Kennesaw State University

DigitalCommons@Kennesaw State University

Masters of Science in First Year Studies

Spring 5-5-2017

Exploring the Googlesphere: Information Literacy and First-Year College Students

Adrienne Harmer
Georgia Gwinnett College, aharmer@ggc.edu

EXPLORING THE GOOGLESPHERE: INFORMATION LITERACY AND FIRST-YEAR
COLLEGE STUDENTS

By

ADRIENNE BUTTON HARMER

A Thesis

Presented in Partial Fulfillment of Requirements for the

Degree of

Master's of Science in First-Year Studies

Faculty of First-Year and Transition Studies
Accepted by:

Stephanie M. Foote, Chair

Jorge Pérez, Committee Member

Rolando Marquez, Committee Member

ACKNOWLEDGEMENTS

I would first like to express my gratitude to my thesis advisor and committee chair, Dr. Stephanie Foote, whose expert guidance and constant encouragement and were invaluable to my graduate experience in general and to the development of this thesis in particular. I appreciate her passion for and voluminous knowledge of best practices for first-year students and students in transition and am grateful for all the resources she mentioned and recommendations she made. The balance she maintained between challenging and supporting me have made this thesis what it is. I would like to thank the other members of my committee, Dr. Jorge Pérez, and Dr. Rolando Marquez for their thoughtful comments and questions and for the assistance they provided at all levels of the research project.

This research would not have been possible without the support of my friends and colleagues at the Daniel J. Kaufman Library of Georgia Gwinnett College. I particularly want to thank Patti Lee, David Minchew, and Bethany Havas for listening to me when I needed to talk about an idea or vent my frustration and who picked up the slack when I needed them to which gave me the time and energy to write. I would also like to thank Dr. Kelsey Woodard from the Georgia Gwinnett College Center for Teaching Excellence for taking time out from her busy schedule to serve as my sounding board and my coach.

I would also like to thank my family, friends, and pets for the support they provided me through this process and in particular, I must acknowledge father, Jerry, without his encouragement and editing assistance, I would not have finished this thesis.

TABLE OF CONTENTS

TABLE OF FIGURES

ABSTRACT

First-year students often lack the information literacy skills necessary to thrive in the 21st century academic environment. The purpose of this pilot study was to explore the impact of a Google literacy intervention on the research skills and attitudes of first-year students enrolled in a first-year seminar course. A secondary purpose of this study is to determine the effectiveness and appropriateness of the Google literacy intervention ("Exploring the Googlesphere") materials, activities, and assessments. This study used the action research model which provided the researcher with a systematic way to test her assumptions and experiences and to improve the quality of teaching and learning in her own classroom (Kember, 2000; Klipfel & Carroll; 2015). Study participants completed a Google Search pre- and post-test survey, an adapted Critical Incident Questionnaire, and pre- and post-class drawings. These instruments were analyzed using qualitative data analysis. The findings indicated that the intervention was a moderate success, particularly in helping students to develop concrete search skills, conceptual understandings of how Google search operates, and confidence in themselves as researchers and Google as a tool for research. Recommendations for future research and implications for practice are discussed.

Keywords: information literacy, Google searching, first-year students

CHAPTER 1: INTRODUCTION

Where does information come from? How is it produced and disseminated? What makes one piece of information more useful than another? How do I find the information I need? How do I determine if this information is trustworthy? Can I use this information for my research assignment? The ability to frame and successfully answer these types of questions is fundamental to a first-year student's success in higher education, to a graduate's success in the workplace, and to successful lifelong learning. The essential skills and understandings necessary to both ask and answer these questions are the building blocks of what it means to be information literate. Particularly in the current climate of information abundance and information overload, where accusations of "fake news" and the polarization and politicization of information sources abounds, where for every fact there is an "alternative fact" a click away, and when prevailing wisdom seems to suggest that we live in a post-truth or post-fact world, information literacy competencies are more important than they have ever been before (Swanson, T. & Jagman, 2015; Weinberger, 2014).

If knowledge is indeed power, and particularly the power to engage as an informed citizen in the processes of a democratic society, then the inability of most Americans to find, access, evaluate and use information is a serious concern. An absence of information literacy, or a lack of the practical skills and habits of mind (the knowledge practices, dispositions, attitudes and understandings of how information is produced, assessed, and valued in a democratic society) produces an underclass of citizens who struggle to find, evaluate, and use information necessary for making informed and reflective decisions about the complicated and contentious arguments and debates that permeate every aspect of American life and society (Bruce, 2004; Asher, 2015). This challenge is particularly sensitive for first-year college students who are

caught between faculty who expect them to understand and move comfortably within the traditional academic forms of information production, dissemination, and evaluation and the new and emerging ways in which they act as creators of information as well as consumers.

Educators need to equip first-year students with the information literacy competencies needed to participate in the processes of lifelong learning, critical thinking, and reasoned and informed discourse that is necessary to fully take part in a representative democracy and to engage meaningfully with the creation, production, sharing, and discovery of information and knowledge in the digital age (Bruce, 2004; Kellner & Share, 2007; ACRL, 2016; Asher, 2015). A survey conducted by Project Information Literacy, an institute responsible for a series of national, large-scale studies on how college students conduct research, reported that employers find that recent graduates rarely go beyond the first page of results in a Google search and do not have the necessary information literacy skills to succeed in the workplace (Head, 2013b). Clearly there is work to be done.

The lack of information literacy is exacerbated by the unceasing flow of information that confronts us all on a daily basis. Americans today have access to more than five times as much information every day than they did in 1986 (Alleyne, 2011). The average American spends almost 12 hours a day dealing with information, which translates into over three quarters of our days (and our lives) being consumed with information (Bohn & Short, 2012). According to a study by Martin Hilbert (2012), the daily amount of information that a person interacts with has increased from the equivalent of 40 newspapers worth of information in 1986 to more than 170 newspapers worth of information today. Not only are people exposed to more information every day, people also produce information at a staggering rate. In 1986, the average American produced the equivalent of about two and a half newspaper pages worth of information each day

and this has increased to the equivalent of six full newspapers today (Alleyne, 2011; Hilbert, 2012). This rate of information growth is going to continue to increase as estimates indicate that the amount of information available is expected to double every two years (Weinberger, 2014). In addition to the sheer amount of information available, there are also challenges related to how this information is being produced and disseminated. Research, data, information, and knowledge are being produced in exciting and innovative ways, and are incorporating new technologies with global participation and perspectives, but it is becoming increasingly more difficult to ascertain the validity and utility of the ever-increasing amount of information (Badke, 2015; Weinberger, 2014).

Statement of the Problem

Given this increasing tension between our sense of information abundance and information overload, how are students to navigate through the ever-increasing stream of information that seems to be filled to overflowing? How can educators equip first-year students with the information literacy competencies they need to be successful in class, in the workplace, and in life? The ways in which information is being produced, disseminated, stored, and accessed, and how we evaluate information for authority, reliability, accuracy, and utility – all this is changing in rapid and unpredictable ways. The overabundance of information paired with the lack of the necessary information literacy skills and understandings leads students to rely on a limited research toolkit that inhibits their ability to successfully navigate the information landscape (Head, 2013a; Cole, Napier, & Marcum, 2015; Asher, 2015; Gross & Latham, 2012). This is a multifaceted problem, particularly for first-year students.

Purpose of the Study

      The purpose of this pilot study was to explore the impact of a Google literacy intervention on the research skills and attitudes of first-year students enrolled in a first-year seminar course. A secondary purpose of this study was to determine the effectiveness and appropriateness of the Google literacy intervention ("Exploring the Googlesphere") materials, activities, and assessments. First-year students are the ideal subjects for such an information literacy intervention because they will then be positioned to carry the skills, aptitudes, and understandings they learn in the first year through the rest of their educational careers and throughout life (Asher, 2015; Fosnacht, 2015). Information literacy instruction in the first-year seminar can help bridge the gap between the skills and understandings students bring with them from high school and the more advanced practices and dispositions that will be required of them in doing college-level research. In fact, the first year of college is critical time for institutions of higher education to focus on the development of students' information literacy competencies because these skills and understandings can enhance students' learning and success as they move into their new academic communities (Fosnacht, 2015; Asher, 2012; Orme, 2008).

      Although the current generation of first-year students has grown up with ready access to information on almost any topic imaginable, they are not necessarily learning the information literacy tools and techniques they need to succeed as college students before they arrive on campus (Cole, Napier, & Marcum, 2015; Head, 2013b; Latham & Gross, 2013; Fosnacht, 2015). As a result, colleges are confronted with the challenge of being committed to open access policies have to meet the needs of thousands of students who are entering college without the requisite information literacy skills they need to succeed. As more and more colleges are attempting to address the challenges of first-year students and to provide support structures that can lead to

greater rates of retention, progression, and graduation, not to mention student satisfaction and holistic growth, educators need to take advantage of the opportunity to embed information literacy into the first-year experience (Fosnacht, 2015). Students need clear and consistent messaging from all campus partners about the value of learning and practicing information literacy skills - they require activities and opportunities that give them that practice and require them to demonstrate competency in completing information literacy tasks (Kuh & Gonyea, 2003).

One crucial part of information literacy is Google literacy. As first-year students move into and through the first year of college they face new challenges and expectations in terms of how they are expected to find, access, evaluate, and use information as ethical members of the academic community. Because there is too much information and because students want to minimize information anxiety and reduce information overload, they rely on tried and true methods for doing research (Head & Eisenberg, 2010; ACRL, 2016; Cole, Napier, & Marcum, 2015; Asher, 2015).

Students tend to rely overwhelmingly on Google for both personal and academic research (Head & Eisenberg, 2010; Head, 2013a, 2013b; Cole, Napier, & Marcum, 2015; Badke, 2015; Asher, 2015; Gross & Latham, 2012). This is problematic not because Google is not a valuable research tool, but because students are notoriously overconfident in their abilities to use Google effectively (Cole, Napier, & Marcum, 2015; Gross & Latham, 2012; Gross & Latham, 2009; Gross & Latham, 2007). They struggle with creating successful search strategies, framing appropriate research questions, selecting the best search tools, refining their results, and filtering out irrelevant resources (Asher, 2015; Head; 2013b). It is up to students to filter information out rather than having information filtered in for them through the traditional gatekeeping methods

associated with academic libraries. In other words, students use Google first and Google almost exclusively, but they don't use Google very well.

