ELECTRONIC HEALTH INFORMATION LITERACY: AN INVESTIGATION OF THE ELECTRONIC HEALTH INFORMATION KNOWLEDGE AND SKILLS OF HEALTH EDUCATION MAJORS

A Dissertation

by

BRUCE WALTER HANIK

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2011

Major Subject: Health Education

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Approved by:

Co-Chairs of Committee,	Buzz Pruitt
	James Eddy
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ABSTRACT

Electronic Health Information Literacy: An Investigation of the Electronic Health Information Knowledge and Skills of Health Education Majors.

(May 2011)

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Health educators are expected to serve as a resource for health knowledge and to be e-health literate, thereby enabling health educators to perform that function. However, the e-health literacy level of health education undergraduate students is rarely explored. A systematic literature review was conducted in order to investigate the e-health literacy levels of undergraduate students. The Research Readiness Self-Assessment-health (RRSA-h) was used to measure the ability of health education majors to find and evaluate electronic health information and a Q-study was conducted to investigate student characteristics that distinguish between those with high, middle, and low levels of e-health literacy.

A convenience sample of 77 health education majors completed the RRSA-h. A multivariate analysis of variance (MANOVA) revealed that e-health literacy levels differed among classification level [$F(4,140) = 2.597$, $p = .039$]. Thirteen health

education majors participated in the Q-study. An exploratory factor analysis revealed three types of e-health literate students exist among the majors.

The literature revealed that college students have limited ability to find and evaluate electronic health information. The RRSA-h indicated that lower-level college students have less ability to find and evaluate e-health information than upper level students. The Q-study suggested that three types of health education majors exist and could be differentiated by their scores on the RRSA-h.

The results of the study have implications for the development of instructional techniques to improve the e-health levels of health education majors. Specifically, the RRSA-h can be used to measure e-health literacy levels among health education majors and learning opportunities can be tailored to improve their e-health literacy levels.

DEDICATION

This study is dedicated to my wife. I most likely would still be finishing this work if it wasn't for her.

ACKNOWLEDGEMENTS

I would like to thank my co-chairs, Dr. Eddy and Dr. Pruitt, and my committee members, Dr. Ballard and Dr. Hall, for their guidance and support throughout the course of this research.

Special thanks go to Dr. Michael Stellefson whose friendship and advice helped me climb this mountain. He showed me what it means to work hard and what it takes to accomplish something worthwhile. Thanks to him I have something that no one can take away.

Special thanks go to Clinton Kotuby. His words of wisdom and encouragement provided the fire I needed to see in the darkness. Heart and fire!

Thanks go to my friends and colleagues in the OHI. I like to think that I helped them when they needed it, but I know that they gave a lot more back to me.

Finally, I would like to thank my family, especially my parents and wife, and my friends. They will get a big hug from me the next time I see them.

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CHAPTER I

INTRODUCTION

As future health professionals, health education majors will serve the public by being a resource of health information. They will use a variety of tools in order to provide the best methods to promote health literacy. This means that future health educators will be involved with electronic resources including e-health, the Internet, and assorted telecommunications outlets. Thus, being literate in an electronic health information environment will allow the future health educators better serve the public.

E-health has been a topic of interest in the field of health informatics since the turn of the century (Pagliari, Sloan, Gregor, Sullivan, Detmer, Kahan, Oortwijn, & MacGillivray, 2005). Many articles have been written on e-health but there is no clear definition. The multitude of definitions conceptualize e-health as a broad range of applications facilitating healthcare, as well as encompassing concepts such as health, technology, and commerce (Pagliari et al., 2005; Oh, Rizzo, Enkin, & Jadad, 2005).

Electronic resources increasingly play a role in consumer health with the Internet as the primary telecommunications outlet of choice (Madden & Fox, 2006; Atkinson & Gold, 2002; Bush, Bowen, Wooldridge, Ludwig, Meischke, & Robbins, 2004). With this increasing role, it is important to understand the consumers' ability to use the e-health tools available on the Internet (Norman & Skinner, 2006) because of the concerns over

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This dissertation follows the style of *American Journal of Health Studies.*

the variable quality of online health information (Sillence, Briggs, Harris, & Fishwick, 2006).

Despite the concerns regarding the quality of online health information (Sillence et al., 2006), health consumers still engage the Internet with more than 113 million American adults influenced by the 70,000 health related websites on the Internet (Pew Internet & American Life Project, 2006; Pagliari et al., 2005). The skills required to be literate in an electronic information environment allow health information consumers to find, understand, and use the information to enhance their own or others' health (Norman & Skinner, 2006).

Health literacy is "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions (U.S. Department of Health and Human Services, 2000, p. 11-20). Norman & Skinner (2006) extended the definition 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 a health problem.

Health literacy (Focus Area 11 – Health Communication) is identified in Healthy People 2010 (U.S. Department of Health and Human Services, 2000) as an important skill which allows people to manage their own health within a complex health system and as a result aiding in closing the gap in existing health disparities. Having this important skill set enables health educators to act as a resource person for health consumers (see Responsibility VI, Competency A, Sub-competency 4; National

Commission for Health Education Credentialing, American Association of Health Education, & Society for Public Health Education, 2006). E-health literate health educators can provide their expertise to help reduce health disparities which is one of the major health objectives for the nation (U.S. Department of Health and Human Services, 2000).

Purpose of the Study

Electronic health information competency levels and use of information by individuals in health professional preparation programs is not an area studied in the literature. The Internet is ubiquitous on American university campuses and the current generation of students has more exposure to the Internet than previous generations. Yet, their ability to make sense of all the health information available is rarely explored. The purpose of this proposed study is to (1) provide an overview of literature pertaining to electronic health information literacy levels of college students, (2) answer questions related to the perceived and actual ability of students in a health professional preparation program to find and evaluate electronic health information, and (3) conduct a study that explores the nature and differences of students identified as having strong electronic health information literacy skills versus students identified as having weak electronic health information literacy skills.

The population of interest is undergraduate health education majors and the sample will come from a large professional preparation program in the southwest United States.

Research Questions

1. What is the electronic health information literacy skill level of college students?
2. What is the perceived ability of health education majors to find and evaluate electronic health information?
3. What is the actual ability of health education majors to obtain electronic health information?
4. What is the actual ability of health education majors to evaluate electronic health information?
5. What is the relationship between the health education majors' perceived ability to find and evaluate electronic health information and their actual ability to find and evaluate electronic health information?
6. Is there a difference in the actual ability to find and evaluate electronic health information between students of different classifications?
7. What characteristics appear to differentiate students with a high level of electronic health information literacy as opposed to students with a low level of electronic health information literacy?

CHAPTER II

E-HEALTH LITERACY AMONG COLLEGE STUDENTS: A SYSTEMATIC REVIEW WITH IMPLICATIONS FOR ELECTRONIC HEALTH EDUCATION

Synopsis

Researchers have begun to investigate e-health literacy among college students, due to the Internet being a favorite resource for locating information among this population. While the current generation of college students has access to a multitude of health information on the Internet, access alone does not ensure that students are skilled at conducting internet searches for health information. To critically evaluate the results of existing research on e-health literacy levels among college students. A systematic literature review was conducted on numerous scholarly databases using various combinations of relevant search terms and Boolean operators. The records were screened and assessed for inclusion in the review based on pre-established criteria. Findings from each study which met inclusion criteria were synthesized and summarized into emergent themes. Six (6) peer-reviewed articles and one (1) doctoral dissertation satisfied inclusion criteria and were analyzed in the final review. All studies measured knowledge and/or behaviors relative to college student ability to locate, utilize and evaluate e-health information. These studies indicated many college students lack competencies which limit their ability to optimally utilize electronic resources to acquire quality health information. The literature suggests there is significant room for improvement with regard to college students' ability to obtain and evaluate e-health information. Although

college students are highly connected to, and feel comfortable with, using the Internet to find health information, their e-health literacy skills are generally sub-par. College students, especially in the health professions, would be well served to receive college-level instruction that improves general e-health literacy skills.

Introduction

Electronic resources increasingly play a major role in consumer health, with the Internet acting as the primary telecommunications vehicle of choice for many seekers of novel and germane health information. Although now widely relevant, the term *e-health* first appeared in 2000 to describe where health informatics, public health, health services, and information transmission processes intersected, primarily through web-based applications (Oh et al., 2005; Pagliari et al., 2005). Subsequent studies conducting e-health interventions have since proposed many definitions for e-health (Jones, Johnson, Millermaier, & Perez, 2009; Oh et al., 2005; Pagliari et al., 2005). Broadly stated, e-health can also be thought of as the field where information and communication technology design enables the delivery of health-related and medical information (Eysenbach, 2001). While the potential for e-health to revolutionize medical and public health practice exists (Kwankam, 2004), there are numerous human resource, organizational, and cultural changes still necessary to enable mainstream adoption of e-health applications to retrieve quality health information (Pagliari et al., 2005).

E-health and the topic of health literacy are two topics closely connected in public health. Health literacy has been identified as a public health goal for the 21st century and a significant challenge facing health care globally (Nielsen-Bohlman,

Panzer, & Kindig, 2004; Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs, 1999). It 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" (U.S. Department of Health and Human Services, 2000, p.11-20). The emergence of the internet has made obtaining, processing and understanding health information on the Internet a critical competency area for medical professionals responsible for finding and evaluating health information resources electronically. In light of this, *e-health literacy* now exists as an important skill set for health professionals tasked with seeking valid and reliable health information in a web-based environment.

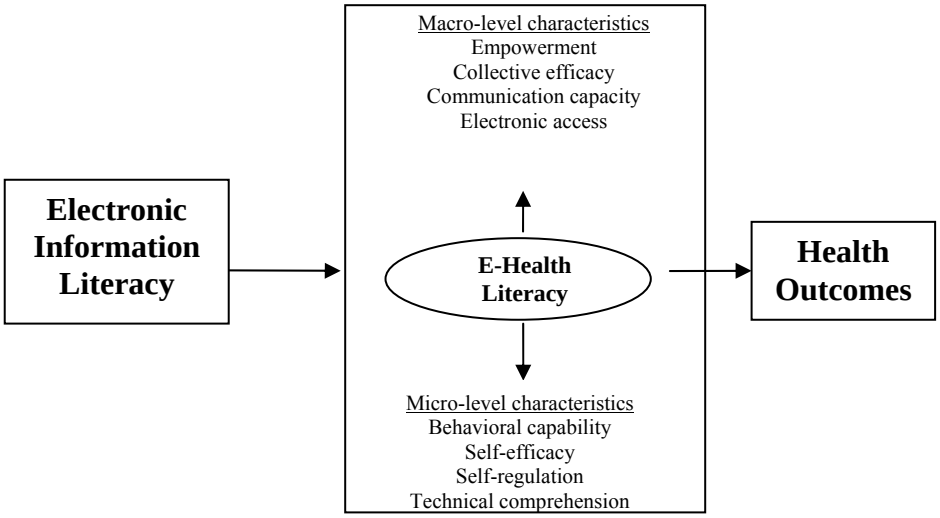
E-health literacy refers to the ability of individuals to seek, find, understand, and appraise health information from electronic resources and apply such knowledge to address or solve a health problem (Norman & Skinner, 2006). This composite skill requires the behavioral capability to work with technology, critically think about issues of media and science, and navigate through a vast array of electronic resources to acquire information necessary to make health-related decisions. Obtaining health information using e-health resources includes a variety of competencies, such as: (a) one's ability to conduct basic and advanced information searches; (b) the application of Boolean operators to limit searches; (c) the ability to differentiate between scholarly documents, authoritative sources, periodicals, and primary sources of information from other types of documents; and (d) understanding selected e-health terminology. In order to locate health information using e-health resources, one must direct basic and advanced

searches using specific techniques to find documents such as an abstracts, bibliographies, research articles and government reports. Figure 2.1 provides a framework for the variety of micro- and macro-level considerations mediating the translation of electronic information literacy into enhanced health through e-health literacy skills.

