E-Health Literacy Competencies among Undergraduate Health Education Students: A Preliminary Study

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Abstract

Background: *Because of the widespread access to health information on the Internet, researchers have begun to investigate e-health literacy skills among college students. Preliminary findings indicate that the general population of college students may not have adequate skills to sufficiently search for, locate, and/or evaluate electronic sources of health information. E-health literacy is an important area for health education undergraduate students, but little research has been conducted targeting this population.* ***Objective:*** *To investigate perceived and actual e-health literacy among health education undergraduate majors at a large Southwestern university.* ***Methods:*** *A convenience sample of health education students completed the Research Readiness Self-Assessment – health (RRSA-h), an online instrument designed to assess perceived and actual ability to obtain and evaluate e-health information. Pearson product moment correlations were used to determine associations between perceived and actual e-health literacy. A multivariate analysis of variance (MANOVA) was used to determine actual ability to obtain and evaluate e-health information according to current academic standing.* ***Results****: Seventy-seven (n = 77) undergraduate students (88% female) reported actual mean e-health literacy test scores (39.3% – 50.4%) which were markedly inferior to mean ratings of perceived e-health literacy (75.3% – 78.5%). Perceived ability to evaluate e-health information was correlated with actual ability (r = 0.26, P = .045), while perceived and actual ability to obtain e-health information was not. Students of advanced academic status (e.g., juniors and seniors), however, reported higher overall e-health literacy than their younger counterparts (F (4,140) = 2.597, p = .039).* ***Conclusion:*** *Health education students appear to lack important e-health literacy skills, especially those students who have less academic experience. The field of health education would benefit from including more coursework across professional preparatory degree programs to adequately prepare undergraduate students to use e-health resources.*

Key Words: *health literacy, e-health, health education, college students*

E-Health Literacy Competencies among Undergraduate Health Education Students

E-health has been a topic of interest in the field of health education since the turn of the 21st century[1-4]; yet, a clear, concise definition of e-health does not currently exist. The many definitions that do exist describe e-health as a broad range of electronic applications facilitating healthcare, generally through making use of the confluence that exists between health, technology, and commerce.[4,5] Electronic resources increasingly play a major role in consumer health, with the Internet acting as the primary telecommunications vehicle.[1-3] Despite concerns regarding the quality of online health information,[6] health consumers use the Internet often for health information. It is estimated that more than 113 million American adults accessed and influenced by nearly 70,000 health-related websites yearly.[4,7] Moreover, health information is one of the most investigated topics online[8]; eight out of ten Internet users access online for health information, making it the third most popular web endeavor (following email and accessing search engines).[9] This vast use of the Internet to acquire health information has spurred numerous e-health information resources that assist consumers in discovering knowledge that can help promote and sustain personal health. In light of this potential capacity, it is important to understand an individual's ability to make use of available e-health tools and resources available on the Internet.[10]

E-health and the topic of health literacy are two closely related topics that are important within the field of health education. Health literacy has been defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions.[11] Health literacy is an important skill which enables people to manage their own health within a complex healthcare system. For health education specialists, who are expected to be proficient resource people in health education[13] health literacy is a fundamental competency area. Health education specialists inevitably should become familiar with utilizing electronic resources (e.g., mobile-Internet, smartphones, iPads, etc.) for accessing health information in order to assist in improving health literacy at the individual, community and population level.

Healthy People 2020 has reinforced the importance of health literacy using electronic resources by including multiple objectives that relate to advancing health literacy in an e-health environment, including increasing the proportion of quality, health-related Web sites and the number of online health information seekers who report easily accessing health information.[12] Norman & Skinner[10(p.1)] have extended the definition of health literacy to 'e-health literacy' which refers to the ability of individuals to "seek, find, understand, and appraise health information from electronic sources and apply such knowledge to addressing or solving health problems". E-health literacy is unique, in that, it assumes literacy in a variety of diverse areas, including: computer, media, science, numeracy, information, and health. Obtaining health information and using e-health sources includes a variety of competencies, such as: (a) conducting basic and advanced information searches; (b) the application of Boolean operators to limit Internet searches; (c) differentiating between scholarly documents, authoritative sources, periodicals, and primary sources of information; and (d) understanding selected e-health terminology. In order to locate health information using e-health resources, one must conduct appropriate searches using systematic search techniques to locate documents such as abstracts or bibliographies on selected health topics. Search protocols for finding e-health information and criteria for evaluating web sites and documents retrieved are often times implied and not explicitly explained or understood by users. This becomes problematic for those not well-versed in retrieving health information using the Internet, as difficulty in locating and assessing e-health information become complicated in a complex web environment.