One of the biggest challenges for academic librarians, faculty, and staff is to demonstrate the value and relevance of information literacy to first-year students (Gatten, 2004). This is particularly true in terms of convincing first-year students of the need for advanced search skills and strategies. Students have successfully searched for information prior to college using "good enough" search skills and have been satisfied with "good enough" resources and information (Head & Eisenberg, 2010; Head, 2013a, 2013b; Cole, Napier, & Marcum, 2015; Badke, 2015; Asher, 2015; Gross & Latham, 2012). If educators are to convince students to begin to use the new terrain of scholarly research, particularly the academic library and its many subscription journals, databases, and other electronic collections, then educators should begin by acknowledging this previous knowledge and experience and situate our program of information literacy instruction from this starting point (Jackson, 2007). This suggests the need for an intervention that addresses a familiar and relevant source of information as the first step in a scaffolded approach to the development of information literacy skills, understandings, abilities, and attitudes. In other words, to meet students where they are, educators need to begin with Google.

This approach engenders a series of questions. How can educators help students as novice academic researchers discover the most effective ways to navigate the immensity of the online information landscape? How can educators meet first-year students where they are and use their prior experiences and knowledge to build their information literacy search skills? How can educators get them to engage with the idea that searching is a strategic exploration? In other words, how can educators help students get better at using Google? Can educators use Google as

a starting place to help first-year students begin to develop the critical information literacy skills, understandings, and habits of mind that will set them up for success using more specialized research resources in the future? If so, what information literacy modules, activities, and assessments will help students learn to use Google more effectively?

Research Questions

This exploratory pilot study seeks to investigate the impact that an embedded information literacy intervention on Google searching has on the knowledge practices and dispositions of first-year students enrolled in a first-year experience seminar course. Specifically, it addresses the following research questions:

1. What impact does this intervention have on first-year students' ability to accurately depict and describe how information is organized online and how Google searches retrieve that information?

2. What impact does this intervention have on first-year students' ability to construct effective and efficient Google search strategies?

3. What impact does this intervention have on first-year students' perceptions of themselves as information-seekers and on Google as a tool for information-seeking?

4. How can this intervention be refined to improve the learning experience of future first-year students?

Significance of the Study

This study addresses a gap in the existing information literacy literature. Little has been written on implementing the Framework which is new and has many concepts (about metaliteracy and metacognition, threshold concepts, knowledge practices, and dispositions) that educators (as a group) have not yet field-tested to any significant degree. The findings in this

study help identify where our first-year students fall within the Framework (and more specifically within the GGC Information Literacy Omnibus) and what aspects of that Framework educators can apply to information literature instruction to help students become more information literate. The results will also help refine the design, delivery, implementation, and assessment of a Google literacy intervention, which can serve as a model for other practitioners and educators of both how to incorporate the Framework into their own instruction and how they can design their own evidence-based interventions.

Limitations of the Study

While the intervention was designed to encourage students to develop more sophisticated metacognitive approaches to searching for information, it is difficult to determine the extent to which this occurred from the data. Although some of the results hint at the likelihood that the intervention was meaningful to student self-concept, no instrument or method provided specific results.

A second limitation is related to the brevity of the pilot intervention. Trying to teach students about the underlying structure of the Internet and the difference between the Internet and the World Wide Web, introducing new concepts and knowledge about Google search, including search algorithms, Page Rank, spider bots, etc., and helping students develop advanced search skills and strategies all in a forty minute time period (this session during a fifty minute class, but five minutes each at the beginning and the end were reserved for students to generate drawings) is a tall order. It is possible that the amount of information covered exceeded the students' cognitive load capacity because the intervention may have asked students to accept, comprehend, assimilate, and use too much information too quickly (Badke, 2008)

A third limitation of this study is the small sample size and even smaller number of participants who successfully completed all of the data collection tools of the current study. A larger sample would allow for more meaningful quantitative and qualitative analysis. Although this particular study was a pilot study and not intended to be generalizable or even transferable but, rather, to test the effects of a pilot intervention and the effectiveness of the data collection instruments themselves, the small number of subjects diminishes its validity.

Definition of Terms Used

Information Literacy - Information literacy has recently been redefined by the Association of College and Research Libraries *Framework for Information Literacy in Higher Education* (Framework) as the "set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning" (ACRL, 2016, p.2). To be information literate means that one has the ability to identify when information is needed, to locate and access information, to evaluate and think critically about information, and to effectively and ethically use information as both a consumer and a creator (AACU, n.d.). It also speaks to the ability to determine how authoritative and accurate a piece of information is, to understanding how specific information products are created, and to acknowledging that information has value as not only a means of education and of making meaning of the world but also as a commodity.

Constructivism - The constructivist paradigm, or worldview, argues that knowledge is constructed based on first hand interaction with the world and that learning is a process of construction in which individuals are actively involved in building their own new knowledge and understanding (Wilson & Swanson, 2015; Vezzosi, 2006; Kay & Ahmadpour, 2015).

Action Research - Action research begins with the idea that an educator has an interest in knowing more about her practice and in finding ways to improve that practice (Merriam, 2009). Action research, then, is "a disciplined process of inquiry conducted *by* and *for* those taking the action...to assist the "actor" in improving and/or refining his or her actions" (Sagor, 2000, p. 2). Action research falls within the critical paradigm because it seeks to improve not only the practice but the practitioner and involves not only into the improvement of a practice but also an improved understanding of that practice (Vezzosi, 2006).

Overview of the Thesis

Chapter One of this study introduces the context for the study and the problem the study seeks to address. It also includes a statement on the purpose of the study, the research questions the study seeks to answer and sections covering the significance and limitations of the study, as well as the definitions used. Chapter Two is a review of relevant literature on searching as a process of strategic exploration and Google as a tool for research. This chapter also includes information on first-year students in terms of their information seeking behaviors and cognitive development and ends with a section that discusses educators, Google, and better evidence-based approaches to designing information literacy interventions for first-year students. Chapter Three lays out the methodology of the study including sections on the design of the "Exploring the Googlesphere" intervention and the design of the study. This chapter includes information on the setting of the study, the study participants, the role of the researcher, the data collection instruments and procedures, and the methods of data analysis. Chapter Four includes an analysis of the major study findings related to the impact of the intervention on developing first-year students' skills, understanding, and confidence. It concludes with an analysis of the usefulness of

the intervention itself. Chapter Five offers discussion of these findings, recommendations for future research, and implications for practice.

CHAPTER 2: REVIEW OF THE LITERATURE

This literature review included an examination of what information literacy is, how the ability to understand and use searching as a process of strategic exploration functions as a part of being information literate, how the tools and technologies that first-year students (particularly Millennials) use both help and hinder search efforts, and why incorporating Google literacy as an explicit point of instruction for those students is both useful and necessary. By examining 1) the frequency and regularity with which first-year students use Google, their level of dependence on Google, and their general overconfidence in how good they are at using Google, 2) the problems first-year students have in using Google (including not understanding how Google operates and demonstrating problematic information-satisficing behaviors), 3) the problems arising from faculty, staff, and librarian attitudes towards first-year students and their use of Google, and 4) the lack of attention given to the prior knowledge and experiences and the to the cognitive and intellectual developmental level of first year students, it is easy to see that there are fundamental issues that need to be addressed to equip first-year students with the information literacy competencies they need in order to be successful in their personal, academic, and professional lives. The following review of the relevant literature further elucidated these points and provides direction and suggestions for best practices for the design and delivery of a targeted information literacy intervention for first-year students based on effectively using Google as a tool for research.

Information Literacy

Information literacy has recently been redefined by the Association of College and Research Libraries *Framework for Information Literacy in Higher Education* (Framework) as the "set of integrated abilities encompassing the reflective discovery of information, the

understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning" (ACRL, 2016, p. 2). To be information literate means that one has the ability to identify when information is needed, to locate and access information, to evaluate and think critically about information, and to effectively and ethically use information as both a consumer and a creator (AAC&U, n.d.). Information literacy encompasses many aspects of living, learning, and working in the Information Age and can be broken into many component parts, as depicted in Figure 1.
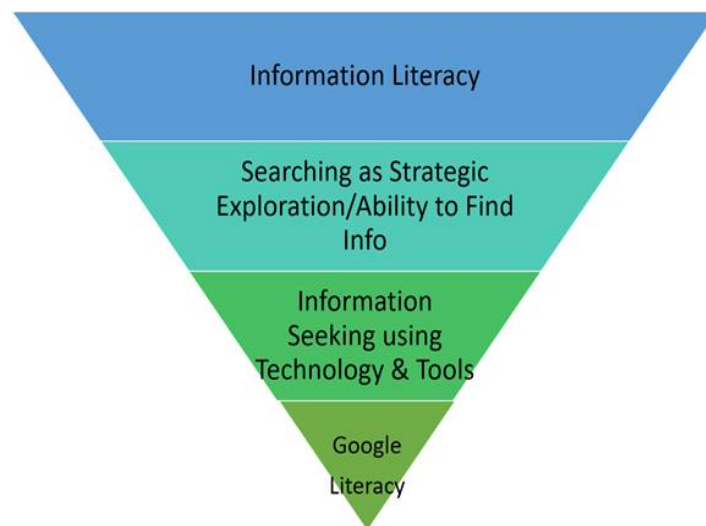
Figure 1 - Information Literacy Pyramid

Christine Bruce's seminal *The Seven Faces of Information Literacy* (1997) discusses how information literacy at the top level involves

- Using technology for information retrieval and communication

- Finding relevant information within information sources and resources

- Creating strategies and processes that help an individual navigate new situations and experiences by finding and using appropriate information

- Organizing and storing information so that it can be retrieved when needed

- Constructing new knowledge, building a personal knowledge base, and developing new mental models and habits of mind

- Extending knowledge by developing new ideas and insights

- Using information wisely and ethically for solving problems and making judgments and decisions

Mackey and Jacobson (2010, p. 1) argue that information literacy is more properly understood as a metaliteracy because it "includes aspects of digital literacy, media literacy, visual literacy, and information technology fluency" and can serve as the comprehensive framework that supports all of these literacies. Information literacy "entails the interaction between the worldview of the student, her understanding of what constitutes knowledge, the context in which she is learning, and the information sources she may discover" (Swanson & Jagman, 2015, p. 7).