Informed health decisions usually require individuals to access quality health information. Access to e-health information is ubiquitous for many; however, access to e-health resources does not automatically imply individual and/or collective acuity discerning quality health information from quackery on the Internet. To ensure that individuals are optimally making use of readily available e-health access, it is important that appropriate search-related practices and procedures are used to retrieve and assess e-health information that is located. The ability to do this successfully becomes far more important than simply being able to solicit the Internet for information regarding health issues or problems. For example, when using the Internet as a medical education resource to find information, consumers should know how to critically examine both primary and secondary sources posting information to health-related web sites (Norman & Skinner, 2006).

Implementing apposite Internet searches for health information is especially important for college students, as the Internet is now a favorite resource for this generation of students to locate information in general. While it may be safe to say that the current generation of college students has ample access to health information on the Internet, access alone does not ensure that college students are adroit when searching for,

Figure 2.1 E-health literacy framework



and evaluating health information found after, rudimentary Internet searches. Ensuring that college students are able to conduct these electronic searches appropriately (versus supplying access to a web-based portal) is generally what dictates whether college students are effectively using the Internet to gather health information. Therefore, the purpose of this systematic review is to evaluate the current literature to determine whether college students can generally be considered an "e-health literate" population.

Methods

This review adopts the widely accepted definition of *e-health literacy*, as the ability of individuals to seek, find, understand, and appraise health information from electronic sources and apply such information to addressing or solving a health problem (Norman & Skinner, 2006). For the purposes of this review, the experimental units of analysis for inclusion were peer reviewed articles evaluating e-health literacy (i.e., seeking, finding, understanding, and/or appraising health information among electronic sources – primarily the Internet) exclusively among college students. The scope of the review included male and female college students between the ages of 17 and 26 attending various 4-year colleges and universities located around the world. In order to generate a sample of empirical studies, an exhaustive search of electronic databases was conducted. Due to the relatively recent emergence of e-health in the 21st century, only articles published in or following 2000 were eligible for inclusion. The searched databases included EBSCO, ERIC, PsychINFO, Health Source, MEDLINE, MasterFILE Premier, Academic Search Complete, CINAHL Plus with Full Text, Health Source: Nursing/Academic Edition, Psychology and Behavioral Sciences Collection, Applied

Social Sciences Index and Abstracts, Cambridge, and CSA. The key terms were entered in various combinations with multiple Boolean operators, and included: *e-health, electronic health, e-health literacy, electronic health literacy, health literacy, internet literacy, internet health, electronic literacy, college students, university students, and literature review*.

All articles gathered through this initial search and screen process (n =135) were evaluated for inclusion in the sample pool. Ninety-eight records were excluded after the screen of titles and abstracts. The reasons for the initial exclusion included not reporting measurement among an exclusively 4-year college student population meeting the specified age limits, and lack of measurement of knowledge or behaviors related to e-health literacy. In addition to the 37 papers that remained after the initial exclusion, five other articles were identified by hand searches after scanning the reference section of each database-identified article to enhance the breadth of the examination. This hand search resulted in the addition of 5 other articles meeting criteria for a full text assessment. Overall, 42 papers were included in this full text assessment, of which 35 were excluded for a variety of reasons, including: being secondary sources of information (n = 5), purely conceptual or theoretical in scope (n = 3); acting as opinion or editorial pieces (n = 2); including populations other than college students (n = 14); failing to explicitly measure and report students' ability to seek, find, or evaluate electronic sources of health information (n = 8); or existing as studies using the Internet as a treatment level for an intervention or trial (n = 3). After accounting for conditions outlined by the above exclusion criteria, 28 articles were left out of the review, leaving 7

articles that were empirical studies assessing e-health literacy among college students. Figure 2.2 presents a flow diagram of the systematic literature review search process described above.

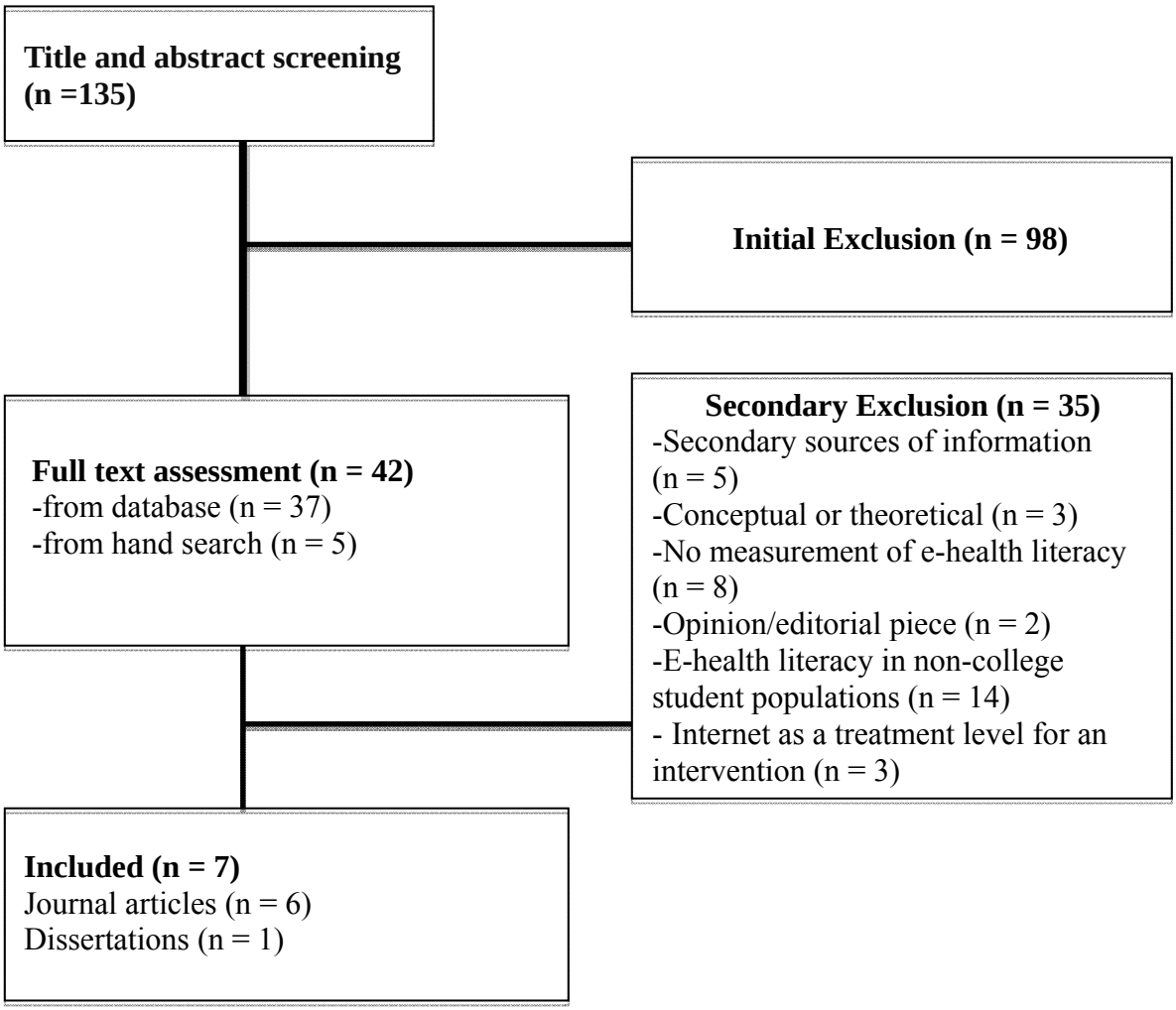
To evaluate the methodological quality of each retained study, a modified version of criteria established by Bernstein and Freeman (1975) was used to develop a Methodological Rigor Score (MRS) for each article ranging from 0 (low) to 4 (high). If a study used multivariate procedures such as discriminant analysis, factor analysis, cluster analysis, hierarchical regression, or MANOVA, then it received a score of 4. Articles reporting descriptive statistics, univariate regression, or non-parametric tests such as chi-square, mean, and/or variance/standard deviation, were assigned a 3. Those reporting strictly qualitative data received a score of 2, and purely narrative descriptions or written observations received a score of 1. When studies failed to report any statistical analysis procedures, then no points were awarded.

Results

Studies' Characteristics

Although e-health has been a topic of interest since the turn of the century, the results of this systematic search produced only six peer reviewed articles (Buhi, Daley, Furhmann, & Smith, 2009; Castren, Huttunen, & Kunttu, 2008; Escoffery et al., 2005; Ivanitskaya et al., 2010; Ivanitskaya, O'Boyle, & Casey, 2006; Nsuangani & Perez, 2006) and one doctoral dissertation (Redmond, 2007), published between the years of 2005 and 2010. Four different journals published the 6 journal articles: *Journal of Medical Internet Research* (2), *Journal of American College Health* (2), *BMC*

Figure 2.2 Flow diagram of systematic literature search process



Four articles (Castren et al., 2008; Escoffery et al., 2005; Ivanitskaya et al., 2006; Nsuangani & Perez, 2006) explicitly defined e-health literacy, but all explored at least one aspect of e-health literacy accounted for within the Norman and Skinner (2006) definition used for this review. For example, Nsuangani and Perez (2006) asked specific questions about Internet use tendencies to find health information. Alternatively, The Research Readiness Self-Assessment (RRSA), administered in 3 studies (Ivanitskaya et al., 2010; Ivanitskaya, et al. 2006; Redmond, 2007), sought to evaluate all major aspects of e-health literacy.

The studies included in this systematic review were generally exploratory in nature. A majority of studies used demographic variables to group students in a non-experimental fashion and then explored differences in patterns and relationships among identified groups. The independent variables used in all studies were unique and directly related to the study purpose; however, the most common independent variables were users and non-users of the Internet, sex, school year classification, and race. The dependent variables for 6 of the reviewed studies (Castren et al., 2008; Escoffery et al., 2005; Ivanitskaya et al., 2010; Ivanitskaya et al., 2006; Nsuangani & Perez, 2006; Redmond, 2007) included: self-reported use of web-based health advice services (Castren et al., 2008); perceptions of accuracy of health information found on the Internet (Nsuangani & Perez, 2006); perceptions of privacy of health information on the Internet (Nsuangani & Perez, 2006); frequency of Internet utilization for seeking health information (Buhi et al., 2009; Escoffery et al. 2005; Nsuangani & Perez, 2006); quality of health-related websites (Ivanitskaya et al., 2010; Ivanitskaya et al., 2006; Redmond,

2007); attitudes and beliefs about using the Internet for finding health information (e.g., beliefs that open-access internet and search engines are always the best source of information) (Redmond, 2007); self-reported levels of health information competency (Ivanitskaya et al., 2010; Ivanitskaya et al., 2006; Redmond, 2007); ability to find electronic health information (Ivanitskaya et al., 2010; Ivanitskaya et al., 2006; Redmond, 2007); ability to evaluate electronic health information (Ivanitskaya et al., 2010; Ivanitskaya et al., 2006; Redmond, 2007); past research & library experience (past behaviors related to doing health research and using health science libraries) (Ivanitskaya et al., 2010; Ivanitskaya et al., 2006; Redmond, 2007); perceived research skills (i.e., self-reported subjective beliefs about one's own skills, a self-report) (Ivanitskaya et al., 2010; Ivanitskaya et al., 2006; Redmond, 2007); ability to critically judge trustworthiness of Internet pharmacies (Ivanitskaya et al., 2010); and number of correct answers to sexual health questions following specified Internet searches (Buhi et al., 2009).