The Internet is ubiquitous on college campuses and the current generation of college students has tremendous exposure to the Internet.[14,15] E-health information seeking and utilization is prevalent on college campuses, yet there are only a handful of studies that have been conducted to examine e-health literacy rates among undergraduate students. Such studies have explored attitudes and behaviors of college students using the Internet for health information seeking purposes.[14, 16-21]Two of these studies[19, 21] measured students' actual ability to find and evaluate e-health information, and one[16] investigated students' ability to find correct answers to a set of sexual health questions on the Internet. The majority of these studies[14, 16,18,19,21] agreed that undergraduate students need extensive training to reap the greatest benefit from conducting health

information searches on the Internet, as their ability to do so is currently subpar. Even more perplexing is the lack of studies specifically examining the ability of future health education professionals to locate and evaluate the quality of e-health information available on the Internet. Therefore, the purpose of this study was to investigate both perceived and actual abilities of health education undergraduate students in terms of finding and evaluating e-health information. Knowledge and skills related to e-health literacy were assessed among this relevant population, along with self-perceptions of e-health information seeking ability on the Internet. This study builds on previous work by Ivanitskaya et al.[19] and Redmond[21] by specifically looking at students majoring in health education, a cohort of future professionals who should be skilled in e-health information seeking.[13]

Methods

Research Questions

The following 3 research questions were investigated during this study:

> 1) What was the perceived and actual ability of health education majors to obtain and evaluate e-health information as measured by the perceived ability to obtain e-health information (PAO), perceived ability to evaluate e-health information (PAE), actual ability to obtain e-health information (AAO), and actual ability to evaluate e-health information (AAE)?
>
> 2) What is the relationship between health education majors' PAO and AAO versus PAE and AAE as measured by the RRSA-h?
>
> 3) Does AAO and AAE differ with respect to health education student classification status (i.e., sophomores, juniors, and/or seniors)?

Measures

To measure perceived and actual ability to obtain and evaluate health information on the Internet, the study utilized the Research Readiness Self-Assessment-health (RRSA-h) scale.[22] The RRSA-h is an online interactive application that is designed to assist faculty from different disciplines to equip students with the skills and knowledge necessary to become effective, independent users of secondary sources of digital (electronic) health information. The instrument evaluates the foundational competencies of searching for, obtaining, and evaluating health information via electronic sources of health information. The instrument incorporates constructs within the two-process theory of human information processing[23] and atomic components of thought[24] by evaluating tasks which introduce stimuli that mimic situations where e-health searches are necessary and automatic and controlled information search responses follow.[22] The RRSA-h is a particularly appropriate instrument for this population, as it can be administered to groups such as undergraduate students who may not possess higher order skills of experienced researchers, such as evaluating the design, measurement, or analysis of a study.[19]

The RRSA-h includes questions from several research-related domains that test participants' declarative knowledge of concepts, skills, and thinking strategies. In addition, participants' procedural knowledge is assessed through skill based problem solving that asks each participant to search databases and evaluate the quality of published documents located through an Internet search.[22] For example, a knowledge-based problem in the survey asks respondents to identify which Boolean operator (e.g., 'and', 'or', or 'not') produces the most Internet search results (answer: or). An example of a skill-based survey item requests that respondents determine which Boolean operator is appropriate for a particular search situation, then prompts the respondent to perform that search using that particular Boolean operator and then report back the number of web resources generated by the search. Table 1 provides selected question stems that appear within each of the RRSA-h subscales measuring both the ability to obtain and evaluate electronic health information.