Searching as Strategic Exploration

The dynamic 21st century information landscape requires students to develop foundational knowledge of how information and ideas are produced, published, shared, and valued (ACRL, 2016). The Framework was developed as an exploration of the big ideas and enduring understandings that are the foundational threshold concepts in information literacy. Threshold concepts are "those ideas in any discipline that are portals to enlarged understanding or ways of thinking and practicing within that discipline" (ACRL, 2016, p. 2). The Framework details six frames or lenses through which students and educators can explore the essential threshold concepts of what it means to be information literate. One of these frames is the ability to understand and approach "searching as strategic exploration", as represented in the second level of Figure 1. "Searching as Strategic Exploration" threshold is defined in the Framework as understanding that "searching for information is often nonlinear and iterative, requiring the

14

evaluation of a range of information sources and the mental flexibility to pursue alternate avenues as new understanding develops" (ACRL, 2016, p. 9).

Searching for information is a process and it takes time and experience to develop a level of expertise in that process. Expert searchers understand that searching is messy and complex and often involves both discovery and serendipity. They understand that searching for information relies on prior knowledge and experience and that it is often "a contextualized, complex experience that affects, and is affected by, the cognitive, affective, and social dimensions of the searcher" (ACRL, 2016, p. 9). Experts generally have the heuristics in mind to know where to start searching and to recognize and understand relevant and useful information when they find it. Finally, experts realize that most questions do not have single uncontested answers that can be found using a simple Google search (ACRL, 2016).

Information Seeking Tools & Technology

Searching for information involves learning how to use and evaluate tools for research, as depicted in level three of Figure 1. The "Searching as Strategic Exploration" frame includes *knowledge practices* (what students will know and be able to do) and *dispositions* (students' reflective and affective experiences and thoughts) related to using technology and tools for information seeking and retrieval (eg. learners will be able to "match information needs and search strategies to appropriate search tools") (ACRL, 2016, p.9). While tools for information seeking and retrieval have existed since the first index was created, the impact of technology on the process of searching for information is undeniable. Whereas students and scholars once relied on print indices and analog tools like the card catalog, now most searches are conducted using digital tools and technologies. Likewise, where once resources were limited and the library's physical collections were necessary, now students' "time and attention are scarce, while

15

resources are abundant with the development of the Internet and Web-based services (blogs, chat, social media sites, etc.) and easily accessed, digitized content" (Connaway, Dickey, & Radford, 2011, p. 179). The physical library is no longer the only entry point to information. Information can now be accessed anywhere, anytime, and from many different platforms and technological devices. The ubiquity of smartphones, laptops, and tablets has changed the way people, especially those in the Millennial generation, search for information.

Millennial Students and Technology

Millennial students, especially young Millennials (those born between 1990-2000), are in some ways defined by technology (Taylor & Keeter, 2010). According to the Pew Research Center report *Millennials: A Portrait of Generation Next* (2010), Millennials cite their use of technology as the defining characteristic of their generation. It is not just the ubiquity of technology in their lives but the ways in which technology is fused into their social and academic lives that makes Millennials truly distinctive. A majority of Millennials think that technology makes life easier, brings them closer to family and friends, and allows them to use their time more efficiently (Taylor & Keeter, 2010). Millennial students take their technology for granted and report that staying connected is a central feature of their lives; 94% own cell phones, 90% access the Internet daily, 75% are on social media, 62% connect wirelessly when away from home, and 59% get the majority of their news online (Taylor & Keeter, 2010, p .27-32). As "digital natives" or members of the "always-on" generation, Millennials view their devices and their platforms, services, and applications as an endless source of entertainment and information (Caruso & Kvavik, 2005; Taylor & Keeter, 2010).

While Millennials are assumed to be inherently technologically savvy, largely because they have always been surrounded by digital technology and are associated so strongly with their

technologies, studies show that just because they are connected does not mean that they are skilled at using those technologies (Hargittai, 2010; Taylor & Keeter, 2010; Change the Equation, 2015; Goodman, Sands, & Coley, 2015). Recent reports indicate that while 83% of Millennials sleep with their phones, 58% rank low on a skills assessment of using technology to solve problems (Taylor & Keeter, 2010; Change the Equation, 2015). Millennials in the United States were the lowest-ranked population in a 19-country study in terms of their technological skills and fluency (Goodman, Sands, & Coley, 2015). As one recent report put it, "Simply being able to use a smartphone isn't enough, to be successful in the global economy Millennials must become fluent in the technologies that are revolutionizing our lives and our work" (Change the Equation, 2015, p. 1).

First-Year Students Information Seeking Behavior

Unfortunately, although these studies show that first-year students (especially those that are young Millennials) lack the necessary technological and information literacy skills they need to succeed in college, these first-year students see themselves as fully capable of knowing how to find, evaluate, and use information. Several studies undertaken by Gross & Latham (2007, 2009, 2012) have shown that students are actually underprepared for the rigors of college level research and, to make things worse, not only are the students not proficient, they wildly overestimate how prepared and proficient they are. This means that they are unlikely to seek help or to voluntarily adopt new information seeking strategies. As Gross and Latham (2012) put it, "students tend to believe that they have above-average [information literacy] skills, when, in fact, an objective test of their ability indicates that they are below-proficient in terms of their actual skills" (p. 575). This discrepancy is highlighted in a Project Information Literacy Report that shows that first year students find research particularly challenging (Head & Eisenberg, 2009). The report goes on to

17

say that "many freshmen felt at a disadvantage from the start because of the limited research skills they brought with them from high school" (Head & Eisenberg, 2009, p. 6).

The fact that high school students are not learning the basic information literacy skills they need to succeed in college is supported by research conducted by the Pew Research Internet Project. The 2012 report, "How Teens do Research in the Digital World", suggests that rather than making research easier, technology is both discouraging students from using a wide range of sources and making it more difficult for students to find and evaluate reliable and authoritative information. Furthermore, the addiction to Google is training students to expect to find information quickly and easily. When they are faced with the higher expectations involved in college level research, new first-year students soon become frustrated because the amount of information that is available today is overwhelming (Head & Eisenberg, 2009; Gross & Latham, 2012; Purcell, Rainie, Heaps, et al, 2012). Students also often have trouble understanding how information is organized and how it can be accessed (Chambers, Smith, Orvis, & Caplinger, 2013). First-year students prioritize effectiveness, efficiency, and ease of use over quality and are at a loss when the satisficing that has served them well up to now is not sufficient (Head & Eisenberg, 2009; Gross & Latham, 2012).

First-year students report that the most challenging aspects of doing college level research are 1) there are too many sources to choose from, which produces a kind of paralysis of choice, 2) a struggle with the expectation that they should find and synthesize information from a variety of types of sources (scientific and scholarly articles, books, reports, websites, interviews, etc.), 3) selecting from among these sources and critically evaluating the information within them, 4) a general unfamiliarity with the format and structure of scholarly publications, and 5) research assignments that require independent choices and demand intellectual exploration (Head

& Eisenberg, 2009). Most high school students and first-year college students have little experience that prepares them for the more advanced skills necessary to conduct college level research (Cole, Napier, & Marcum, 2015; Head, 2013b; Head & Eisenberg, 2010; Asher, 2015). For example, Raven (2012) reports that more than three quarters of first-year college students in her survey indicated that their high school teachers encouraged them to use Google most or all of the time and less than half had ever used a library database in high school.

Google as a Tool for Research

The fourth and final level of Figure 1 is Google literacy. Google is an essential tool for research for and developing the Google literacy skills and understandings necessary to use Google effectively are critical to being information literate in the 21st century. The number of studies that show that Google is the first (and often only) choice for first-year students who are searching for information is voluminous (Asher, 2015; Badke, 2015; Bloom & Deyrup, 2012; Chambers, Smith, Orvis, et al., 2013; Cole, Napier, & Marcum, 2015; Fosnacht, 2015; Georgas, 2013; Gross & Latham, 2012; Hargittai, Fullerton, Menchen-Trevino, et al., 2010; Hartsell-Gundy, Resnis, Misco, et al., 2009; Head, 2013a; Head & Eisenberg, 2011; Holman, 2011; Orme, 2008; Raven, 2012; Purdy, 2012; Smallwood, 2015; Weiler, 2005). In fact, Google is used three times more often than any other source of information (Purdy, 2012; Asher, 2015). Google is also twice as popular as any other source of information, including off line sources such as professors, friends, books, course readings, and librarians (Purdy, 2012).

Students use Google so frequently and favor Google so strongly not because they are "lazy, disinterested, or ignorant" but because of a host of other factors (Purdy, 2012, para. 2). Students report preferring Google because:

- **Google is easy to use** and students expect to find information both easily and

19

quickly (Connaway, et al., 2011; Hartsell-Gundy et al., 2009; Head & Eisenberg, 2009; Purdy, 2012; Smallwood, 2015; Georgas, 2013; Holman, 2011). Students cited ease of use twice as often as any other reason for using Google (Purdy, 2012).

- **Google is free, fast, convenient, connected, and accessible** (Cole, Napier, Marcum, 2016; Connaway, Dickey, & Radford, 2011; Badke, 2015; Holman, 2011).

- **Google is familiar** for finding information for personal and academic use and this familiarity makes searching for information in Google a low-risk and low cognitive load task (Connaway, et al., 2011; Purdy, 2012; Hartsell-Gundy et al., 2009; Head & Eisenberg, 2011; Holman, 2011).