Results from the methodological assessment described above indicated that the reviewed articles had similar degrees of rigor. All of the studies' designs were non-experimental, with 2 studies (Castren et al. 2008; Nsuangani & Perez 2006) implementing random selection and the others composed of convenience (Escoffery et al., 2005; Ivanitskaya et al., 2010; Ivanitkaya et al., 2006; Redmond, 2007) or purposive (Buhi et al., 2009) samples. Six of the studies (Castren et al., 2008; Escoffery et al., 2005; Ivanitskaya et al., 2010; Ivanitskaya et al., 2006; Nsuangani & Perez, 2006; Redmond, 2007) used a quantitative paradigm to determine patterns between

independent and dependent variables, and one study (Buhi et al,2009) used a mixed-methods approach. Only 2 studies (Nsuangani & Perez, 2006; Redmond, 2007) used validated surveys containing reliability estimates of the data obtained from instruments. Two studies (Castren et al., 2008; Ivanitskaya et al., 2010) failed to explicitly report the validity of their measures and the reliability of the measures' scores. Three studies (Castren et al., 2008; Escoffery et al., 2005; Nsuangani & Perez, 2006) used Chi-square as the analysis of choice to explore differences in patterns between groups, and the remaining studies (Buhi et al., 2009; Ivanitskaya et al., 2010; Ivanitskaya et al., 2006; Redmond, 2007) reported descriptive statistics. Redmond (2007) used multiple t-tests to determine whether differences in e-health literacy skills existed between rural and non-rural college students. Ivanitskaya and colleagues (2010) performed multiple independent t-tests to assess whether differences in critical judgment existed between students who (a) did/did not use Internet information to make health decisions or (b) did/did not use Internet information to help another individual make health decisions. The mean MRS score for the reviewed studies was 3.14 (SD = 0.38), with 6 of the 7 (85.7%) studies scoring a "3". Table 2.1 describes the basic design, measurement, and analysis of each study accompanied by each study's individual MRS.

Table 2.1 Research design, instrumentation, analysis, and MRS for each reviewed study

Author (Year)	**Design**	**Intervention**	**Instrument**	**Instrument Validity**	**Instrument Reliability**	**Analysis**	**MRS**
Nsuangani & Perez, 2006	Non-experimental	None	Ad-hoc survey	Face (expert panel)	Pre-post Kappa > 0.4 for items retained for analysis	Freq. distri-butions; Cross-tabs; Chi-sq.	3
Castren, Huttunen, & Kunttu, 2008	Non-experimental, explorative	None	'Student Health Survey 2004' (Finland)	Not reported	Not reported	Freq. distri-butions; Cross-tabs; Chi-sq.	3

Table 2.1 continued

Author (Year)	Design	Intervention	Instrument	Instrument Validity	Instrument Reliability	Analysis	MRS
Escoffery, Miner, Adame, Butler, McCormick, & Mendell, 2005	Non-experimental	None	Ad-hoc survey	Not reported	Not reported	Descrip-tive stats; Chi-square	3
Ivanitskaya, O'Boyle, & Casey, 2006	Non-experimental	None	RRSA	Face Content	Yes, but no value reported	Descrip-tive stats; Multiple reg.	3

Table 2.1 continued

Author (Year)	Design	Intervention	Instrument	Instrument Validity	Instrument Reliability	Analysis	MRS
Redmond, 2007	Non-experimental	None	RRSA	Face Content	Ability to obtain health information, α= .69; Ability to evaluate electronic health information, α= .65; Overall health information competency, α= .77	Descrip-tive stats; t-tests; Cohen's d	3

Table 2.1 continued

Author (Year)	Design	Intervention	Instrument	Instrument Validity	Instrument Reliability	Analysis	MRS
Buhi, Daley, Fuhrmann, & Smith, 2009	Non-experimental	None	Ad-hoc	Content (implied)	Not reported	Descrip-tive stats	3
Ivanitskaya et al., 2010	Non-experimental	none	RRSA	Face Content	Not reported	Descrip-tive stats; Probabil-ities; t-tests; hierarch-ical regres-sion analysis	4

Demographics

The research findings related to sex varied among 5 studies Castren et al. 2008; Escoffery et al. 2005; Ivanitskaya et al., 2006; Nsuangani & Perez, 2006; Redmond, 2007). For example, Nsuagani and Perez (2006) found that male college students were more likely to use the Internet to buy pharmaceutical products and locate consumer health information; whereas, female students were more likely to obtain general health and medical related information online. This finding was supported in 2 other studies as well (Castren et al., 2008; Escoffery et al., 2005). Based on this evidence, it appears that females used the Internet more for health information and diagnostic purposes, while males were more likely to use e-health resources for consumer health purposes. Interestingly, however, males were more likely than females to seek out medical consultations using the Internet (Nsuangani & Perez, 2006), whereas females were more likely to self-report diagnosing chronic health conditions using the Internet (Castren et al., 2008). Also, no statistically significant differences existed between male and female college students related to whether or not they expressed concern regarding the accuracy of health information found on the Internet (Nsuangani & Perez, 2006). And there were no statistically significant differences found on any outcomes related to race or ethnicity.

Obtaining Health Information Using the Internet

Three studies revealed that between 67% and 74% of college students reported using the Internet to acquire health information in the United States (Buhi et al., 2009; Escoffery et al., 2005; Nsuangani & Perez, 2006). In one study, only 15% of college students reported having used the Internet to locate health information in the past day or

week, with less than one-third reported doing so in the past month (Escoffery et al., 2005). Over 25% students in this study reported being averse to logging onto a health program delivered over the Internet. Another study supported the idea of reluctance using the Internet for interactive health purposes, with a majority (88%) reporting an unwillingness to use online medical discussion applications (Nsuangani & Perez, 2006). Yet another study conducted in Finland corroborated this reluctance to participate in on-line health programming, finding that only 12% of Finnish undergraduate students had ever used a web-based health advice service offered to them through their student health services department (Castren et al., 2008).

While one study (Escoffery et al., 2005) suggested that over half (53%) of college students surveyed would like to individually retrieve health information on the Internet, several studies indicated college students self-reporting a lack of acuity with regard to successful health-related searches on the Internet (Escoffery et al., 2005; Ivanitskaya et al., 2010; Ivanitskaya et al., 2006; Redmond, 2007). Escoffery et al. (2005) found that 89% of college students do not always find desired e-health information that they are looking for. Furthermore, only slightly more than half of the 11% who did feel as if they were capable of finding health information on the Internet, reported success 'most of the time'. Two studies (Ivanitskaya et al., 2006; Redmond, 2007) concluded that many college students are rather unsophisticated health information seekers when using the Internet, and another found college students being unable to critically evaluate health information found on the Internet (Ivanitskaya et al., 2010). College students were also unaware of the difference between a primary and

secondary source of e-health information when attempting to identify scholarly journal articles in health-related fields (Ivanitskaya et al. 2006; Redmond, 2007). Finally, students who used e-health information for health decisions had lower overall critical judgment ability than those who used non-electronic sources of information for either purpose (Ivanitskaya et al., 2010).

Perceived vs. Actual E-health Literacy

Ivanitskaya et al. (2006) and Redmond (2007) assessed (a) how students felt about their own level of health information competency, (b) how proficient students were at searching for and evaluating health-related information, and (c) how well students understood the difference between peer-reviewed scholarly resources and opinion pieces or sales pitches. Both studies used the RRSA on-line assessment tool which evaluated perceived and actual knowledge of student ability browsing the internet and researching health information given selected scenarios and multiple choice questions. Ivanitskaya, O'Boyle, & Casey (2006) found that most college students (84%) perceived their e-health literacy skills as 'good', 'very good', or 'excellent'; yet, student scores on a 56-item scale evaluating student's actual e-health literacy skills were very poor (mean = 37%, SD = 6.35%).

Also, it was found that within each perceived skill category (e.g., perceived ability to find health information and perceived ability to judge the quality of health information), there was a large amount of variation in the actual overall competency scores of college students. Moreover, the ability of college students to evaluate their own competency was inconsistent with their actual e-health literacy. Using the same RRSA

instrument as Ivanitskaya, O'Boyle, & Casey (2006), Redmond (2007) found that non-rural college students were better able to obtain e-health information as opposed to rural college students, but there were no statistically significant differences in the ability to evaluate e-health information between the two groups. Escoffery et al. (2005) found that 35% of college students expressed 'serious concern' about their ability to find quality health information using the Internet, while only a small proportion of participants (7%) expressed 'no concern' regarding the accuracy of health information they acquired on the Internet. Despite the relatively high level of apprehension regarding the ability to find quality e-health information, more than 1/3 (36.7%) of these college students believed that being able to retrieve health information online improved the way they took care of their health 'some' or 'a lot'.

In light of these overarching findings, all studies tended to agree that college students in general (Buhi et al., 2009; Escoffery et al. 2005; Ivanitskaya et al., 2010; Ivanitskaya et al., 2006; Nsuangani & Perez, 2006; Redmond, 2007), and those in health and/or medical professional programs specifically (Ivanitskaya et al, 2006; Redmond, 2007), should further develop their proficiency appraising, using and evaluating health information found on the Internet. Table 2.2 describes the primary findings gathered from the research questions posed in each study.

Table 2.2 Principal findings of reviewed studies

Author(s)	Research Question(s)	Findings
Nsuangani & Perez, 2006	Do male and female college students differ in their Internet behaviors related to health?	Males more likely than females to report online medical consultation. Males more likely to buy pharmaceuticals online. More males use email to communicate with healthcare provider.
Castren, Huttunen, & Kunttu, 2008	Does self-reporting of chronic conditions differ between users and non-users of a web-based health advice service?	Male users of health advice service had higher rate of self- reported chronic conditions than male non-users; Female users of health advice service had higher rate of reported chronic condition than female non-users
Escoffery, Miner, Adame, Butler, McCormick, & Mendell, 2005	Are there differences in Internet use for health information by gender?	Statistically significant more female than male students obtain health information online.
	Are there differences in Internet use for health information by level of Internet experience?	No difference.
	Are there differences in Internet use for health information by level in college?	No difference.
Ivanitskaya, O'Boyle, & Casey, 2006	How proficient are university students at searching for health-related information?	Students are not proficient at advanced health information searches.