Additionally, the RRSA-h measures students' attitudes and beliefs regarding their own perceived abilities to locate and evaluate e-health information. The dependent variables of interest measured by the RRSA-h were the following: PAO, PAE, AAO, and AAE. Both PAO and PAE are single item visual analog scales that range from 0 to 10, where higher scores indicate stronger beliefs in ability to find and evaluate e-health information. The AAO subscale is comprised of 11 multiple choice items where total scores can range from 0 to 16. The AAE subscale is comprised of 13 multiple choice items where total scores can range from 0 to 23. The number of items in each subscale is not equal to its respective highest

possible score because some questions have multiple correct answers for which respondents are instructed to choose all that apply. A higher score on both subscales indicates better actual ability to obtain and evaluate e-health information. In a prior study,[19] the data derived from the RRSA-h demonstrated satisfactory internal reliability ($\alpha = .78$). The internal reliability of the scores gathered from each of the actual ability scales within the RRSA-h was deemed acceptable: AAO ($\alpha = .69$) and AAE ($\alpha = .72$).

Procedures

A convenience sample of eligible health education majors was recruited using a variety of proactive strategies. Specifically, introductory emails were sent from department academic advisors at a large southwestern university in the United States. The email, sent at two time points over a period of approximately 2 weeks, described the nature of the study (i.e., to measure the e-health literacy of undergraduate health education majors) and asked students to create an on-line account necessary to complete the RRSA-h. Four weeks after sending these initial recruitment emails, additional contacts were made bimonthly to students who had created an online account, but who had not yet completed the on-line assessment. The email thanked students for being willing to participate in the study and reminded them that they needed to complete the online survey to become eligible for a chance to receive an incentive for participation. Students who completed the survey were entered into a drawing for a chance to win one of five cash prizes worth $25.00 and one grand prize of The Flip™ Video camera. In addition, members of the study team visited numerous undergraduate classes in health education to recruit potential participants. Participants were treated in accordance with ethical standards approved by the university's institutional review board. The study was anonymous in that personal identifiers were not connected to students' actual answers; however, it was possible to identify the IP address of the computers that students used to create an account and complete the survey.

Data Analysis

Statistical analysis was carried out using SPSS version 17.0. Descriptive statistics (i.e., means and standard deviations) were computed to answer research question #1. Research question #2 was analyzed by computing Pearson's product-moment correlations to quantify the relationships between students' perceived and actual ability to obtain and evaluate e-health information. To investigate research question #3, a one-way multivariate analysis of variance (MANOVA) was used to test whether differences existed between undergraduate student classifications (e.g., freshman, sophomore, junior, senior, etc.) on the two actual ability outcomes of interest (i.e., AAO, AAE). A multivariate analysis of variance (MANOVA) was appropriate to determine whether mean centroid differences existed between student classification status when considering the two dependent variables in a set simultaneously. A post-hoc descriptive discriminant analysis (DDA) was used to explore statistically significant MANOVA results. DDA examines linear composites of the outcome variables which are useful in defining and identifying the structural dimension of the latent variable(s) that underlie the grouping variable effect.[25]

Results

One hundred and twenty-three (n = 123) students willingly created an online RRSA account. Of the enrolled students, seventy-seven (n = 77) completed all aspects of the survey for an overall response rate of 62.6%. The majority of the respondents were female (88.3%) and upper-classmen (i.e., juniors or seniors) (84.4%). The low number of freshman is attributable to health education major being considered a "discovery" major within the department where this study took place, with students transferring into the health education major after their freshman or into their sophomore years. The average age of the respondents was 21.3 years (± 2.0 years). The health education major at the institution where this study took place had 3 distinct tracks that students could choose to pursue: allied health, community health, and school health. The majority of the respondents (77.9%) chose the allied health option, which indicated that these students were more interested in seeking clinical employment in the medical professions. Students also reported a solid average GPA of 3.12 points (± 0.39 points) on a 4-point scale and very good overall health (mean = 8.18, SD ± 1.39) rated on a 10-point scale. Table 2 provides a summary of the demographic characteristics of this sample.