While Google is a valuable resource for searching for information, first-year students tend to use Google uncritically, without knowing or understanding how it operates as a research tool and have trouble understanding how information is organized and how it can be accessed using Google (Badke, 2008; Chambers, et al, 2013). Indeed, many students seem to not realize that Google is a search tool at all and see Google as a product rather than a process and thereby fail to see that using Google is part of a strategic searching and exploring experience (Gross & Latham, 2009; Badke, 2008). Several studies indicate that students lack the foundational knowledge required to construct an accurate conceptual model of how information is organized on the Internet and the World Wide Web, how information is accessed using a Google search, how Google searches operate at an algorithmic level, and how search results are ranked when they are returned (Asher, 2011; Asher, 2015; Hargittai, et al., 2010; Hartsell-Gundy, et al., 2009).

Students tend to treat Google searches as "magical" experiences and ultimately "simply put their faith and trust in algorithms and the people who design them" (Asher, 2011, p. 3).

Risk-Averse Searching Behaviors

This uninformed approach profoundly affects how students approach searching in Google and how they interpret the results of those Google searches and the information those searches return. The lack of conceptual models for understanding how Google organizes and retrieves information also impacts how students construct their searches and how satisfied they are with the results (Holman, 2011). In short, students tend to rely on satisficing when searching Google for information. The concept of "satisficing" is a recurring theme in much of the literature on the information seeking behavior of first-year students and indicates the predilection of students to determine that information is "good enough" to satisfy their needs even when more authoritative, relevant, or complete information is readily available (Cole, Napier, Marcum, 2016; Bloom & Deyrup, 2012; Hargittai et al., 2010; Georgas, 2013; Asher, 2011; Porter, 2014; Holman, 2011; Sorenson & Dahl, 2008; Badke, 2015).

Satisficing search behavior manifests itself in many detrimental ways. For example, first-year students tend to give up on searches very quickly (Asher, 2015; Head & Eisenberg, 2009; Bloom & Deyrup, 2012). Students assume that search engines are evaluating information sources and then ranking those sources by quality and relevance, which leads students to expect that the very best results will be the most highly ranked (Hartsell-Gundy et al., 2009; Head & Eisenberg, 2011; Hargittai, et al. 2010; Asher, 2015). Students often lack the mental models necessary to understand how results are ranked and tend to believe that the first result is necessarily the best result (Bloom & Deyrup, 2012; Asher, 2011; Asher, 2015). This "trust bias", coupled with students' limited time and patience for extended searching, means that students almost never go

beyond the first page of a results list when gathering information sources from a Google search which necessarily limits the amount of information available to them (Cole, Napier, Marcum, 2016; Bloom & Deyrup, 2012; Hargittai et al., 2010; Porter, 2014; Holman, 2011; Asher, 2011; Connaway, et al., 2011).

Students strongly prefer predictability and familiarity when searching for information and when confronted with the overwhelming number of databases, journals, multimedia materials and texts available in the typical academic library, students tend to revert to risk-averse strategies that have served them well in the past and often develop a reluctance or even a resistance towards learning new research methods, even when they recognize the need to improve their research skills (Cole, Napier, & Marcum, 2015; Head, 2013a; 2013b; Hartsell-Gundy et al., 2009; Purdy, 2012; Connaway et al., 2011). Students who prioritize effectiveness, efficiency, and ease of use over quality are at a loss when the satisficing that has served them well up to now is not sufficient (Head & Eisenberg, 2010; Gross & Latham, 2012; Asher, 2015).

First-Year Students' Research Skills

All of the problems with satisficing search behaviors are compounded by the fact that students' are not searching very well to begin with. It would be one thing for students to limit themselves to the first page of results if the search strategies they used were more efficient at returning reliable and relevant results on that first page. Unfortunately, that is not usually the case. As Steve Kolowich indicates "students are lousy at searching" (2011, para. 10). Study after study shows that students are not good at constructing effective and efficient search strategies (Head, 2013b; Cole, Napier, & Marcum, 2015; Head & Eisenberg, 2010; Asher, 2015; Smallwood, 2015; Porter, 2014; Holman, 2010; Bloom & Deyrup, 2012; Hartsell-Gundy et al., 2009; Head & Eisenberg, 2011; Asher, 2011). First-year students are accustomed to relatively

22

simple default Google searches that don't involve open-ended and authentic inquiry and they

struggle with developing and adopting more advanced and better structured search techniques

(Head, 2013a; Cole, Napier, & Marcum, 2015; Head & Eisenberg, 2010; Asher, 2015;

Smallwood, 2015; Porter, 2014; Holman, 2010; Bloom & Deyrup, 2012). An over reliance on

basic and poorly constructed keyword searches and a reluctance and resistance to digger deeper

and pushing harder for better sources leads students to switch topics and to give up on searching

to the detriment of their learning (Cole, Napier, Markum, 2016; Hartsell-Gundy et al., 2009;

Head & Eisenberg, 2011; Asher, 2011).

Educators and Google

First-year students could obviously benefit from developing the Google literacy skills and

understandings needed to address these fundamental problems with how they use and think about

Google as a tool for research. Unfortunately, faculty, staff, and librarians generally fail to

provide specific and explicit information literacy instruction, especially on Google searching, for

a variety of reasons.

One barrier to the inclusion of explicit information literacy instruction on the more

effective use of Google specifically and research resources in general is that faculty tend to tend

to either assume that these skills and abilities have been covered in other classes or to believe

that students will develop information literate competencies naturally as a result of completing

readings and assignments (Chambers et al., 2013). That this does not seem to be happening in

practice has still failed to convince many faculty members of the need for explicit information

literacy instruction in their classrooms (Head & Eisenberg, 2011; Chambers et al., 2013; Raven,

2012). In Raven's 2012 study, she found that while 42% of students thought that professors

should be responsible for teaching information literacy and research skills, 80% of professors thought learning these skills was solely the responsibility of the student (p. 10).

A second barrier that prevents faculty, staff, and librarians from increasing students' information literacy skills and understandings of Google searching is that they often do not *want* to teach these competencies because they do not want to encourage their students to use Google at all. Many faculty still dismiss using Google as not doing "real" academic research and would strongly prefer that their students confine themselves solely to library resources and materials (Sorenson & Dahl, 2008; Bloom & Deyrup, 2012). This position presents several problems.

First, this outdated way of thinking ignores the fact that Google in general and Google Scholar in particular are portals to many valuable scholarly resources. Educators need to acknowledge, formally and explicitly to first-year students that the ways in which scholarly research is conducted, communicated, and shared are changing and that resources like Google and Google Scholar can be immensely valuable research tools (Asher, 2015; Raven, 2012). While some researchers do acknowledge the benefits of Google searching, far more devote themselves to decrying its presence and prominence in our students' research toolkits (Sorenson & Dahl, 2008; Bloom & Deyrup, 2012; Raven, 2012).

Second, this dismissive attitude towards using Google for research is disingenuous because it ignores the fact that educators and researchers use Google all the time as a starting place for their own research and for their personal and professional information seeking. Faculty, staff, and librarians use Google for the same reasons first-year students do, because it is easy, convenient, connected, and familiar (Sorenson & Dahl, 2008; Purdy, 2012). Educators also use Google because it is usually sufficient for their needs for background information and for quick answers. The only difference between faculty, staff, and librarians and first-year students is that

24

educators are expert researchers who may start with Google but who have the knowledge, skills, and inclinations to go further using specialized resources, often provided by academic libraries. When faculty, staff, and librarians are overly critical and dismissive of students' habits, which to their minds have worked well enough in the past, and expect them to immediately abandon Google when they walk into their first college classrooms, there is a risk alienating them as novice researchers and discouraging them from improving their research practices (Raven, 2012; Bloom & Deyrup, 2012). Educators also risk damaging first-year students' developing sense of themselves as researchers (Purdy & Walker, 2013).

Third, taking a position that educators should focus exclusively on library resources when discussing research or when designing instruction to increase first-year students' information literacy skills ignores those students' fails to consider students' developmental level, prior knowledge and experience (Orme, 2008; Jackson, 2007).

A third barrier presents itself when faculty, staff, and librarians who do want to improve their students' information literacy skills and understandings (even those recognizing that the students are novice researchers who are dependent on and deficient in Google searching) have unrealistic expectations. Educators seem to want first-year students to arrive on campus ready, willing, and able to adopt expert practices and modes of thought even though the vast majority of first-year students don't yet see the value of these approaches, aren't prepared to enact them, and haven't been taught how to do so (Kolowich, 2011). Educators want first-year students to know that academic research entails not only knowing where and how to look for discrete pieces of information but also how to understand, evaluate, and analyze the information they find (in terms of context and content) in order to create their own information products (AAC&U, n.d.). Educators want students to understand that academic research is often messy, non-linear, and

25

iterative (ACRL, 2016). Unfortunately, such educators often fail to take account of or plan for the possibility that first-year students may not yet be at the level of cognitive and psychosocial development required to fully grasp and apply these concepts to their academic work or to their lives in general (Jackson, 2007; Porter, 2014; Cole et al., 2015; Asher, 2015; Cook & Klipfel, 2015). It is incumbent on faculty, staff, and librarians to recognize and remember that they themselves were once novices too and to be willing to meet first-year students where they are experientially, psychosocially, and intellectually.

First-Year Students, Cognitive Development, and Information Literacy

Most of the research on student development in the library literature focuses on William Perry's (1999) model of intellectual development. Perry's (1999) work focuses on the ways in which students think and make meaning of information through the development of a progression of stage-based intellectual skills (Gatten, 2004; Skipper, 2005; Jackson, 2007; Perry, 1999). There is a sequence of nine positions through which students tend to move in predictable ways in Perry's (1999) scheme, 1) basic duality, 2) multiplicity prelegitimate, 3) multiplicity legitimate but subordinate, 4) multiplicity coordinate or relativism subordinate, 5) relativism coordinate, competing, or diffuse, 6) commitment foreseen, 7) initial commitment, 8) orientation in implications of commitment, and 9) developing commitment (Gatten, 2004; Skipper, 2005; Jackson, 2007; Perry, 1999). These stages are generally condensed into four pre-dominant positions: dualist, multiplist, relativist, and commitment. As most first-year students are in the dualist and multiplist positions, these positions will be the focus of this literature review (Skipper, 2005; Tomlinson & Johnson, 2014; Orme, 2008; Gatten, 2004; Weiler, 2005; Jackson, 2007).