Table 2.2 continued

Author(s)	Research Question(s)	Findings
	How proficient are university students at evaluating health-related information?	Students have mixed proficiency at evaluating health-related information.
	How well do university students understand the difference between peer-reviewed scholarly resources, opinion pieces, or sales pitches?	Students are deficient in discriminating among different types information sources.
	How aware are university students of their own level of health information competencies?	Undergraduate students are inaccurate judges of their own health information competencies. Self-reports may not be an accurate predictor of students' actual health information competencies.
Redmond, 2007	Does a difference exist in the ability to obtain health information between rural and non-rural freshmen?	A statistically significant difference exists with non-rural students performing higher than rural students, $t(241) = 2.23$, $p = .03$. Cohen's $d = .29$.
	Does a difference exist in overall health information competency between rural and non-rural freshmen?	No difference exists, $t(241) = -.14$, $p = .89$. Cohen's $d = .02$.
	Does a difference exist in the ability to evaluate health information between rural and non-rural freshmen?	No difference exists, $t(241) = 1.34$, $p = .18$. Cohen's $d = .18$.

Table 2.2 continued

Author(s)	Research Question(s)	Findings
Buhi, Daley, Fuhrmann, & Smith, 2009	When asked questions about sexual health, do college students find accurate answers online?	For 12 of the 13 questions asked, at least 70% of the students answered the questions correctly. 50% of the students correctly answered the question that asked to locate an anonymous HIV test in the local area.
Ivanitskaya et al., 2010	To what degree are college educated information seekers able to determine trustworthiness of online pharmacies?	Substantial variation exists in how college students rate trustworthiness of online pharmacies. Only 31% of respondents gave low ratings to untrustworthy online pharmacies.
	Do those who used information to make health decisions have better judgment skills?	Respondents using online health information for decision making purposes have significantly worse judgment than those not using online health information for decision making purposes.

Discussion

Principal Results

This systematic review revealed that college students lack important skills seeking and evaluating health information available on the Internet. While college students have, for the most part, easy access to health information on the Internet, and feel comfortable using the Internet, data indicate many students possess weak e-health literacy competencies which limit their ability to search for, retrieve, utilize and evaluate electronic resources to obtain quality health information. Furthermore, and perhaps more importantly, the subjective perceptions of college students concerning their own acuity using electronic health resources was inconsistent with their demonstrated e-health literacy levels. College students seem to have the tendency to mistakenly judge their own electronic research-based competencies and hold a very positive view of their ability to do health-related research over the Internet. Specifically, students' self-ratings of their e-health literacy skills tended to be quite high, which did not correspond to their actual information competencies revealed during skills testing.

Moreover, there is a discord between what college students think about their e-health literacy skills and their actual skill level. A skill development discrepancy such as the one illustrated provides an invaluable opportunity to build health education competencies especially among college-age students in degrees related to the health professions. These students will doubtless use the Internet for health information purposes for the remainder of their professional careers. Molding confident "e-health/medical educators" among future medical and allied health professionals should

be an important emphasis area within forthcoming research and practice initiatives, because, as Bandura (1977) explained within self-efficacy theory, "expectation alone will not produce desired performance if the component capabilities are lacking" (p. 194). It is not enough simply to recognize that college students are self-reporting confidence using electronic resources to locate health information more frequently, because college students who use the Internet to find health information tend to be worse judges of the health information they locate.

The literature also indicated a tendency for male college students to be more likely to use the Internet to locate and acquire consumer health products (e.g., pharmaceuticals, dietary/sports supplements, vitamins and minerals, performance enhancing substances) and services and less likely to search for information on illness, disease, and/or disease prevention using medical reference websites. Female college students were generally more likely to undertake these types of general health and medical searches on the Internet. It should be noted, however, that female college students were less likely than male college students to obtain health services over the internet (e.g., primary care physician web portals, medical consultations, e-mail communications with health care providers, etc.). Furthermore, among college students, the existing literature suggests that general health information seeking behavior on the Internet is more prevalent and acceptable among female students, while using the Internet to acquire health related goods and services is more of a male oriented information-seeking activity. These differential e-health search propensities among

male versus female college-age consumers could speak to various developmental issues of marketing pressures, peer influences, and even health privacy concerns.

College students also reported reluctance using interactive Internet applications for health enhancing purposes (i.e., electronic communication with health care providers). This finding revealed itself not only in the United States, but also in the one Finnish study that was reviewed. Perhaps the convenience of using the Internet for personal health is overshadowed by a lack of trust and comfort among college students related to using on-line applications to share and receive personal health information. While the literature supports college students wanting to use the Internet to seek out general health information, there is little evidence to suggest that students care to discuss their own health problems and/or obtain medical advice over the Internet. Suffice to say, college students seem to prefer locating health information online in isolation without having to interact with a health professional to do so. Given this solitary perspective of e-health, college students should be equipped with the skills to conduct valid and reliable searches to find quality health information on their own. Much should be done to alleviate any dissonance that may exist between student willingness to use the Internet to gather health information and fear that using the Internet for personal medical information has potential security, identity and breach of privacy implications.

Limitations

The review suffers from several limitations. Although a comprehensive literature search was conducted on numerous databases using a variety of pertinent search terms, certain studies may have been overlooked due to lack of indexing in searched databases.

Also, one standard definition of ‘e-health’ does not currently exist which limits the ability of researchers to find all articles examining e-health literacy within a single literature review. Another limitation involves the number of articles included in the review. Although the studies reached similar conclusions in selected instances, the small sample of studies reviewed (n = 7) may not truly reflect the populations’ (i.e. college students) true e-health literacy levels. In addition, the studies, by and large, recruited participants using convenience samples which can result in findings not being reflective of the true population of interest. As well, most studies in this review (n = 4) collected self-report data and failed to test actual e-health literacy skills to complement these self-perceptions. Finally, among college students, there is a rapidly shifting marketplace penetration of information technologies into students’ lives and educational settings (e.g., smartphones, social networking websites, iPads, etc.). Within the reviewed studies of e-health literacy among college students, these emerging applications were not delineated as alternative electronic sources of information, which may not reflect modern day search inclinations among college students. These types of applications conducive to health information retrieval have spawned a new field of ‘m-health’ which may necessitate broadening the study of e-health among college students. Finally, while the mean MRSs for the studies in this systematic review were quite good, no studies were experimental in nature, few reported sufficient validity and reliability measures for data collected with survey or testing instruments, and almost all data analyses were of a univariate versus multivariate nature.

Comparison with Prior Work

Even where access to basic Internet infrastructure exists or is provided, optimal utilization of the Internet to locate quality health information is often limited by other factors, such as human interface. To some extent, human interface encompasses issues commonly considered when assessing *usability*. Usability of an e-health information source typically refers to the quality of a user experience when interacting with the resource, with an emphasis on behavior rather than opinion or recollection (Atkinson & Gold, 2002; Glasgow, 2007). The construct measures learnability, memorability, efficiency, frequency and severity of errors, and user satisfaction focuses on human limitations, such as literacy, and health website quality criteria such as accuracy, completeness, readability and design. With regard to using the Internet, varying levels of usability exists among e-health resources so it would be useful to determine whether perceived usability of e-health resources explains health information acquisition (Stellefson, Chaney, & Chaney, 2008; Korp, 2006). Further, an analysis that assesses individual perceptions of e-health usability in relation to overall behavioral capability to locate and evaluate e-health information is vital for future e-health literacy research (Glasgow, 2007; Korp, 2006). Studying consumer health informatics (i.e. analyzing consumer needs for acquiring and using information retrieved using technology) in conjunction with e-health literacy (Stellefson et al., 2008; Korp, 2006) can further develop methods that pave the way towards health care service rendering in the information age.

Finally, as suggested by Escoffrey et al. (2005), and supported by this systematic review, more research needs to be done to inform the training of students in the health and medical professions, to "search the Internet for health information and to evaluate health information on Web sites" (p. 187). For example, health educators are expected to find valid health information resources electronically and evaluate the usefulness of such information (National Commission for Health Education Credentialling, 2006). Unfortunately, assessment research in e-health competencies among future health professionals in training remains limited in scope; thus, there does not exist a complete understanding of their preparedness for locating evidence-based related health information electronically. Preliminary evidence from this systematic review suggests that future health professionals are in need of professional preparatory experiences to build their e-health literacy proficiencies. Enhanced skill development will likely develop as a product of both critical thinking and extensive medical Internet research among this population, which is likely to assist in augmenting student ability to navigate the world wide web of health information.

Consequently, collegiate degree programs for those entering the medical and allied health fields are uniquely positioned to nurture and develop e-health competencies among both majors and non-majors alike. It is important for education administrators to determine: (a) what list of topics should be covered, (b) what types of courses/materials can address needed competencies; (c) how many hours of subject matter instruction might be necessary for e-health literacy skill development; and (d) whether "e-health" warrants a specific emphasis area/track within health professional preparation programs.

Paying attention to these aspects of e-health literacy via mission and policy statements within professional preparation programs will help improve e-health literacy competence, empowerment, and skills needed at both the undergraduate and graduate levels.

Conclusion

In the current e-health environment, the literature suggests two important questions that should continue to be investigated in medical education: (1) In a world where the availability of health information is constantly expanding, do professionally prepared college students in the health professions have the skills to navigate electronic environments to retrieve evidence-based health information? And (2) do college students studying to be health professionals have an inflated sense of self-efficacy regarding their ability to consume and evaluate quality health information on the Internet? Given that governmental and advisory agencies have designated both health and e-health literacy as paramount to improving societal health in both Canada and the United States (Canadian Council on Learning, 2008; U.S. Department of Health and Human Services, 2010), it is important that future "e-health/medical educators" be provided with planned learning experiences to improve their literacy in regards to searching for, locating and using e-health information. It is incumbent upon health/medical educators to develop proficiencies among future professionals to facilitate the astute procurement and management of e-health information. Both current and future college students need essential e-health literacy skills to find, evaluate, interpret, and present health-related information found on the Internet.

CHAPTER III

E-HEALTH LITERACY COMPETENCIES AMONG UNDERGRADUATE HEALTH EDUCATION STUDENTS

Synopsis

Due to the ubiquitous access of health information on the Internet, researchers have begun investigating e-health literacy among college students. Because access does not necessarily translate to skill in searching for, or evaluating health information previous research has studied e-health literacy of college students. However, health education majors, who are expected to act as a health information resource, have yet to have their e-health skills evaluated. To investigate the perceived and actual e-health literacy of health education majors at a large Southwestern university. A convenience sample of health education undergraduates completed the RRSA-h. Descriptive statistics, correlations, and MANOVA were used to describe their e-health literacy. Results: Seventy-seven students completed the instrument. The majority of the respondents were female upperclassmen. The respondents perceived e-health skills did not correlate with actual e-health skills and their overall e-health skills were low, however, the upperclassmen's' overall e-health skills were higher than the lowerclassmen. Health education students on average appear to lack the e-health skills as measured by the RRSA-h, however some respondents scored well. The field of health education could benefit by investigating the characteristics that discriminate between the e-health competencies of undergraduate students.

Introduction

E-health has been a topic of interest in the fields of health education since the turn of the 21st century (Atkinson & Gold, 2002; Bush et al., 2004; Madden & Fox, 2006; Pagliari et al., 2005); yet, a clear, concise definition of e-health does not currently exist. The multitude of definitions which do exist describe e-health as a broad range of applications facilitating healthcare, generally augmented by strengthening the confluence between health, technology, and commerce (Oh et al., 2005; Pagliari et al., 2005). Electronic resources increasingly play a major role in consumer health, with the Internet acting as the primary telecommunications vehicle of choice (Atkinson & Gold, 2002; Bush et al., 2004; Madden & Fox, 2006). Despite concerns regarding the quality of online health information(Sillence et al., 2007), health consumers engage the Internet often for health information with more than 113 million American adults influenced by nearly 70,000 health-related websites yearly(Fox, 2006; Pagliari et al., 2005). This voluminous use of the Internet for health information has spurred a pool of e-health information resources that act as virtual aides to help consumers acquire knowledge that both promotes and sustains personal health. In light of this, it is important to understand an individual's ability to locate and use e-health tools and applications available on the Internet (Norman & Skinner, 2006).