Scores on the perceived and actual ability subscales of the RRSA-h were reported to answer research question #1. Perceived ability to obtain (PAO) and evaluate (PAE) e-health information was rated relatively high among the health education students,

with mean percentage scores of 78.7% (SD ± 13.9%) and 75.3% (SD ± 14.3%) respectively. Conversely, performance on the actual ability to obtain (AAO) and evaluate (AAE) subscales revealed much lower outcomes, with mean percentage AAO scores of 50.4% (SD ± 15.6%) and AAE scores of 39.3% (SD ± 12.5%). Table 3 presents the mean raw scores (% in parentheses) on the RRSA-h correct across all four subscales according to the students' academic classification. Across all levels of student classification, students' perceived ability to obtain and evaluate health information was far greater than their actual ability to perform these skills.

The correlation matrix of association for scores on the 4 RRSA-h subscales (i.e., PAO, PAE, AAO, AAE) was examined to answer research question #2 (see Table 4). Of particular interest were the correlations between the variables measuring perceived and actual ability for obtaining and evaluating e-health information. While a small but statistically significant correlation ($r = 0.26$, $P = .045$) existed between the perceived and actual ability to evaluate e-health information (i.e., PAE and AAE), no corresponding significant effect existed between the perceived and actual ability to obtain e-health information (i.e., PAO and PAE) ($r = 0.03$, $p = .725$). Although not a main focus of this particular research question, Pearson r correlations of linear relationship between the two actual ability variables (i.e., AAO and AAE) were correlated to a noteworthy degree ($r = .46$, $P > .05$).

Given the statistically significant correlation between actual ability to obtain and evaluate e-health information subscales (i.e., AAO and AAE), the choice of MANOVA versus multiple analyses of variance (ANOVAs) was made to answer research question #3. To consider the effects of academic classification on the two correlated dependent variables simultaneously, a one-way, three-level between subjects MANOVA was performed to test whether differences existed between academic classifications on the mean centroids. The MANOVA assumption of multivariate normality was supported through a non-statistically significant Box[26] test (M=11.032, $F(6, 611) = 1.727$; $\chi 2\ (6) = 10.37$, $p = .110$) which provided evidence supporting equality among the two dependent variable population covariance matrices. Also, Q-Q plots confirmed univariate normality among the outcome variables; therefore, it was determined with relative confidence that the joint distribution of the 2 outcome variables within each group was approximately multivariate normal.

Due to extremely low participation among consenting freshman (n = 2), and the need to have more cases than dependent variables in each cell,[27] the freshmen level was removed from the MANOVA model. Following removal, an omnibus MANOVA null hypothesis was rejected at the $\alpha = 0.05$ level, Wilks $\Lambda = 0.868$, $F(4, 140) = 2.597$, $p = .039$. This indicated that the student classification groups (i.e., sophomores, juniors, and seniors) differed beyond reasonable expectation due to chance or sampling error. Furthermore, the η^2_{adj} effect size characterizing the magnitude of this statistically significant effect showed that 10.80% of the variation on the mean centroids was shared within classification level. These findings warranted further statistical analysis to determine the nature and extent of the statistically significant differences.

Descriptive discriminant analysis (DDA) was used to determine which groups differed on the mean centroid. The linear discriminant functions (LDFs) were consulted to help make this determination. In this study, a maximum of two LDFs could be derived since the maximum number of LDFs that can be extracted is the minimum of either the number of outcome variables (i.e., 2) or the number of grouping levels minus one (i.e, $3 - 1 = 2$)[25]. A dimension reduction analysis confirmed that the canonical variate was adequately represented by one dimension and both outcome measures defined the single dimension as suggested by their error structure coefficients ($r_{sAAO} = .88$; $r_{sAAE} = .80$). Figure 1 illustrates the linear discriminant functions of each student classification group evaluated at the mean centroids. The plot suggests clear separation on actual ability to obtain and evaluate e-health information between the sophomores versus the juniors and seniors in the sample. To empirically validate this visual schematic, a one-way ANOVA and a Tukey post-hoc analysis on the LDF scores confirmed where the statistically significant differences in the mean centroids lied.[28] Sophomores had significantly lower scores on the first LDF than juniors and seniors at the .05 significance level, $F(2, 72) = 5.03$, $p = .009$. As expected (based on the plot of the mean centroids), the post-hoc comparison between juniors and seniors was not statistically significant.