Dualism

Dualists, as the word implies, tend to see the world as very absolute. In this position students tend to believe that any question has one "right" answer and that authorities know these right answers (and if they do not yet they will soon, the answer just has not been found yet). Therefore, information is either right or wrong and students will look for answers that agree with their beliefs or with what their teachers have told them. Furthermore, since the authorities know which answers are right, dualists may want their librarian or professor to tell them which sources are right, which are wrong, and which are unacceptable. Dualists believe that it is the authority's job to provide the right answer and for the student to passively receive and reproduce that information (Skipper, 2005; Tomlinson & Johnson, 2014; Orme, 2008; Gatten, 2004; Weiler, 2005; Jackson, 2007). A typical question for a student in the dualist position is "What is the right answer?" (Jackson, 2007, p. 29).

In terms of the relationship of cognitive development to information literacy, dualists will frequently be frustrated by the often ambiguous nature and overwhelming amount of information available through the academic library. For example, when dualist students are presented with an overwhelming amount of information (both in terms of cognitive load and information overload) and are unable to prioritize and evaluate that information, they tend to use a variety of coping mechanisms to limit the amount of information that is coming in, for example by tuning out during information literacy instruction and by returning to tried and true (if not particularly effective) methods of information seeking and retrieval (Cole, et al., 2015; Cook & Klipfel, 2015). Likewise, as Constance Mellon (1981) noted , "dualists have little patience with alternative search strategies, with a wide variety of materials all designed to answer the same

type of question, and with the complexities of information retrieval" (as cited in Jackson, 2007, p. 28).

These first-year students in the dualist position, who believe that Google will magically provide them with the best information anyway, tend to retreat to their familiar search habits and haunts (Porter, 2014; Cole, et al., 2015; Asher, 2015; Fister, 2015). This is not because they do not want to become better researchers, but because they are intimidated and confused by the new research practices and resources educators are asking them to adopt (Porter, 2014; Jackson, 2007; Kolowich, 2011; Asher, 2015). This is particularly true when educators are asking first-year students to do research in unfamiliar and complicated resources and even more so when first-year students are asked to identify potentially valuable pieces of information by evaluating and assessing evidence to determine the authority, reliability, and utility of that piece of information, which something that they not only cannot do, but also something that they fundamentally do not see the point of doing (Asher, 2011; Porter, 2014; Jackson, 2007).

Multiplicity

In this position, students have left behind the dualist belief that there is one right answer and that everything can be known absolutely. Multiplists acknowledge that there are some areas in which the answers are not known and even begin to appreciate that there are some questions that are too complex to ever have a definitive answer. Students at this developmental position tend to overcompensate in this direction however, and to believe that having diverse schools of thought in a field or discipline means that no one is an authority or that there are no right answers at all. Multiplists argue that because there is uncertainty, everyone's opinion is equally valid (Skipper, 2005; Tomlinson & Johnson, 2014; Orme, 2008; Gatten, 2004; Weiler, 2005; Jackson, 2007). Firmly held opinions are sacred and have no need of evidence to support them, indeed

evidence is treated skeptically as biased information designed to infringe on the rights of people

to have their own opinions (Porter, 2014). A typical comment for a student in the multiplist

position is "Everyone has a right to their own opinion" (Jackson, 2007, p. 29). While many first-

year students move from duality prior to or during the first year of college, when confronted with

the expectations and realities for conducting college level research multiplists often experience

cognitive dissonance and cognitive overload, which causes them to at least temporarily regress to

a dualist position (Jackson, 2007; Porter, 2014). Understanding these positions can help in the

identification and recognition of the potential pain points and stumbling blocks of first-year

students from a student development perspective and can also provide the foundation from which

to plan the kinds of interventions that will help our students grow and progress. These

interventions will be particularly effective if they introduce concepts at the right times and in the

right ways so that students are able to receive them (Gatten, 2004).

Better Approaches to Designing Information Literacy Interventions for First-Year

Students

Asking students to engage in research behaviors for which they are not developmentally

ready and for which they lack the background knowledge, context, and disciplinary content

knowledge to be successful sets students up for failure and resentment (Kolowich, 2011). This

brief review of the literature on student cognitive and intellectual development and the

relationship of these theories to information literacy instruction for first-year students suggests

that it does not serve librarians or first-year students well for librarians to rail about the

uselessness or danger of using Google and Wikipedia as academic resources as a way to

introduce the value and utility of library resources (Smallwood, 2015). This "directly contradicts

the students' prior knowledge and experience of using Google and viewing the internet as a

'good' source of information" (Weiler, 2004, p. 48). This attitude also undermines the librarian as a trusted authority, because the students and educators both know that Google specifically and the internet in general are in fact good sources of information for both personal and academic use (Cook & Klipfel, 2015; Orme, 2008; Weiler, 2004; Smallwood, 2015). This approach runs the risk of permanently alienating students who are likely resistant to information literacy instruction in the first place.

Likewise, instead of rushing into a description and demonstration of an academic library's myriad, complex, and confusing subscription resources and databases, it may be more fruitful for librarians to begin with an in-depth exploration of how Google works and how students can use that understanding to search for required information more effectively (Smallwood, 2015; Porter, 2015; Asher, 2015). Educators can use this type of instruction to build connections between where are students are and where faculty, staff, and librarians want them to be. For example, an information literacy lesson on Google Scholar could serve as a bridge between the familiarity of Google and the more scholarly resources first-year students will be expected to use in the future (Badke, 2015). This type of information literacy learning experience can also encourage students to see themselves (intellectually and psychosocially) as apprentice scholars in an academic community (Jackson, 2007; Orme, 2008; Cook & Klipfel, 2015; Purdy & Walker, 2013).

If information literacy instruction is designed to include dynamic lecturing, active learning, and hands-on practice, there is an opportunity to motivate and engage students who expect "learning to be about doing, to relate to their interests, to be fun, to pay off immediately" (Spence, 2001, p. 4). A Google-specific information literacy intervention that connects readings, activities, and assessments to students' interests and that taps into students' prior knowledge and

experience in a way that authentically connects to their personal and academic lives is a meaningful and authentic approach to learning and to developing the kinds information literacy knowledge practices and dispositions that educators want first-year students to embody (Porter, 2014; Cook & Klipfel, 2015).

As Mimi Ito (2013) put it in an article in *The Atlantic*, "Young people are desperate for learning that is relevant to their lives...where they are making choices about how, when, and what to learn without it all being mapped out for them in advance" (para. 10). Incorporating real questions, scenarios, and problems with legitimate stakes and consequences for our first-year students is essential to encouraging significant learning and intellectual development and educators have the ability and opportunity to structure our information literacy interventions in ways that allow for students to ask and answer real questions that are meaningful to them (Fink, 2013; Obst & Eshleman, 2015; McDonough, 2015; Smallwood; 2015; Fister, 2015; Head, 2013b; Gross & Lathan, 2012, Head & Eisenberg, 2011; Hartsell-Gundy, et al., 2009; Porter, 2014; Weiler, 2004; Orme, 2008).

Information literacy instruction in general and Google literacy instruction in particular is especially appropriate for first-year students because it encourages us to meet students where they are and to acknowledge their prior experiences and knowledge, while at the same time creating meaningful learning experiences that engage attention, are transferable to other contexts, have relevance for real life, improve students' confidence as searchers and scholars, and increase student satisfaction with the research process (Hess, 2015; Keller, 1987). Google literacy instruction can be a foundation from which to scaffold further information literacy instruction.

To date the research literature has largely focused on identifying problems that students and educators face when confronted with inadequate preparation to engage in college level

research and students' biases with respect to Google as a research tool rather than on into how to design, develop, implement, and assess a Google information literacy intervention for first-year students. In other words, there is an understanding of why first-year students are struggling in this area and there are ideas about how to help them, but there are few evidence-based best practices for educators to follow. This study seeks to help fill that gap.

CHAPTER 3: METHODS

The purpose of the study was to determine the effectiveness of an information literacy intervention ("Exploring the Googlesphere") targeted at improving the Google literacy of first-year students. In particular, this study examined the impact of the intervention on the degree to which students understand the deep structure of how information is organized online, how Google functions as a tool that retrieves and ranks information sources, the limits of that tool, and how to use that tool more effectively by constructing and employing more effective and useful search strategies. The purpose of the intervention is to challenge students' misconceptions about Google searching and to support their acquisition of new conceptual knowledge and practical information literacy skills. This intervention invites both dualist students who need librarians to act as "how-to" guides and multiplist students from whom librarians can serve the role of chief strategist to explore and challenge some assumptions about Google that they might have as they begin their first year in college (Orme, 2008; Jackson, 2007). The ultimate goal of this intervention was to help students develop the foundation information literacy skills, understandings, and habits-of-mind they need to successfully find information and to approach searching for information as a process of strategic exploration.

This study was designed to provide a better understanding of whether and in what ways the "Exploring the Googlesphere" intervention was successful.

In particular, this study seeks to discover:

1. What impact did this intervention have on students' ability to use search operators and limiters to construct effective Google search strategies?

2. What impact did this intervention have on students' ability to accurately depict and describe how information is organized online and how Google indexes,

organizes, searches, retrieves, and ranks that information?

3. What impact did this intervention have on students' perceptions of themselves as information-seekers and on Google as a tool for information-seeking?

4. Did this intervention succeed in its goals? How can the intervention itself be refined to improve the learning experience of future students?

As in many research projects where the ultimate aim is to improve the teaching and learning experience for educators and students, the intervention and the study were developed simultaneously (Vezzosi, 2009). Therefore, this chapter will describe the process of both the design of the intervention and the research study design. A brief discussion of the design of the intervention is followed by an examination of the design of the research study, which includes discussion of the study's theoretical underpinnings, participants and sample selection, data collection tools, and plans for data analysis (Merriam, 2009).