E-health and the topic of health literacy are two topics in health education which are important and closely related. 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" (US Department

of Health and Human Services, 2000). Health literacy is an important skill which allows people to manage their own health within a complex health system. *Healthy People 2020* has reinforced the importance of health literacy by including multiple objectives that relate to health literacy in an e-health environment (U.S. Department of Health and Human Services, 2009). Suffice to say, health literacy is important for health educators who are expected to be competent resource people in health education (National Commission for Health Education Credentialing, 2006).

In today's increasingly "tech-savvy" world, health educators inevitably must become discerning with regard to utilizing electronic resources (e.g., mobile-Internet, smartphones, iPads, etc.) for health information gathering. Norman & Skinner (2006) 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" (p. 1). 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 specific search techniques to find documents such as an abstracts or bibliographies.

E-health information seeking and utilization among undergraduate health education majors is not an area widely studied in the literature. This is surprising given that the Internet is ubiquitous on college campuses and the current generation of college students has tremendous exposure to the Internet (Jones et al., 2009; Nsuangani & Pérez, 2006). Various studies have explored attitudes and behaviors of college students relative to using the Internet for health information seeking purposes (Buhi et al., 2009; Castren et al., 2008; Escoffery et al., 2005; Ivanitskaya et al., 2006; Ivanitskaya et al., 2010; Nsuangani & Pérez, 2006; Redmond, 2007). Two of these studies (Ivanitskaya et al., 2006; Redmond, 2007) measured students' actual ability to find and evaluate e-health information, and one (Buhi et al., 2009) investigated students' ability to find correct answers to a set of sexual health questions on the Internet. The majority of studies (Buhi et al., 2009; Escoffery et al., 2005; Ivanitskaya et al., 2006; Nsuangani & Pérez, 2006; Redmond, 2007) agreed that undergraduate students need extensive training to reap the greatest benefit from implementing health information searches on the Internet.

Even more perplexing is the lack of studies 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 the perceived and actual abilities of health education undergraduate students to find and evaluate e-health information. Knowledge and skills related to e-health literacy were assessed among this population, along with self-perceptions of information seeking ability on the Internet. This study builds on previous work by Ivanitskaya et al. (2006) and Redmond (2007) by specifically looking at students majoring in health education, a

cohort of future professionals who should be skilled in e-health information seeking (National Commission for Health Education Credentialing, 2006).

Methods

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) (Ivanitskaya, Laus, & Casey, 2004). The RRSA-h evaluates the foundational competencies of searching for, obtaining, and evaluating health information. The instrument incorporates constructs within the two-process theory of human information processing (Schneider & Shiffrin, 1977) and atomic components of thought (Anderson & Lebiere, 1998) by evaluating tasks which introduce stimuli which mimic e-health search situations that induce automatic and controlled information search responses (Ivanitskaya et al., 2004). The RRSA-h can be administered to groups such as undergraduate students, as it does not measure higher order skills of experienced researchers, such as evaluating the design, measurement, or analysis of a study (Ivanitskaya et al., 2006).

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 problems that ask each participant to search databases and evaluate the quality of published documents (Ivanitskaya et al., 2004). For example, a knowledge-based problem in the survey asks respondents to identify which Boolean operator (e.g., and, or, not) produces

the most Internet search results (answer: or). An example of a skill-based survey item asks respondents to determine which Boolean operator is appropriate for a requested search, then prompts the respondent to perform the search using that particular Boolean operator, and then report the number of web resources generated by the search.

Additionally, the RRSA-h measures students' attitudes and beliefs regarding their own abilities to locate and evaluate information from e-health sources. The dependent variables of interest measured by the RRSA-h were actual ability to obtain (AAO), actual ability to evaluate (AAE), perceived ability to obtain (PAO), and perceived ability to evaluate (PAE). The AAO subscale is comprised of 11 multiple choice items where scores can range from 0 to 16. The AAE subscale is comprised of 13 multiple choice items where 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 ability to obtain and evaluate e-health information. Both PAO and PAE are visual analog scales that range from 0 to 10, where higher scores indicate stronger beliefs in ability to find and evaluate e-health information. In a prior study (Ivanitskaya et al., 2006), the data derived from the RRSA-h demonstrated satisfactory internal reliability ($\alpha = .78$). The internal reliability of the scores gathered from each scale of the RRSA-h were the following: AAO ($\alpha = .69$) and AAE ($\alpha = .72$).

Research Questions

The following 4 research questions were investigated during this study:

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

Participants

A convenience sample of eligible health education majors was recruited using a variety of proactive strategies. Specifically, introductory emails were sent through a listserv operated by the academic advising department at a large southwestern university in the United States. The email was sent at two time points over a period of approximately 2 weeks, asking students to create an on-line account necessary to complete the RRSA survey instrument described above. Four weeks after sending this initial recruitment email, 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 willingly participating in the study and reminded them that they needed to complete the online survey to become eligible for a chance to win one of the prizes. 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, the principal investigator visited numerous undergraduate classes in health education to recruit another possible 300 potential participants. In all, 123 students willingly created an online RRSA account. Seventy-seven students (n = 77) completed all aspects of the survey for a response rate of 62.6%. The participants were treated in accordance with ethical standards approved by the university's institutional review board.

Data Analysis

Statistical analysis was carried out using SPSS version 17.0 (SPSS Inc., Chicago IL). Descriptive statistics (i.e., means and standard deviations) were computed to answer the research questions #1-3. Pearson's r correlations quantified the relationship between the students' perceived and actual ability to both obtain and evaluate e-health information. A one-way multivariate analysis of variance (MANOVA) tested whether differences existed among undergraduate student classification status on the 2 outcomes variables of interest (i.e., AAO, AAE). The current study used a multivariate analysis of variance (MANOVA) to assess whether or not mean centroid differences existed among the 3 different student classifications when considering the dependent variables in a set simultaneously. The choice of MANOVA versus multiple analyses of variance (ANOVAs) was made because of the hypothesized theoretical association between the outcome variables (Stevens, 2009). A post-hoc descriptive discriminant analysis (DDA) followed up statistically significant MANOVA results. A post-hoc descriptive discriminant analysis (DDA) was used to describe the nature of the effects of a

statistically significant omnibus MANOVA. DDA examines linear composites of the outcome variables which are useful in defining and identifying structure dimension of the latent variable(s) that underlie the grouping variable effect (Huberty & Olejnik, 2006).

Results

The majority of the respondents were female (88.3%) and classified as upper-classmen (84.4%). The disproportionate numbers of females to males is reflective of the female to male ratio within the health education major. The low number of freshman can be explained because the health education major is considered, within the department, as a "discovery" major. This means that students tend to transfer into the major after their freshman or sophomore years. The health education major at the institution has 3 options; allied health, community health, and school health. The majority (77.9%) of the respondents' option was allied health. The average age of the respondents was 21.3 years (± 2.0 years) with an average GPA of 3.12 points (± 0.39 points). On average, the respondents overall health was reported as very good. Table 3.1 provides a summary of the demographic characteristics described above.

Mean PAO and PAE were both rated relatively high at 78.7% (SD ± 13.9%) and 75.3% (SD ± 14.3%), while mean AAO and AAE scores were rated low at 50.4% (SD ± 15.6%) and 39.3% (SD ±12.5%). Table 3.2 presents mean scores on the RRSA along with the standard deviations and percentage of answers correct for all four dependent variables according to academic classification. In addition, the correlation matrix for the four variables (i.e., PAO, PAE, AAO, AAE) is also included.

Table 3.1 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 in Years	21.34	1.97
GPA	3.13	0.39
Overall Health (10 point scale)	8.18	1.39

Table 3.2 Outcome variable descriptive statistics by academic class

Variable	Sophomore (n=10)	Junior (n=24)	Senior (n=41)	Total (n=75)
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
Pooled correlation matrix				
	AAE	AAO	PAE	
AAO	0.4553*	-	-	
PAE	**0.2554***	0.0199	-	
PAO	0.2284*	**0.0281**	0.4469*	

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

Values in parentheses shows the percent of the total possible points for dependent variables by academic class.

Bold numerical figures indicate correlations of interest.

*$p < 0.05$

Pearson's r correlations quantified the linear relationship between the two actual ability variables (i.e., AAO and AAE) and the two perceived ability variables (i.e., PAO and PAE). A small but statistically significant correlation ($r = 0.27$, $p = .045$) existed between PAE and AAE, but no statistically significant correlation ($r = 0.04$, $p = .725$) existed between PAO and AAO.

Multivariate normality was supported through a non-statistically significant Box (1949) test [M=11.032, $F(6, 6111) = 1.727$, $\chi 2\ (6) = 10.372$, $p = .110$] which provided evidence that supported equality among the three dependent variable population covariance matrices. Moreover, Q-Q plots confirmed univariate normality among the outcome variables; thus, it was determined with relative confidence that the joint distribution of the 2 outcome variables (i.e., AAO, AAE) within each group was approximately multivariate normal.

Due to the extremely low participation of consenting freshman (n = 2), and the need to have more cases than dependent variables in each cell (Tabachnick & Fidell, 1989), the freshmen level was removed from the MANOVA model. Therefore, a one-way, three-level between subjects MANOVA was performed on the two dependent measures (i.e., AAO, AAE) to test whether difference existed between student classification level on the mean centroids.

The omnibus MANOVA null hypothesis was rejected at the defined $\alpha = 0.05$ level [Wilks $\Lambda = 0.868$, $F(4, 140) = 2.597$, $p = .039$] indicating that the classification groups differed beyond reasonable expectation due to chance or sampling error. The η^2_{adj} effect size characterizing this statistically significant result indicated that 10.80% of the

variation on the mean centroids was shared within classification level. Therefore, it can be surmised that the observed differences among the three classification levels were generalizable across levels with respect to the two outcome variables. Table 3.3 shows the MANOVA results as well as the error structure coefficients for the two outcome variables.

Following this statistically significant result, descriptive discriminant analysis (DDA) was used to determine whether groups differed on the mean centroid. The linear discriminant functions (LDFs) were consulted to help make this determination. The maximum number of LDFs that can be extracted is the minimum of either the number of outcome variables or the number of grouping levels minus one (Huberty & Olejnik, 2006). In this study, a maximum of two LDFs could be derived; however, the dimension reduction analysis confirmed that the canonical variate was adequately described by one dimension. Both outcomes measures (e.g., AAO and AAE) contributed to the makeup of the canonical variable as described by the first LDF, heretofore described as the Actual Research Ability (ARA) construct. The group centroids for the linear discriminant functions suggest clear separation between the sophomores versus the juniors and seniors in the sample. A one-way ANOVA and a Tukey post-hoc analysis was then conducted on the LDF scores to empirically determine where the statistically significant differences in the LDF mean centroids occurred (Enders, 2003). 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 LDF mean centroids), the post-hoc comparison between juniors and seniors was not

Table 3.3 MANOVA results and LDF weights

Outcome Variable	Error Structure r	Wilks' Λ	*F*	*p*
AAO	0.877	0.868	2.597	.039
AAE	0.796			

statistically significant.