Discussion

The present study was an attempt to measure perceived and actual e-health competencies of undergraduate health education majors using the RRSA-h, an online survey instrument. Data from this investigation indicated that the current sample of health education students were lacking in actual knowledge and skills to obtain and evaluate health information available on the Internet. Historically, when administering the actual ability subscales (i.e., AAO and AAE), entry level undergraduate students showed lackluster e-health literacy scores, answering only 65% of the AAO questions and 54% of the AAE questions correctly. [29] The students in the current study actually performed worse, correctly answering only 50% of the AAO questions and 39% of the AAE items. This underperformance is interesting, if not disconcerting, especially considering that 84% of the sample was either juniors or seniors (i.e., upper level students) who had mean GPAs over 3.0. Although pursuing an advanced degree can elicit intellectual development, tasks such as e-health information seeking can prove complex for those not adequately prepared to undertake such types of multifaceted activities. The overwhelming majority of respondents in this study (77.9%) were interested in pursuing a health education degree with an emphasis in allied health. Most students who pursue this track have ideas of gaining employment in the clinical setting (e.g., nursing, physician's assistant, physical therapist, etc.). Perhaps these types of students are less inclined to be interested in searching for health information on the Internet, a task that can be considered largely a research-oriented task. Future studies should examine the link between health education interest area and e-health literacy skills.

Also of note was the self-report of high perceived ability to obtain and evaluate e-health information. Both of these variables (i.e., PAO & PAE) are measures of self-efficacy,[30] or confidence when undertaking a task to produce a desired outcome, which is said to be a strong predictor of actual skills or ability. Past review research has speculated that self-efficacy for obtaining and evaluating e-health information may be inflated among undergraduate students who use the Internet quite frequently, yet are green when it comes to using the Internet for researching and locating quality online health information.[31] Results from this study supports the notion that dissonance may exist within undergraduate students when considering their own confidence in searching for health information on the Internet. They may believe themselves to be adroit users of the Internet to find general types of information, but this belief of personal capability may not be compatible with beliefs about competence conducting e-health searches. Focused training to improve the latter belief can help resolve this dissonance among undergraduate health education students.

While students' elevated self-ratings of their own ability to obtain and evaluate e-health information did not match their actual ability, there was a small yet positive correlation between perceived and actual ability to evaluate e-health information (i.e., PAE and AAE). No corresponding significant relationship existed between perceived and actual ability to obtain e-health information (i.e., PAO and AAO). Thus, perceived ability to evaluate e-health information corresponded more with actual evaluation ability than did perceived and actual ability to obtain e-health information. The non-statistically significant correlation between PAO and AAO, and weak statistically significant correlation between PAE and AAE, is consistent with findings from previous research,[19] which reported weak linear relationships between students' perceptions of obtaining health information in comparison with their actual ability to do so.

Students' perception of their own actual ability to evaluate e-health information, on the other hand, may be poor, but it may also be more accurate than their perception of their ability to obtain e-health information. Moreover, college students may be better judges of their ability to evaluate (versus obtain) health information retrieved over the Internet. While both skills may be poor, college students may be more cognizant that their ability to decipher "quality" e-health information is limited (given that it is a general struggle to know what health information to listen to and/or disregard), but they may not realize that their web searching capability may also be less than adequate (given the amount of time this cohort spends searching for almost anything on the Internet). Replication of this type of finding could have important implications since college students will be unable to truly evaluate sources of e-health information if they have faulty perceptions of their own ability to find e-health information. This phenomenon could also prove to be especially problematic because it will likely be exacerbated by the nature of Internet search behavior where seeking out health information is commonplace, yet applying evaluation criteria to search results is not.[32] From a professional preparation perspective, this discord could also limit health education students' ability to act as an information resources for the public, which

is a responsibility for health education professionals.[13]