Intervention Design

The "Exploring the Googlesphere" intervention and the current study were both based on the action research model. This model represents a research process by which practitioners and educators can systematically examine their own teaching and the learning that takes place in their classrooms in order to improve that teaching and learning and to increase student achievement. (Denscombe, 2014; Gaffney, 2008; Sagor, 2000; Vezzosi, 2006). The first step of the action research process in the design of the "Exploring the Googlesphere" intervention and the design of this study involved identifying the student population that would be invited to participate in the intervention and which thus become the participant sample for the study. Second, the desired student learning outcomes of the intervention were identified, which later became the research questions for this study. These outcomes were drawn from both the Association of College &

Research Libraries *Framework for Information Literacy in Higher Education* (2015) and the

Association of American Colleges & Universities *Information Literacy VALUE Rubric* (n.d.). In

order to help novice researchers develop the knowledge practice and dispositions needed to

become expert researchers, the Framework suggests, among other things, that information

literacy instruction help students learn to:

- match information needs and search strategies to appropriate search tools;

- design and refine needs and search strategies as necessary, based on search results; and

- understand how information systems are organized in order to access relevant

    information (ACRL, 2016, p. 9).

Likewise, the AAC&U VALUE Rubric (n.d.) suggests that an information literate student

- "accesses information using simple search strategies" (Access the Needed Information –

    Milestone 2) and

- "demonstrates ability to refine search" (Access the Needed Information – Milestone 3).

The "Exploring the Googlesphere" intervention has the following student learning outcomes:

After completing the "Exploring the Googlesphere" intervention, students will begin to:

- Develop an accurate understanding of how information is organized online and how

    Google operates as a tool that retrieves and ranks information sources according to a

    proprietary algorithm from across the World Wide Web.

- Determine their own answers to questions such as:
    - How does the WWW work? How does the Internet work? What's the difference?
    - What is the difference between the open web and the hidden/deep web, and the dark
        web?
    - How does Google search work?
    - How are results returned?
    - How can I use Google more effectively?

- Use Google search operators and filters to construct effective search strategies

Third, assessment measurements were designed to provide evidence of learning and of the success of the intervention, which became the data collection tools used in this study. Fourth, in-class learning activities and an instructional plan for the intervention were developed and he planned intervention was implemented in the middle of the spring 2017 semester. Fifth, the data representing evidence of learning related to the intervention were collected and analyzed inductively to allow for the emergence of themes (see Appendix A for a more detailed description of the process).

Design of Research Study

Since the primary goal of this research was to explore problems in current practice and to produce evidence that can be used to contribute to the development of future best practices, it seemed natural to use an action research approach in the design of the study. Action research falls into the qualitative research design and the constructivist and critical paradigms. Qualitative research is a systematic investigation into how people make sense of their experiences in the world through purposeful data collection and analysis and a careful examination of practice (Merriam, 2009). Qualitative research often seeks to discover the ways in which truth or reality are socially constructed (Orme, 2008). When an investigator begins a qualitative study, she often knows what problem she is investigating and has selected a purposeful sample from which to collect data in order to gain insight into the problem, but in which the final analysis or outcome is not yet known (Merriam, 2009). Qualitative studies are frequently situated within the constructivist paradigm (Wilson & Swanson, 2015).

Constructivism

The constructivist paradigm, or worldview, argues that knowledge is constructed based on first hand interaction with the world and that learning is a process of construction in which

individuals are actively involved in building their own new knowledge and understanding (Wilson & Swanson, 2015; Vezzosi, 2006; Kay & Ahmadpour, 2015). The constructivist paradigm is well-suited to information literacy studies because this worldview encourages a shift away from passive knowledge transfer ("where to click" mechanistic skill acquisition) toward building conceptual understanding and active and reflective thinking about the structure and nature of information in the 21st century (Wilkinson, 2015; Kay & Ahmadpour, 2015). In particular, it's becoming increasingly important for students to recognize that information is not necessarily neutral and objective, that in fact it is often (if not always) socially constructed, interconnected, and complex and that interactions with information require critical thought and reflection (Morrison & Greenfield, 2015).

By inviting students to engage in critical thought and reflection on how Google search operates and by challenging students to build their own mental models, Google literacy instruction supports students as they construct their own knowledge and understanding of the information landscape, which is crucial to developing information literacy (Orme, 2008; Morrison & Greenfield; 2015; Kay & Ahmadpour, 2015; Vezzosi, 2006). In order to understand how both the first-year student and the information literacy educator experience the "Exploring the Googlesphere" intervention and how those experiences are used to construct knowledge, make meaning, and further cognitive development it is necessary to evaluate the impact of the intervention and to determine a basis for future improvement (Merriam, 2009). One of the best ways to accomplish this kind of reflective and recursive investigation designed to provide practical solutions is through action research.

Action Research

Action research begins with the idea that an educator has an interest in knowing more about her practice and in finding ways to improve that practice (Merriam, 2009). Action research, then, is "a disciplined process of inquiry conducted *by* and *for* those taking the action...to assist the "actor" in improving and/or refining his or her actions" (Sagor, 2000, p. 2). Action research falls within the critical paradigm because it seeks to improve not only the practice but the practitioner and involves not only into the improvement of a practice but also an improved understanding of that practice (Vezzosi, 2006).

The action research process is often used by educators to gather evidence that will help improve teaching practices and the quality of their students' learning. There are several questions that need to be answered during any action research project including: who conducts the research, who benefits from the study, how the study population is chosen, how the data is analyzed, how the results are shared, and how the findings are put into action (Gaffney, 2008). Once the research questions have been identified, the next phase in an action research project is to collect evidence and data. This involves creating a research design strategy, which includes identifying study participants, developing of a set of assessment measurements for data collection, implementing the study procedures, and evaluating and analyzing the data and evidence (Davis, 2013; Gaffney, 2008). Finally, the data must be synthesized so that the researcher can draw conclusions, make recommendations, address limitations, and communicate and reflect on results in order to improve and inform future action (Vezzosi, 2006). Many researchers depict the action research method as cyclical in nature, as depicted in Figure 2 (Denscombe, 2014; Gaffney, 2008; Sagor, 2000; Vezzosi, 2006).

```
                    ┌─────────────┐
                    │ Identifying & │
                    │ Developing   │
                    │ Research     │
                    │ Questions    │
                    └─────────────┘
```

Identifying & Developing Research Questions

Collecting Data & Evidence

Analyzing Data & Reflecting on Evidence

Sharing Results & New Insights

Taking Informed Action

Evaluating Changes
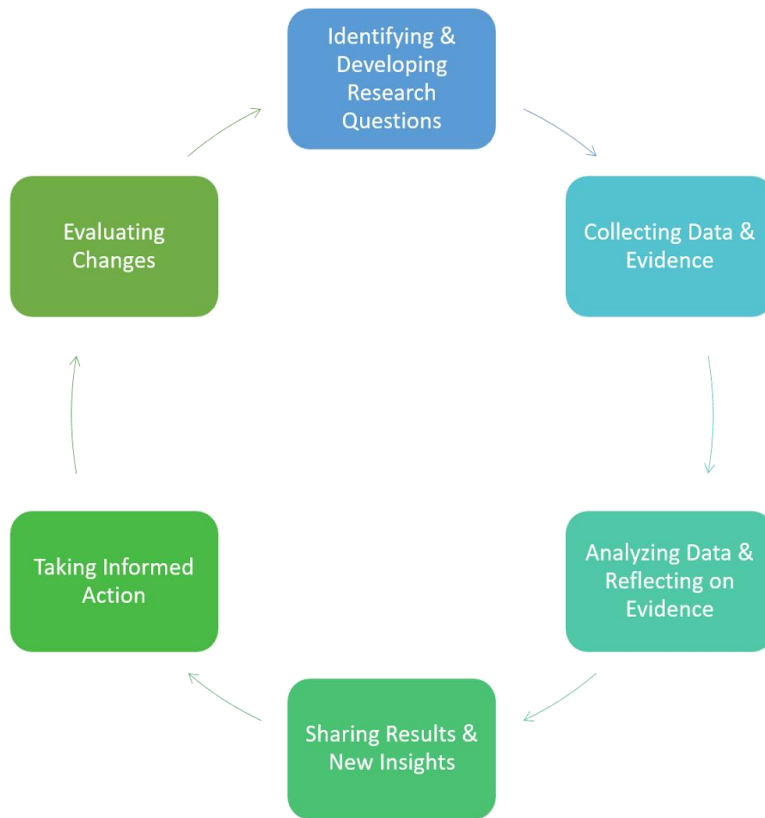
Figure 2 - Action Research Cycle

The Role of the Researcher

The role of the researcher in education action research is dual; she is both the researcher and the facilitator of an educational experience or intervention (Trondsen & Sandaunet, 2009). Action research provides the researcher with a systematic way to test her assumptions, intuitions, and anecdotal experiences in order to improve the quality of teaching and learning in her own classroom (Kember, 2000; Klipfel & Carroll; 2015). The researcher in an action research project differs from other types of researchers in that she is often starting with a recognized problem for which she is seeking a practical solution and is more concerned with issues of practical and local relevance rather than statistical significance (Trondsen & Sandaunet, 2009; Klipfel & Carroll; 2015). Likewise, the action researcher is generally more interested in improving practice than in

39

contributing generalizable findings to the field (Klipfel & Carroll; 2015). Although other forms of research frown on using convenience samples, in action research convenience samples are not only appropriate but necessary as the researcher's sample is drawn from the students she works with (Klipfel & Carroll; 2015). Action research "provides the researcher with knowledge grounded in local contexts and situations that will be useful to the researcher and the research participants" (Kemper, 2000, p. 36). The researcher is also empowered to act as an agent of change by using the results of the research to improve her own practice and the educational experience of her students (Kember, 2000; Klipfel & Carroll; 2015).

This study is the culmination of the researcher's experiences teaching information literacy classes for first-year students over the last 12 years and coordinating the information literacy instruction program for the Kaufman Library at GGC for the last five years. The researcher's education, experience, and reading of the professional literature all indicate that too many students rely on Google as their first, and often only, search tool without understanding how Google works (i.e. how its search algorithms function and how its results lists are populated) and how they can use Google more effectively to conduct college level research. The researcher used her prior knowledge and experiences, the best practices recommended by the relevant literature and the action research model to simultaneously design and implement the "Exploring the Googlesphere" intervention and this study. The researcher was also the instructor of record for one of the two pilot sections of GGC 1000 and taught the "Exploring the Googlesphere" class for both sections. The researcher initiated change by implementing the intervention and, by collecting and analyzing the data, the researcher is further empowered to act as an agent of change in the future by using the results of the research to improve her own practice and the educational experience of her students (Kember, 2000; Klipfel & Carroll; 2015).