Discussion

The present study is an attempt to measure basic e-health competencies of undergraduate health education majors. The measurement tool, the RRSA-h, provided scores on each participant's actual and perceived abilities to obtain and evaluate health information from electronic sources. Before further discussion of specific results, it is important to acknowledge some possible limitations regarding the generalizability of the results gathered within this study design. Limitations of the study include non-randomized sampling method (i.e., convenience sample), an extremely small number of freshmen completing the survey (i.e., 2), and (3) a majority (88%) of respondents being female. 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.

The data indicate that the current sample of health education students were lacking in regards to skills necessary for obtaining and evaluating health information available on the Internet as measured by the RRSA. Historically with the RRSA survey, entry level undergraduate students were able to correctly answer 65% of the AAO questions and 54% of the AAE questions (Ivanitskaya, 2009). The students from the current study, however, were only able to correctly answer 50% of the AAO questions and 39% of the AAE items. This underperformance is interesting, if not disconcerting, considering 84% of the sample was either juniors or seniors (i.e. upper level students). Interestingly, perceived ability to obtain and evaluate electronic health information was

rated as relatively high. While the current generation of undergraduate health education majors can, in general, easily access online health information, the current sample of students demonstrated an inability to evaluate health information. This discord can serve as a barrier to health education students' expected competency to act as an information resource for the public, which is a responsibility for health education professionals (National Commission for Health Education Credentialing, 2006).

A small, but positive linear relationship existed between PAE and AAE, yet no statistically significant correlation existed between PAO and AAO. Students' perceptions of their ability to obtain e-health information were unrelated to their actual ability to obtain such information. The perceptions undergraduate health education students hold about their competency to conduct basic e-health searches was not in concordance with their actual performance obtaining and evaluating e-health information, given no linear relationship existed between students' perceived ability to obtain health information and actual ability to obtain health information. On the other hand, students perceptions of their ability to evaluate e-health information was related to their actual ability to evaluate health information, albeit to a small degree ($r^2 = .07$). Regardless, 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 (Ivanitskaya et al., 2006), which reported weak linear relationships between students' perceptions of obtaining health information versus their actual ability to do so.

Interestingly, while not the focus of the research questions under investigation in this study, there were statistically significant positive associations between perceived and actual ability scores both to obtain and evaluate e-health information. Both the PAO and PAE variables were measures of self-efficacy (Bandura, 1977), which has been shown to be a strong predictor of ability, ability being commensurate with the measures of AAO and AAE. Past review research has speculated that self-efficacy in regards to obtaining and evaluating e-health information may be inflated among undergraduate students who use the Internet quite frequently, yet perhaps greenly when searching for health information. Results from this study support the dissonance between confidence in ability and actual competence conducting appropriate e-health Internet searches. Therefore, while students' perception of their own actual ability to evaluate e-health information may be poor, it may be more accurate than their perception of their ability to obtain e-health information. This may be indicative of the nature of Internet search behaviors where seeking out health information is commonplace, yet applying evaluation criteria to search results is not (Eysenbach, Powell, Kuss, & Sa, 2002).

Actual electronic health research ability (ARA), comprised of actual ability to obtain (AAO) and evaluate (AAE) e-health information, differed when considering academic classification level. Sophomores had significantly lower scores on the resultant ARA dimension than did juniors and seniors. The current study's results are consistent with other studies that revealed more high-ranking undergraduate students possessed advanced literacy skills and abilities (Ivanitskaya et al., 2006; Redmond, 2007). Certain academic experiences facilitated through the course of an undergraduate degree plan

may introduce students to more in- and out-of-class activities which require more e-health Internet searches. These activities may provide experiences that help improve students' skills obtaining and evaluating e-health information. Unfortunately, this marginal improvement for upper versus lower classmen is not all the encouraging given that overall ARA ability (as measured by the AAO and AAE subscales) were quite disappointing.

Conclusion

This study has indicated that health education undergraduate students may be especially lacking in terms of possessing the skills sets necessary for obtaining and evaluating health information available on the Internet. Specifically, there was a clear distinction made between underclassmen and upperclassmen performance. More academic experiences focused on improving e-health literacy skills of undergraduate students in health education should be implemented. Although, on average, undergraduate health education students in this study showed to be lacking in e-health literacy competencies, certain participants did score high on the instrument 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 insight into the types of characteristics that define high, average, and low achievers when assessing levels of e-health literacy. Future research would benefit from understanding which particular cognitive characteristics discriminate between e-health literacy competencies among undergraduate health education students.

CHAPTER IV

E-HEALTH INFORMATION RETRIEVAL CHARACTERISTICS OF UNDERGRADUATE HEALTH EDUCATION STUDENTS: A DISCOURSE ANALYSIS USING THE Q-TECHNIQUE

Synopsis

Research has begun to investigate e-health literacy of college students. Current studies have measured e-health literacy of college students but not how or why e-health literacy levels vary among them. To investigate, from a subjective perspective, how many types of students exist, which students group together, and which descriptive statements do the different types of students identify with themselves. A Q-technique study was conducted on a select group of health education undergraduates from a large southwestern university. First a Q-concourse was developed and a set of statements was derived from the concourse to form the Q-sample. Then the students (Q-participants) conducted Q-sorts which and an EFA was used to explore the patterns of the sorts between the participants. The number of retained factors and pattern / structure coefficients were used to determine the number of types of students and which students belonged to which type. Factor scores were used to determine which Q-statements were salient for each group. Three types of students participated in the study and they separated along the lines of high-, middle-, and low- levels of e-health literacy. High-performers described themselves as conscientious group workers, middle-performers

described themselves as conscientious individual workers, and low-performers described themselves as procrastinators who work alone.

Introduction

As future health professionals, health education students will be called to act as resource people for finding, interpreting and using health information (see Responsibility VI, Competency 6.1; National Commission for Health Education Credentialing Inc., 2010). Electronic resources increasingly play a role in consumer health, with the use of Internet acting as the primary telecommunications outlet of choice (Atkinson & Gold, 2002; Bush et al., 2004; Madden & Fox, 2006). With the evolution of new information and communications technologies from which to access the Internet, health educators have embraced the importance of e-health literacy competencies within studies of health information seeking (Ivanitskaya et al., 2010; Ivanitskaya et al., 2006; Redmond, 2007). Both personal and collective empowerment in e-health information seeking is paramount; thus, it is important to understand consumers' ability to use e-health tools available on the Internet (Norman & Skinner, 2006). This becomes especially relevant in light of concerns expressed over the variable quality of online health information (Sillence et al., 2006).

Access to the Internet is ubiquitous on college and university campuses across the United States and around the world (Jones et al., 2009). The current generation of college-level health education students has exposure to a world wide web of health information at the touch of their fingertips; yet, their inability to find, appraise and use health information available on the Internet (Ivanitskaya et al., 2010; Ivanitskayaet al.,

2006) bring to light concerns over the quality of e-health literacy among college populations. The literature review for this study identified seven studies which investigated e-health literacy among college students. The studies explored health information seeking behaviors on the Internet and the students' perceptions of their skills related to obtaining and evaluating information using e-health resources. The studies found that males were more likely to report online medical consultation and buy pharmaceuticals online than females (Nsuangani & Perez, 2006); female students are more likely than male students to obtain health information online (Escoffery et al., 2005); substantial variation exists in college students' judgment of online health resources (Ivanitskaya et al., 2010); and college students think they are proficient at obtaining and evaluating online health information but their actual skills are lacking (Ivanitskaya et al., 2006). These results indicated that a complete understanding of college students' preparedness for locating and evaluating health information was scarce. Identifying, in a systematic way, college students' perspective about their knowledge, attitudes and behaviors towards their experiences searching for and evaluating health information could provide important insights which can help define those characteristics which help to discriminate between college students of varying e-health literacy skills.

The Q-method, which is a systematic way to study subjectivity (Thomas & Watson, 2002), can be used to reveal various social perspectives that exist on a given topic (Webler, Danielson, & Tuler, 2009). The Q-method fits under the broad umbrella of *discourse analysis* techniques, which constitutes a large category of methods that analyzes text-based statements in order to find underlying patterns or meaning (Webler

et al., 2009), by clustering individuals into different types based on how they describe themselves (Thompson, 1980). Alternative qualitative research designs such as the Q-method (Thomas & Watson, 2002; Webler et al., 2009) are useful to systematically answer subjective research questions that delve into the cognitive characteristics which attempt to characterize social perspectives about activities such as e-health information seeking among undergraduate health education students. This method of inquiry can provide exceptional insight into how many types of people there are, which people belong to different groups, and which particular variables best delineate different types of people (Thompson, 2005). An advantage that Q-method has over other forms of discourse analysis is that the participants' responses can be directly compared in a consistent, methodical manner, given that all participants are asked to react to the same set of Q-statements which is not usually the case in other kinds of qualitative discourse analysis (Webler et al., 2009). In Q-method research, participants and independent variables are inverted; thus, the "participants" in a Q-study are those Q-statements evaluated , and the "variables" are the people – more specifically, their unique, individual Q-sorts. Each study participant is asked to complete a "Q-sort" whereby various statements are sorted according to how those statements fit into each individual participant's own belief system and their personal understanding as to who they believe themselves to be. Following these Q-sorts, patterns are identified throughout the numerous Q-sorts completed by different individuals. When patterns are identified, it suggests that there are inter-subjective orderings of beliefs that are shared among people. This leads to the notion of social perspectives (Webler et al., 2009). In the context of

college students and e-health literacy, the Q method can be used to explore, from an undergraduate student's perspective, which individual characteristics shed light on the nature and differences of students identified as having strong e-health information literacy skills versus students identified as weaker electronic health information literacy skills.

A Q-study will attempt to differentiate varying levels of performers on the Research Readiness Self-Assessment-Health (RRSA-h), a measure of perceived and actual ability to obtain and evaluate health information on the Internet (Ivanitskaya et al., 2004). The RRSA-h consists of multiple choice questions and skill based problems, and generates an overall actual research ability score when using e-health resources. While the RRSA-h quantifies overall research ability among students, it does not explore the subjective perspectives of the students related to their own procedural and declarative knowledge, self-efficacy, and behaviors demonstrating their associated knowledge and confidence. This information is crucial to helping gain better insight into which characteristics can classify e-health literacy levels. Therefore, the current study addressed three research questions in hopes of creating a typology of undergraduate health education majors based on their identification with statements pertaining to their own knowledge, self-efficacy, and behaviors associated with finding health information on the Internet:

1) How many types of students exist, given information on self-perceptions regarding their own knowledge, attitudes, and behaviors related to conducting e-health research?

2) Into which types can students be categorized into, given perceptions of their knowledge, attitudes, and behaviors related to conducting e-health research?
3) Which perceptions provide the basis for differentiating various "types" of e-health literate college students?