The academic status of undergraduate health education students had a significant effect on overall e-health literacy. Although overall e-health literacy was disappointing among this sample, juniors and seniors performed markedly better than sophomores when considering actual ability to obtain and evaluate e-health information concurrently. This study's results are consistent with other studies that revealed that undergraduate students of an advanced academic standing generally possess better e-health literacy skills.[19, 21]To lessen this disparity, academic experiences provided during the course of an undergraduate degree program should introduce students to more e-health information seeking activities, earlier on in their degree program. The authors suggest that a renewed emphasis be placed on enhancing e-health literacy among undergraduate students enrolled in health education degree programs. With more instruction and coursework specifically devoted to enhancing the various dimensions of e-health literacy, it is likely that any gaps which exist between upper and lowerclassmen will be filled, and there will be a greater probability that undergraduate students in health education will become more proficient when using the Internet to locate and evaluate e-health information. These types of scholarly activities could introduce new instructional experiences that can improve the quality of both teaching and learning in health education. This emerging competency area is one that health education instructors should place exceptional value on given the digital landscape that future health professionals will undoubtedly encounter throughout the duration of their careers. It is important that future research continues efforts to more fully understand how to develop e-health literacy within college student populations, particularly within those students studying to be future health educators.

Although, on average, students in this study were lacking in the area of e-health literacy, it should be noted that certain participants did score high on the assessment and acted as outliers. It is important for future research to determine the unique characteristics and Internet search tendencies among undergraduate students scoring high versus low on measures of e-health literacy. These underlying characteristics of individuals can provide important insights into the types of characteristics that define high, average, and low achievers on e-health literacy instruments. Future research would benefit from understanding which particular cognitive characteristics discriminate e-health literacy scores among undergraduate health education students.

Limitations

It is important to acknowledge some possible limitations regarding the internal and external validity of the results reported within this study. Limitations of the study included a non-randomized sampling method (i.e., convenience sample) and a majority of respondents being female (88%). It is important to note that the latter limitation was reflective of the disproportionate number of female to male students enrolled in the health education major. Additionally, students in this study attended only one large, research-oriented institution in the southwestern United States. Future studies should consider recruiting students from multiple types of college and universities, representing schools of diverse backgrounds (e.g., teaching-focused schools, community colleges, HBCUs, etc.) so that studies can begin to fully develop population validity for e-health literacy among college students. It is also vitally important to recruit diverse samples of students when studying this underdeveloped area of inquiry. The present study also suffered from experimental mortality to the extent that individuals within the Freshman class were excluded due to an extremely small number completing the survey (n = 2). Finally, there were possible instrumental threats to the internal validity of this study. The RRSA-h is an online assessment which is accessed by students through a third party website. Due to the differential processing capacity of the computers each student used to complete the assessment, there was potential for students completing surveys using different computers to have different testing experiences. This threat to internal validity was controlled for within the RRSA-h, however, by pre-specifying that participants use computers with modern operating systems and be connected to a broadband Internet provider.

Conclusion

This study has indicated that health education undergraduate students may be lacking in terms of possessing the skill sets necessary for obtaining and evaluating health information available on the Internet. Somewhat troubling is the notion that college students in health education believed that they were skilled in retrieving on-line health information, when in fact these perceptions were

proven to be false after students completed an actual online experiential assessment. Specifically, there was a clear distinction made between e-health literacy skills among underclassmen and upperclassmen, with more senior level, health education students exhibiting higher levels of e-health literacy. Because of this, it is suggested that more academic experiences focus on improving e-health literacy skills among undergraduate students in health education as early as possible. More practice-based curriculum applications should ensure that all health education undergraduate students (regardless of specialty area) are adequately prepared to use the Internet to obtain and evaluate health information.

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Table 1 *Selected RRSA-h items by category*

Obtaining Electronic Health Information
• I'll get the most documents when I search an online database for…
• If I type "health administration" in an online library database and click "search", I will most likely find…
• You are looking for information about work stress, but are not interested in its medical side effects. Set up a document search in a separate window using the following keywords: stress, medical, and side effects. How many hits did your search produce?
Evaluating Electronic Health Information
• You are looking for information on nutritional supplements. You found 3 websites. Click the links below to see and evaluate each site. Which website is most trustworthy?
• Check all statements that are true about the three websites you evaluated.
• Click on the links below to see three articles on learning disabilities. Which article is the most commercial because it aims to sell?