40

The first step in the action research process is to identify and develop the research questions. The researcher faced the following decision points in the design of the intervention and the study: Who was going to be studied?, What were the student learning outcomes of the intervention and the subsequent research questions of the study?, How was learning going to be assessed and evaluated?, and What activities and materials were needed to facilitate the teaching and learning process? The answers to these questions became the study setting, participants, data collection instruments and procedures, and the methods for data analysis, each of which is described in more detail in the following sections.

Setting for Study

Almost twelve years ago the state of Georgia and Gwinnett county recognized that there was a need for an institution of higher learning within the county and set about creating what would soon become Georgia Gwinnett College (GGC), a new four-year baccalaureate, public state college. Located in Lawrenceville, Georgia, GGC enrolls more than 12,000 students; almost 70% live in or are from Gwinnett County (GGC, n.d.). According to the GGC website (n.d., para. 2), it is "the nation's first four-year public college founded in the 21st century, and the first four-year public institution created in Georgia in more than 100 years". GGC prides itself on being innovative, student-centered, open-access, and game changing. In addition to its innovative design and forward-thinking outlook, GGC also values and pursues diversity in its curricula, faculty, staff, and student body. GGC is not only the first 21st century institution in the state of Georgia, it has also been recognized as the most diverse regional college (public or private) in the South for the last three years (U.S. News and World Report, n.d.). The GGC student body is approximately 17% Hispanic, 33% Black, and 35% White and almost half (47%) of the students are first-generation college students (GGC, n.d.).

However, GGC was also one of the few institutions of higher education in the state that did not currently offer a first-year experience course. The research on the effectiveness, efficacy, and impact of first-year seminars is voluminous (Upcraft, Gardner, & Barefoot, 2004; Greenfield, Keup, & Gardner, 2013; Kuh, Kinzie, Schuh, & Whitt, 2010). These same studies demonstrate that to engage students to their full potential institutions must academically challenge students (for instance with rigorous intellectual readings and assignments that are assessed with high standards), but must also provide resources that support and enable students to meet these challenges. First-year seminars are one type of program that can provide these challenges and support by structuring access to high quality resources and encouraging the development of skills and abilities in assessing, critiquing, and using information for learning (Fosnacht, 2015).

In designing the pilot sections of GGC 1000, the First-Year Experience Launch Committee determined that one of the student learning outcomes for the course would be that students would be able to identify relevant and reputable sources of information for academic and personal success. This outcome provides the opportunity to embed several information literacy learning goals and outcomes into the course curriculum. This course learning outcome was the direct inspiration for creating the "Exploring the Googlesphere" intervention and associated learning activities as well as the impetus for this study. Students were introduced to the idea of strategic searching in Google as an exploratory process that could be improved on with a deeper conceptual understanding of how Google search operates and a better set of search tools and techniques. This intervention took place in the middle of the spring 2017 semester. The in-class portion of the intervention took place in one of the Daniel J. Kaufman Library information literacy instruction rooms. This room was equipped with a projector and two

screens, two whiteboards, and 30 computer stations, which allowed for class activities including a series of mini-lectures, the showing of a video, and interactive hands-on activities and skills practice. Because this intervention was planned specifically for the pilot sections of GGC 1000, the pool of participants for this study was that student population.

Participants

The participants in this study were all first-year students enrolled in two spring 2017 pilot sections of GGC 1000. All first-year students enrolled in GGC 1000 were invited to participate in this study. These students were purposefully selected because the "Exploring the Googlesphere" intervention was designed specifically for first-year students enrolled in the first-year experience seminar as a systematic unit of instruction that will serve as the first in a series of integrated information literacy interventions for the general education curriculum at Georgia Gwinnett College. It was therefore essential to discover during the pilot phase of the seminar if this intervention was successful in meeting its student learning outcomes so that the intervention can be improved before it is embedded into the permanent course design of GGC 1000.

Students in the two pilot GGC 1000 sections completed an information literacy in-class activity for course credit, however, completing the pre-test, post-test, and critical incident questionnaire was voluntary and anonymous and participation was not graded or counted for course credit. Of the thirty students enrolled in both sections, thirteen students participated in the in-class "Exploring the Googlesphere" information literacy class *and* completed all three assessment measurements used for data collection. Participation in this study was both voluntary and anonymous, and because the sample was so small and the pool of potential participants was known, it was determined that collecting and evaluating demographic information would have likely led to revealing the identities of the participants. Thus, no demographic information was

collected. This study was approved by the Internal Review Boards of both Georgia Gwinnett College and Kennesaw State University, and consent for participation was obtained from study participants using a signed consent form distributed and collected before students completed the pre-test.

Data Collection Instruments & Procedures

The second phase of the action research process is to collect data and evidence. To that end, participants completed three assessment measurements, which were also the data collection tools for this study. Namely, students were asked to complete a Google Search pre-test and post-test survey, a Critical Incident Questionnaire (CIQ), and a pre-class and post-class drawing (a visual representation of how Google search operates). The Google Search surveys featured both closed and open response questions, which yielded qualitative data because the questions were designed to uncover the students' understanding of their own experiences and factual knowledge. The CIQ and the drawings are researcher-generated documents that can also be used as data sources since they provide deep insight into the research questions under investigation (Merriam, 2009).

Google Search Pre-Test

The pre-test survey was made available to students through their learning management system for one week before the in-class "Exploring the Googlesphere" lesson. The Google Search pre-test was designed to determine what students already know about the deep structure of how information is organized online, what information seeking behaviors they engage in and how they construct search strategies they employ, and to measure participants' existing confidence levels in themselves as researchers and in Google as a tool for research. This pre-test established a baseline of participants' Google literacy and proficiency. Students needed only a

44

basic familiarity with Google and Google search procedures to participate in this survey. The survey instrument was loosely adapted from questions on the post-course assessment of the *Power Searching with Google* course (Google, n.d.). The survey consists of ten questions, four open-response questions designed to elicit the students' existing level of foundational knowledge in regards to how information is organized online and how Google search algorithms operate in returning and ranking search results, five fixed-choice questions designed to test first-year students skills in constructing advanced searches using search operators and limiters, and one Likert-scale question designed to measure the confidence level of the students as Google researchers. A copy of the survey instrument is included in Appendix B.

Google Search Post-Test

The Google Search post-test survey was made available through students' learning management system for one week following the in-class "Exploring the Googlesphere" lesson. This survey was designed to provide data on the efficacy and impact of the in-class mini-lectures and active learning activities on students' foundational knowledge and practical skills. The post-test closely mirrors the structure and questions of the pre-test. However, two new questions, one using a Likert-scale ("Has this class changed how you will use Google in the future?") and an additional open-response question ("What was the most useful thing you learned about Google searching?"), were added to elicit data on the students' experiences of participating in the "Exploring the Googlesphere" intervention. A copy of the survey instrument is attached as Appendix C.

Critical Incident Questionnaire

Students also completed an adapted version of Stephen Brookfield's (1995) Critical Incident Questionnaire (CIQ), which provides evidence of the impact of the in-class activities on

the students' perceptions of themselves as researchers and their dispositions towards Google as a tool for research. This instrument was also available to students' through their learning management system for one week after the class. The CIQ is critical because it is "actively investigating and revealing beliefs, experiences, and practices" of student respondents (Morrison & Greenfield, 2015, p. 175). This questionnaire also elicited information on which aspects of the in-class activities and lesson were particularly useful or salient to the students and which were confusing, alienating, or unnecessary. The standard CIQ consists of five open-response questions:

- At what moment in class this week did you feel most engaged with what was happening?
- At what moment in class this week were you most distanced from what was happening?
- What action that anyone (teacher or student) took this week did you find most affirming or helpful?
- What action that anyone took this week did you find most puzzling or confusing?
- What about the class this week surprised you the most?) (Brookfield, n.d.).

In addition to those questions, the adapted version of the CIQ included questions designed to tease out more specifically how the "Exploring the Googlesphere" in-class mini-lecture and active learning activities impacted students' self-perceptions and dispositions, and to elicit information on how to refine the intervention in the future:

- How has your perception of yourself as a Google user and your perception of Google as a tool for finding information changed as a result of our class this week?

- In what ways was class this week a valuable experience for you?

- What could you have lived without?

- How will you use what you've have learned in a future class or for your personal benefit?

- Should the lesson on Google searching be a part of future GGC 1000 courses? Why or why not?) (For the full instrument, see Appendix D).

Drawing for Learning

Student drawings can serve as valuable artifacts of learning and of important sources of data for qualitative studies (Brier & Lebbin, 2015; Quillin & Thomas, 2015). While not widely used in information literacy instruction, methods of teaching that involve students generating their own visual representations of concepts and phenomenon has been employed as a learning strategy in many of the sciences (Brier & Lebbin, 2015; Quillin & Thomas, 2015; Ainsworth, Prain, & Tytler, 2011; Lerner, 2007). Drawing can become artifacts that provide evidence that can be subjected to analysis and can be used to track developmental changes in thinking and understanding (Merriam, 2009).

Assigning and assessing drawing as a method for learning has five main educational rationales. First, drawing is more a active and more interactive activity than listening to lectures or writing responses and students report that creating drawings is more interesting, fun, and memorable that other learning activities, all of which can increase student motivation for learning (Brier & Lebbin, 2015; Quillin & Thomas, 2015; Ainsworth, et al., 2011). Second, drawing is an alternative learning strategy that taps into several different modalities including the tactile, the kinesthetic, and the visual. This strategy can help students organize their thinking and

47

to integrate new and prior knowledge into a self-directed expression of learning (Brier & Lebbin, 2015; Ainsworth, et al., 2011).