Theoretical Framework

There are two theories of human information processing that inform the present research. First is the two-process theory of human information processing (Schneider & Schiffrin, 1977). This theory describes memory as a large, permanent collection of nodes which become increasingly inter-associated through learning. The nodes are part of both short- and long-term memory and are able to transition to and from both types of memory. Long-term memory is the permanent, passive repository that contains learned sequences; whereas, short-term memory is temporary with a limited number of activated nodes (Schneider & Schiffrin, 1977). The two processes that make use of these nodes are activated by automatic and controlled processes. An automatic process is a learned process that allows an individual to perform a task with lower levels of required attention; however, once learned, an automatic process is hard to suppress. Controlled processing, unlike automatic processing, is conscious and intentional. Controlled processing requires more attention and has limited capacity, but has the characteristic of being adaptable to novel situations (Schneider & Schiffrin, 1977).

The Atomic Components of Thought (ACT) is the second theory to inform the present research (Anderson & Lebiere, 1998). ACT explains skill development as a process of encoding, strengthening, and proceduralizing knowledge (Ritter, Anderson,

Koedinger, & Corbett, 2007). The theory posits there are two types of knowledge, declarative and procedural. Declarative knowledge is what one knows and can describe to others (e.g., facts), and procedural knowledge is the understanding of how to do things. Procedural knowledge brings forth declarative knowledge to solve problems (Anderson & Lebiere, 1998). Further, complex tasks can be described as combinations of declarative and procedural knowledge relevant to a task. Importantly, both types of knowledge can be lost if not used (Ritter et al., 2007).

Methods

Concourse and Q-Sample Development

The study protocol was split into two parts: (1) the "concourse" development, and (2) the Q-sort. The first part consisted of developing a concourse (i.e., ideas that flowed from 42 health education majors each responding to a set of 12 open-ended statements regarding experiences and attitudes related to conducting e-health research) which served as the source of the Q-sample. Concourse statements probed ideas related to constructs informed by the two-process theory of human information processing (Schneider & Schiffrin, 1977), the atomic components of thought (ACT) theory (Anderson & Lebiere, 1998), and Bandura's self-efficacy theory (1977). These statements were meant to elicit responses about the students' experiences learning, practicing, and their confidence in their skills related to conducting research for e-health information. All 12 statements were color coded (to facilitate organization of the cards once collected), and each student was given corresponding color-coded cards to write their response to each statement. For example, each student was asked to, "List the

source you use the most when you search for information". Students responded to this statement using an open-ended response on a color coded index card that corresponded to the color and number of the statement. There were 504 statements (42 students X 12 statements each responded to) produced initially. Repetitive responses were removed from the concourse leaving behind only those unique responses. This reduced the number of responses to 380 statements, which comprised the final concourse.

Student responses were grouped by themes which emerged throughout the concourse. The identified themes were: (1) confidence in ability to conduct e-health research, (2) knowledge about conducting health information research, (3) how students conduct health information research, and (4) educational experiences related to conducting health information research. Once the concourse was developed, a Q-sample (i.e., a subset of statements from the concourse) was used for the Q-sort. The Q-sample consisted of 36 statements among the 380 which captured the essence of the concourse. Statements then randomly assigned an identifier number from 1 to 36 in order to to reduce the probability of the Q-participants recognizing conceptually similar statements.

Q-Participants

To recruit students, personalized emails were sent to a convenience sample of 20 students who indicated within the RRSA-h study that they would be willing to participate in a follow-up study. An incentive of $10 USD was offered for participation in the study. One follow up email was sent weekly over the course of two weeks to solicit participation from non-responders. Due to the low response rate following this initial recruitment effort, additional emails were sent to another subset of students. The

recruitment goal was to secure participation from 18 individuals, because the number of participants in a Q-study should be less than or equal to one-half of the number of Q-statements (Thompson, 1980). Unfortunately, only 13 students agreed to participate in the Q- study. This number was deemed acceptable because 13 participants was considered enough for 3 perspectives to emerge and best practice suggests that Q-researchers are allowed leeway in terms Q-participant numbers (Webler et al., 2009). For the purposes of this investigation, Q-participants were separated into either low (n = 4), middle (n = 5), or high (n = 4) groups based on their original RRSA-h score. The scores ranged from 13 points to 26 points. The low group was defined by those students at or below the 25th percentile (i.e., 16 points or less), the middle group was defined by those students within the inter-quartile range (17 to 19 points), and the high group was defined by those at or above the 75th percentile (i.e., 20 points or more). The participants were treated in accordance with ethical standards approved by the university's institutional review board.

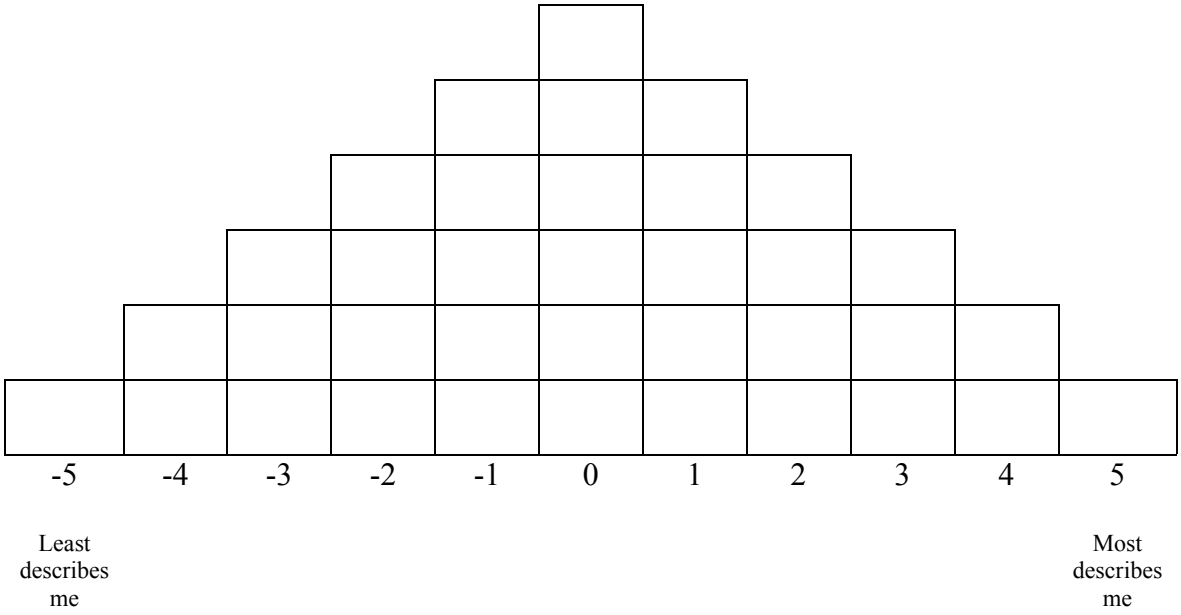
Q-Sort

Following recruitment, willing participants were asked to perform an individual "Q-sort," which consisted of a rank-ordering procedure in which the Q-statements were placed in an order that was significant to the Q-participant. The Q-participants were instructed to think about their experiences conducting e-health information research and then order the Q-sample from those statements that describe them the least to those statements that describe them the most. Through this procedure, patterns of the participants' variable, self-referential perspectives emerged regarding their skills,

abilities, and behaviors conducting e-health related research. This task forced the participants to sort the cards such that the finished sort would have the shape of a triangle where columns at both extremes of the triangle possessed one card, with each column incrementally closer to the middle adding an additional card until the middlemost column contained 6 cards. Each participant's triangle consisted of 11 columns in width) with the leftmost column assigned a score of -5 and the rightmost column assigned a score of +5. Figure 4.1 provides a visual depiction of what each participant's final Q-sort yielded. The Q-sort ranking was performed in a room where only one participant was present.

In order to make manageable the overwhelming task of rank-ordering 36 statements, participants were first instructed to sort the cards into three piles, with one pile for cards that described them the least, one pile for cards that did not describe them at all, and the last pile for cards that described them the most. The next step was then to instruct participants to take the cards which were least descriptive and order them according to the pattern on the leftmost side of the triangle. Following this, the same procedure was done on the right side of the triangle for cards that most described each participant. Finally, the neutral cards were sorted to fill in the middle portion of the triangle. Once the ranking task was completed, each card was assigned a score based on the column it occupied. For example, if card number 23 was in the second column, it would be assigned a score of -4.

Figure 4.1 Final distribution of Q-sort procedure



Data Analysis

Data from the Q-participants rankings of the 36 statements were analyzed using Q-technique factor analysis (Stephenson, 1953). This technique clusters individuals into "types" and provides insight to the similarities of the participants (Thompson, 1980) by examining the correlations among the participants (Gorsuch & Dreger, 1979). Exploratory factor analysis (EFA) is a technique that typically analyzes a two dimension data matrix where the rows are defined by participants and the columns are defined by variables. This technique was labeled by Cattell (1966) as R-technique factor analysis. However, for this Q-technique, the EFA is performed on a two dimensional matrix where the rows are defined by the statements and the columns are defined by participants (i.e., the Q-participants).

The Q-sort for each person was entered into SPSS version 17.0 (SPSS Inc., 2008). Exploratory factor analysis (EFA) using principal components analysis with a varimax rotation was used in order to identify the patterns among the Q-sorts (Webler et al., 2009). The eigenvalues associated with each factor and the bootstrap method analysis (Zientek & Thompson, 2007; Stellefson, Hanik, Chaney, & Chaney, 2009) were used to determine the number of factors to retain for the factor analysis. Bootstrapping was used to determine the correct number of factors to extract by considering sampling error as part of using the eigenvalue-greater-than-one rule (Zientek & Thompson, 2007). The solution was varimax-rotated to improve the interpretability of the final EFA solution. The varimax-rotated pattern/structure coefficients provided insight into which people belong to the different types of e-health literacy categories. Factor scores were

computed for each person. Factor scores less than -1.0 and more than +1.0 are more than one standard deviation from the factor score mean and these are the items of most importance or least importance to the individuals defining the factors (Thompson, 2005). Negative scores were scores that described the Q-participants' experiences, attitudes, and behaviors related to conducting e-health research the least, whereas positive scores described the Q-participants' qualities related to e-health research the most; therefore, factor scores less than -1.0 are indicative of statements which describe the Q-participants' the least and factor scores that are greater than +1.0 are indicative of statements describe the Q-participants' the most.

Results

All of the Q-participants were female from a large southwestern university in the United States, with the majority (77%) being upperclassmen (i.e., juniors and seniors). All of the Q-participants were undergraduates majoring in health education, with twelve of the thirteen specializing in allied health. The average RRSA-h score of the participants was 18 ± 4 points with an average GPA of 3.26 ± 0.42 points. Table 4.1 shows the demographics of the Q-participants.

The EFA of the 36 statements resulted in 3 retained factors after consulting Guttman's (1954) eigenvalue-greater-than-one rule and the sampling distribution of the bootstrapped eigenvalues (Zientek & Thompson, 2007; Stellefson et al., 2009). The 3 factors suggested that there were 3 types of health education students as characterized by student perceptions, attitudes and behaviors toward e-health

Table 4.1 Demographic Characteristics of Q-Participants

Sex	**n (%)**
Female	13 (100)
Classification	
Freshman	1 (7.7)
Sophomore	4 (30.8)
Junior	2 (15.4)
Senior	6 (46.2)
Option	
Allied Health	12 (92.3)
Community Health	1 (7.7)
Average GPA (SD)	3.26 (±0.42)
Average RRSA-h Score (SD)	18.46 (±4.11)

research. Moreover, the varimax-rotated factor pattern coefficients (i.e., the correlations between each Q-participant with each of the three factors) indicated that the factors separated along the lines of the high, middle, and low performers on the RRSA-h. The first factor was composed of all Q-participants from the high-scoring group and three of the Q-participants from the middle-scoring group. The second factor was composed of two participants from the middle-score group and one from the low-score group. The third factor was composed of the three remaining participants from low-score group. This suggests that the first factor could be named *high performers*, the second factor *middle performers*, and the third factor *low performers*. Table 4.2 shows the varimax-rotated component matrix which lists the pattern / structure coefficients of the Q-participants on each of these 3 retained factors. Every participant had at least one pattern / structure coefficient on one factor that was at least equal to .5, which is shows that each participant was moderately correlated (Hinkle, Wiersma, & Jurs, 2003) with at least one factor.