Table 2 *Demographic characteristics of survey respondents (n = 77)*

Characteristics		
Sex		n (%)
Female		68 (88.3)
Male		9 (11.7)
Classification		
Freshmen		2 (2.6)
Sophomore		10 (13.0)
Junior		24 (31.2)
Senior		41 (53.2)
Major Option		
Allied Health		60 (77.9)
Community Health		14 (18.2)
School Health		3 (3.9)
	Mean	SD
Age	21.34	1.97
GPA (0 to 4 point scale)	3.13	0.39
Overall Health (1 to 10 scale)	8.18	1.39

Table 3 *Outcome variable descriptive statistics by academic class*

Variable	Sophomore (n=12)	Junior (n=24)	Senior (n=41)	Total (n=77)
PAO				
M (%)	7.75 (77.5%)	7.66 (76.6%)	8.03 (80.3%)	7.87 (78.7%)
SD	1.78	1.30	1.34	1.39
PAE				
M (%)	7.72 (77.2%)	7.23 (72.3%)	7.66 (76.6%)	7.53 (75.3%)
SD	1.38	1.41	1.46	1.43
AAO				
M (%)	5.70 (38.0%)	7.79 (51.9%)	7.88 (52.5%)	7.56 (50.4%)
SD	2.26	1.64	2.53	2.34
AAE				
M (%)	7.10 (30.9%)	8.88 (38.6%)	9.61 (41.8%)	9.04 (39.3%)
SD	3.07	2.40	2.92	2.87

Notes: PAO = perceived ability to obtain e-health information; PAE = perceived ability to evaluate e-health information; AAO = actual ability to obtain e-health information; AAE = actual ability to evaluate e-health information.

(%) indicates the mean percent of the total possible points scored on each subscale

Scale Measurements: PAO: 1 to 10; PAE: 1 to 10; AAO: 0 to 16; AAE: 0 to 23

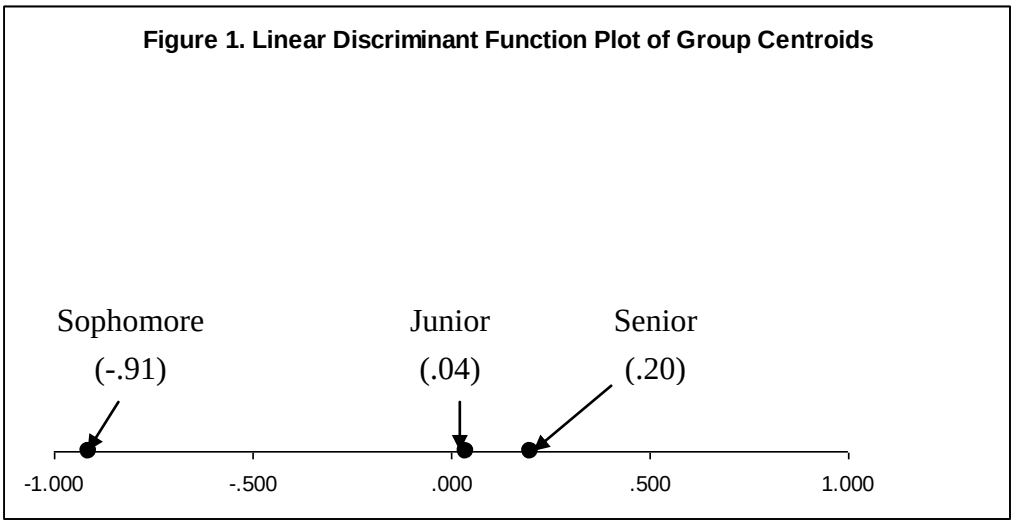
Table 4 *Pearson r correlations among RRSA-h subscale scores*

	AAE	AAO	PAE
AAO	**0.46***	-	-
PAE	**0.26***	0.02	-
PAO	**0.23***	0.03	**0.45***

Notes: PAO = perceived ability to obtain e-health information; PAE = perceived ability to evaluate e-health information; AAO = actual ability to obtain e-health information; AAE = actual ability to evaluate e-health information.

*Statistically significant correlations $P < 0.05$ alpha level

Figure 1: *Linear Discriminant Function Plot of Group Centroids*



Note: ( ) = Linear discriminant function coefficients of group centroids