of uncertainty [23].

Study limitations
This study has several limitations. First, the study was performed under trial conditions in which it was expected that the participants would answer the hypothetical questions which were not clear and did not directly address the participants’ actual physical health concerns. Second, this study found that both younger college students and senior university students were capable of reading and understanding online health information. The participants did have basic eHealth literacy. However, both groups experienced difficulties in recognizing correct health information online. Because of the higher level of critical eHealth literacy was not easy to observe and understand, the data collected through our investigation may not have been specific enough.

Conclusions

This study explored the associations among age factors and eHealth literacy in the hope that the findings will stimulate further debate about how a health education framework can be translated into practical approaches and contribute to further refinement of the eHealth literacy concept. Furthermore, this is the first study, both domestically and internationally, to explore whether differences exist within the eHealth literature. Therefore, the results of the study highlight the issue of eHealth literacy to understand the current situation among different generation groups; moreover, they also stimulate a lifelong learning society, thereby promoting personal health, capital learning innovation, and development practice. The findings showed gaps in eHealth literacy among college students and the senior university students (people over the age of 55). We therefore suggest that schools strengthen the functional and critical eHealth literacy of college students and the elderly. Schools can use the six core skills of eHealth literacy (traditional literacy, health literacy, information literacy, scientific literacy, media literacy, and computer literacy) to develop healthy behavior guidelines and to incorporate these guidelines into health education programs [4]. Moreover, the study observed that participants, when faced with challenging and uncertain health situations, employed various strategies to reduce or maintain ambiguity about a health-related condition. Future studies could investigate how the Internet may provide an effective and valuable channel for health information to health consumers who wish to utilize information strategies for managing health-related uncertainty.

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References