The final step in the analysis determined which of the 36 statements defined and differentiated the three types of health education students as regards their perceptions, attitudes and behavior toward e-health research by calculating the factor scores for the statements. Table 4.3 lists each of the 36 Q-statements sorted by the participants, and Table 3.4 presents the factor scores that are greater than 1.0 or less than -1.0 for each statement.

Table 4.2 Factor pattern / structure coefficients for Q-participants

Q-Participant	High Performers	Middle Performers	Low Performers
H1	**.555**	.236	.458
H2	**.674**	.124	.250
H3	**.732**	.255	.468
H4	**.801**	.305	-.257
M3	**.713**	.238	.355
M4	**.782**	-.006	.377
M5	**.603**	.349	.356
M1	.107	**.896**	.091
M2	.339	**.846**	.048
L3	.201	**.746**	.391
L1	.227	.188	**.538**
L2	.078	.397	**.744**
L4	.369	-.130	**.755**

Note: Bold print represents factor membership for participants
H = high group, M = middle group, L = low group

Table 4.3 Q-statements used for Q-sort

Card #	Q-Statements
1	I use sources that are easy to cite
2	I rely on search engines (e.g. google, bing) to find information for research projects
3	I have been taught how to find reliable information
4	I have had assignments that required me to evaluate information sources
5	I use up-to-date information for assignments that require me to find information
6	I use the library databases (e.g. ebsco, CSA) when I search for information
7	I seek help from library staff for difficult searches
8	I get feedback from professors regarding the quality of sources I use for homework assignments
9	I check the ending of web addresses (.com, .gov, .edu) when I search for information
10	I consider the source when I find information useful for my research projects
11	I usually have at least one assignment per semester that requires me to conduct an information search
12	I brainstorm to help me figure out the information that is important for my project
13	I know how to critically evaluate information sources
14	I evaluate information I use for projects such as research assignments
15	I finish research projects such as papers at least one week before their due dates
16	I look for up-to-date information when I conduct information searches
17	I go to the library when I start a research project
18	I can figure out how to find information that is unfamiliar to me
19	I know where to find reliable information
20	When I am assigned to complete a research paper, I do not hand in the first draft as the final product
21	I use search engines (e.g. google, bing) when I search for information
22	I get flustered looking for information I know little or nothing about
23	I find it difficult understanding new information
24	I do not know where to find reliable information
25	I know how to use Boolean operators
26	I know what is meant by "peer review"
27	I am confident in my ability to find reliable information
28	I use information that I can easily understand
29	I know what Boolean operators are
30	I have difficulty finding information when I use library databases such as ebsco or CSA.
31	I evaluate information sources when conducting information searches
32	I know what a primary source is
33	I go to my professor for help to make sure I use quality information for research projects
34	I follow references back to the original source when I find information that is useful for research assignments.
35	I can find useful sources in the library
36	I use refined searches to narrow the amount information I need to look at

Table 4.4 Salient Q-statements for retained factors

Card #	High Performers	Middle Performers	Low Performers
2	-1.95922	1.3366	
3			1.99139
6	1.85056		
7	1.11604	-1.37895	-1.10815
8		-1.06755	
9		1.37136	
11			1.2078
12	1.0138		-1.49619
13		-1.22913	
15			-1.63711
16	1.14558		
17		-1.37304	
18			1.23584
19			1.83075
20	1.53448	2.04443	-1.78750
21	-1.08848	2.30850	
22	-1.49202		
23			-1.07828
24	-1.2486		-1.04253
25	-1.65856	-1.55995	
26			1.61895
27			1.63784
28	-1.29149	1.87467	
29	-1.75107	-1.51721	
32	1.28343		
34		-1.16145	

Note: Factor scores less than -1.0 and greater than +1.0 were removed from table.

Discussion

This study was conducted in order to determine how many types of health education students existed, to which type each student belonged and which statements differentiated each student type given information about the students' perceptions of their knowledge, experiences, attitudes, and behaviors related to health information research. The study revealed three types of students with more than half (53.8%) of the students clustered on the *high-performers* factor, while three students clustered on each of the other two factors (*middle performers* and *low performers*). In order to provide an understanding of how the student-type factors differed, the factor scores for the Q-statements were consulted (Thompson, 2005). By consulting the factor scores for each of the Q statements, we were able to determine which statements discriminated between types of performance on e-health literacy. It was important to remember the scaling of the Q-sorts in order to understand the interpretation of the factor scores.

The factor scores indicated that the high performers described themselves as students who rely on multiple sources of information to obtain health information (see statements 2, 6, and 12 in Table 3.4). Interestingly, however, high performers did not identify with using Internet search engines to find health information (see statements 2 and 21). High performers also indicated that they work with others by brainstorming ideas and by seek help from library staff for difficult searches (statements 12 & 7). Furthermore, high performers identified with completing assignments in a timely manner (statement 20). The factor scores suggest that the high performers use multiple sources to obtain information, are not averse to seeking help from others and are confident in

their ability to search for and use new health information. Factor scores for the middle performers suggested that they, like high performers, complete assignments in timely manner (statements 20); yet, unlike high performers, they work independently (statements 7, 8, & 17). Middle performers tend to rely solely on the Internet search engines when conducting e-health information research (statements 2 & 21). Those moderate performing students also reported lack of necessary skill sets to critically evaluate e-health information sources (statement 13), and they profess not knowing what Boolean operators are or how to use them (statements 25 & 29). The factor scores of the low performers suggest that they are independent (statements 7 & 12) much like the middle performers, yet they are procrastinators (statements 15 & 20), with confidence in their ability to conduct e-health research (statements 18, 19 & 27). Unlike both middle and high performers, the low performers indicated that they received some instruction on how to conduct information searches (statement 3), they have at least one assignment per semester that requires them to conduct information searches (statement 11), and they tend to complete projects at the latest possible moment (statement 15).

Limitations

Although the Q-technique has strengths such as enabling comparisons across subjective topics (Corr, 2001; Webler et al., 2009), the current study has several limitations. Even though 3 perspectives emerged from this study in the form of a 3 factor structure, it is very possible that other perspectives do exist and were not reflected in the current study. Also, any number of participants in this study may have misunderstood the instructions for the Q-sort, which could have led them to misrepresent their views on

e-health information seeking. Future studies would be best served to evaluate whether or not students clearly understood the instructions for the Q-sort. Furthermore, the meaning (and naming) ascribed to each of these 3 factors was contrived solely by the research team which could be influenced by research bias (Barbosa, Willoughby, Rosenberg, & Mrtek, 1998). In future replications of this research designs, it would be useful to assess the inter-rater reliability of the number of factors retained and how the retained factors are articulated by different raters.

Conclusion

The present research investigated, from a subjective perspective, differences among students with varying levels of e-health literacy. Previous studies (Ivanitskaya et al., 2006; Redmond, 2007) investigated the e-health literacy of college students but did not investigate the reasons for varying levels of e-health literacy among college students. The current study is an attempt to fill this gap in knowledge and the results from this Q-study indicated that a subset of these study participants could be differentiated based on their level of e-health literacy.

The Q-participants with the highest levels of e-health literacy characterized themselves as conscientious students who tend to work together in groups. The Q-participants with the middle level of e-health literacy also characterized themselves as conscientious students however, they tend to work alone. The participants with the lowest level of health literacy characterized themselves as students who tend to procrastinate and work alone. These results suggest that time management and working with others are important determinants of improved e-health literacy skills. Perhaps, by

procrastinating on research assignments, students tend to resort to elementary methods of obtaining information, such as using Internet search engines. A result of the procrastination is that students may not have the time to practice and develop more advanced research skills, such as using library databases.

The high-performers were the only group to identify working with others as a defining characteristic. Perhaps lower performers should be encouraged to work in groups in order to observe some part of the high performers thought processes which could result in raising the lower performers e-health literacy skills (Nihalani, Wilson, Thomas, & Robinson, 2010).

Low-performers' positive confidence in their skills was one characteristic that differentiated them from the other groups. This is interesting because previous studies (Ivanitskaya et al., 2010; Ivanitskaya et al, 2006) showed that college students have an inflated sense of their e-health literacy skills. This indicates that the component skills for high e-health literacy are lacking among college students. It may be important for the teachers of the students to ensure that the proper e-health literacy skills are being mastered by the students because expectation alone will not produce the desired performance (Bandura, 1977).

CHAPTER V

SUMMARY AND CONCLUSION

Summary

This systematic review revealed that college students lack important skills seeking and evaluating health information available on the Internet. While college students have, for the most part, easy access to health information on the Internet, and feel comfortable using the Internet, data indicate many students possess weak e-health literacy competencies which limit their ability to search for, retrieve, utilize and evaluate electronic resources to obtain quality health information.

Moreover, there is a discord between what college students think about their e-health literacy skills and their actual skill level. A skill development discrepancy such as the one illustrated provides an invaluable opportunity to build health education competencies especially among college-age students in degrees related to the health professions. These students will doubtless use the Internet for health information purposes for the remainder of their professional careers.

The RRSA-h provided scores on each participant's actual and perceived abilities to obtain and evaluate health information from electronic sources. The current sample of health education students were lacking in regards to skills necessary for obtaining and evaluating health information available on the Internet as measured by the RRSA. This discord can serve as a barrier to health education students' expected competency to act

as an information resource for the public, which is a responsibility for health education professionals (National Commission for Health Education Credentialing, 2006).

The Q-study revealed three types of students who were differentiated by whether or not they worked in groups, finished assignments in a timely manner and used multiple sources of information when conducting basic research.

Conclusion

This study found that undergraduate students in general and health education majors specifically have an inflated sense of their actual ability to find and evaluate electronic health information. The study also found that health education majors can be differentiated by their scores on the RRSA-h. In the current health information environment, it is important for professional health educators to be e-health literate in order to act as health information resource for the public. It is also important that future health educators be provided with experiences to improve their ability to search for, locate and use e-health information.

Although this study indicated that health education majors, on average, lack basic skills to find and evaluate electronic health information it also suggests that they need instruction on how to conduct health research. Basic search skills should be reinforced by instructing on topics such as how to use library databases to find health information. Also, lower performers should be encouraged to work with higher performers in order to observe some part of the high performers thought processes which could result in raising the lower performers' e-health literacy skills.

Understanding the factors that influence health education major's e-health literacy levels is important in order to understand how to address areas where their skills are lacking. This study was the first one to the author's knowledge that looked at characteristics that differentiated undergraduate students with varying levels of e-health literacy. Further investigations to determine appropriate curricula meant to improve the e-health literacy skills of undergraduate health education majors would be useful to the field of health education as well as the public who would benefit from e-health literate health educators.

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