Third, drawing can help students build their own mental models and representations of learning objects. Drawings move beyond words and can help learners construct and record new knowledge and understanding. This is useful when seeking evidence of student learning related to abstract and intangible concepts, particularly when those concepts are difficult for students to articulate in writing. Visual representations can also be used to measure students' pre-existing conceptions and misconceptions about foundational ideas and processes (Brier & Lebbin, 2015; Quillin & Thomas, 2015; Ainsworth, et al., 2011). Fourth, pre- and post-class drawings can also be used together to show evidence of student reasoning. Drawing forces students to think about and focus on the key distinctive features or attributes of the learning object and it is useful to examine students' reasoning as they generate and refine their mental models (Brier & Lebbin, 2015; Quillin & Thomas, 2015; Ainsworth, et al., 2011). Finally, drawing is a different method through which students can clarify and communicate their learning. Drawings are tangible forms of assessment that externalize personal knowledge and understanding and can be used to provide diagnostic, formative, or summative feedback (Brier & Lebbin, 2015; Ainsworth, et al., 2011). In short, drawing can be a fun, cheap, low-tech, and different way for students to explore information literacy concepts and to experience information literacy instruction (Brier & Lebbin, 2015).

To that end, a pre- and post-class set of student drawings were collected from the students during the in-person "Exploring the Googlesphere" class. These researcher-generated documents were prepared by the study participants directly before and after the "Exploring the Googlesphere" in-class learning activities. Students were instructed to spend the first five

minutes of the class drawing a response to the prompt "How does Google search work?" and also

spent the last five minutes of class drawing a new visual representation in response to the same

prompt based on what they had learned during the class.

Data Analysis

The third phase of the action research process is to analyze and reflect on the data that is

collected. Data from the fixed and open-responses to the Google Search pre- and post-test

surveys, the Critical Incident Questionnaire, and the pre- and post-class drawings was analyzed

using qualitative data analysis methods, including constant comparative analysis and content

analysis. In qualitative research the "analysis of the data involves identifying recurring patterns

that characterize the data" (Merriam, 2009, p. 23). This analysis is primarily inductive and

comparative and involves consolidating, categorizing, reducing, and interpreting in order to

make meaning of the collected data (Merriam, 2009; Morrison & Greenfield, 2015; Thomas,

2006).

The inductive approach to qualitative data analysis consists of a systematic review of raw

data in order to uncover concepts and themes that are responsive to a study's research questions.

In other words, the primary purpose of inductive analysis "is to allow findings to emerge from

the frequent, dominant, or significant themes inherent in the raw data" (Thomas, 2006, p. 238).

Inductive analysis begins with the process constant comparative analysis. In this process, raw

data are grouped (or coded) together on a similar dimension, the dimension is tentatively given a

name, if the dimension continues to develop it becomes a category, and eventually categories are

condensed into themes (Merriam, 2009).

To begin the data analysis process, the raw data must be collected and cleaned (Thomas,

2006). The data from the "Exploring the Googlesphere" intervention were generated when

students answered the questions on the Google Search pre-test, Google Search post-test, and the Critical Incident Questionnaire, all of which exist as unique Google Forms. These measurements were available from the course research guide and were also embedded into the course learning management system. Each form was used to generate a Google spreadsheet to aid in data analysis.

Initial analysis of the data included a quick examination of the textual responses and the percentage of students who were successfully able to identify the correct Google search operators. This analysis revealed that most students had no clear conceptual understanding of how information is organized online or how Google search operates. At that point, a decision was made to include the pre- and post-class drawings as an additional data collection tool in order to ascertain if participating in this learning activity and assessment would yield more positive results. The drawings were made on plain white printer paper using colored pens that were provided and both the pre- and post-class drawings were collected and collated at the end of the class.

After all the data were collected, a close reading of all open-responses to the Google Search surveys and the Critical Incident Questionnaire occurred along with the process of open coding, in which like responses were grouped together particularly into tentative categories that seemed responsive to my research questions. After this step more categories were reduced and refined to eliminate overlap and redundancy and to create more concise and meaningful themes for analysis. Select quotations and artifacts that illustrated or exemplified those themes were selected for inclusion in the findings and a final selection of the most important themes that provided insight into the answers to my research questions was determined (Thomas, 2006).

Study Trustworthiness

This was an exploratory study testing a pilot version of an information literacy intervention in two pilot sections of a new first-year experience course. Therefore, this study was designed as a qualitative pilot study. Pilot studies are often used as small-scale or initial versions of planned larger studies and they are useful for developing and testing data collection instruments, refining learning objects and activities, identifying logistical problems, and determining what resources might be needed to conduct a larger scale study (van Teijlingen & Hundley, 2002). Pilots can be used to "Ensure that methods, tools, and ideas will work in practice" and provide researcher with the opportunity to refine their future efforts (Kim, 2010, p. 191). Pilot studies can also be used to increase credibility, dependability, confirmability, and transferability (the four types of trustworthiness for qualitative studies) for future larger-scale studies (Thomas, 2006; Merriam, 2009; van Teijlingen & Hundley, 2002). Finally, pilot studies are also ideal training grounds for budding qualitative researchers as they can introduce new researchers to most of the elements of the research process and can provide novice researchers with a valuable experience and tool for self-reflection and improvement (Kim, 2010; van Teijlingen & Hundley, 2002).

<center>**CHAPTER 4: RESULTS**</center>

In reviewing and analyzing the data four major themes emerged. These themes can be categorized as students 1) Developing Google literacy skills, 2) Developing foundational conceptual understandings of the structure of the online information landscape and of how Google search operates within that landscape, 3) Developing confidence in their skills as Google searchers and of their abilities to use Google to its full potential, and 4) Comments on the usefulness of the intervention itself. These themes correlate well to the research questions of this study. Each theme was identified using the inductive and comparative analysis of data as described in the methodology and will be illustrated through a description of the theme and the inclusion of data visualizations that illustrate the themes. The remainder of this chapter is devoted to describing and discussing each of these four themes in more detail. The themes are presented in ascending order of cognitive and affective complexity.

Developing Skills

This study sought to discover if the "Exploring the Googlesphere" intervention impacted students' abilities to improve their search skills. One theme that emerged from the data is that the intervention did indeed impact and improve students' abilities to construct efficient and advanced search strategies as evidenced by improved performance by students in using select Google search operators. These search operators were used as a measure of proficiency in constructing effective Google search strategies and focused on three specific operators: site:, filetype:, and exclude [-] because those are the ones I have found most useful for student research and in my own professional and personal practice. Table 1 displays the gains in students' factual knowledge from the Google Search pre-test to the Google Search post-test.

<center>52</center>

Table 1 - Search Operator Proficiency Pre- and Post-Test

Search Operator	Pre-Test (#correct/#total)	Post-Test (#correct/#total)
site:edu	17/27 (65.4%)	13/13 (100%)
filetype:pdf	0/27 (0%)	9/13 (69.2%)
- (exclude)	10/27 (37%)	8/13 (61.5%)

While students showed increased skill in identifying or generating each of the search operators, the increase in correct answers was not uniform. This could be due to the fact that two of the search operator questions (related to site searching and excluding) were fixed-response multiple choice whereas the filetype question was open-response. In any event, it seems fairly clear that the evidence from the Google Search pre- and post-tests indicates that participating in the intervention did increase students' skills in identifying advanced search operators that can be used to create more efficient and useful Google searches.

Evidence of increased skill in creating Google search strategies was also found in the open-responses to the Critical Incident Questionnaire. Four students, a quarter of the total respondents, specifically mentioned being the most engaged and/or surprised in the class during the mini-lecture and hands-on practice using search operators. For instance, one student commented, "I felt most engaged when Dr. Harmer was really teaching us how to use google to our full potential. I had no idea there was so many ways in narrowing my searches. I always asked questions and rarely used keywords. This will be a huge help.", while another remarked that the most engaging part of the class was "...when we started to use google and actually search with the new tricks." In short, it seems that a preliminary answer to the first research question of

this study ("What impact does this intervention have on students' ability to use search operators and limiters to construct effective Google search strategies?") is that participating in the "Exploring the Googlesphere" intervention had a positive impact on students' knowledge and use of search operators.

Developing Understanding

A second theme that emerged from the data was a visible shift in students' fundamental conceptual understanding of how information is structured online and how Google search operates within that structure to search for and retrieve information. An increased understanding was evinced by analyzing both the Google Search pre- and post-test and the pre- and post-class student drawings. The pre- and post-test asked three open-ended response questions designed to gauge students' understanding of these concepts ("How does Google search work?", "How does Google rank search results?", and "What is the difference between the World Wide Web (WWW) and the Internet?"). The text of the open responses to these questions for both the pre- and post-tests were copied from the data collection spreadsheets and turned into word clouds.

Word Clouds. Word clouds, or content clouds, are a way to present qualitative data that is visual and that is easy to summarize, interpret, and communicate (Cidell, 2010). Word clouds are visual representations of word usage and the frequency with which a term, phrase, or concept appears determines the size and prominence of that idea within the cloud (Brooks, Gilbuena, Krause, & Koretsky, 2014; Cidell, 2010). While word clouds are an emerging form of qualitative data analysis they are useful in uncovering themes in much the same ways as more traditional forms of data analysis and are particularly well suited to content analysis of textual responses to open-ended questions (Brooks, et al., 2014; Cidell, 2010). Word clouds generated from and compared to pre-and post-tests can be especially helpful in providing a snapshot of student

learning (Cidell, 2010). WordArt.com was chosen as the online word cloud generator for this study because it is free, open-access, allows for the inclusion of phrases and sentences in addition to single words, and because it allows the researcher to save the clouds that are generated.

Figures 3 and 4 present the word clouds generated from responses to the question "How does Google rank search results?".

Figure 3 - "How does Google rank search results?" Pre-Test Responses

key-words Site speed
Quality of inbound links" by the most searched website or the most popular website
Google ranks searches by the relevancy, how many times the sites are linked to other sites, and the amount of times your keywords were used.
by hits and relevances "Keyword usage
I think the credibility of the website and if other people use it also.
it will find the source that is most commonly used
Google search results by putting all different types of information that includes from books, news,websites, pictures, and videos that connect with the information you are looking for.
According to if the page is spam, ranking of that page, and credibility of information.
How does Google rank search results?
from popularity and how many times the key word is used in the web page
By ads first and then the most reliable source most closely related to what you typed in the search bar
most relevant and most used
How important the links are
Number of inbound links
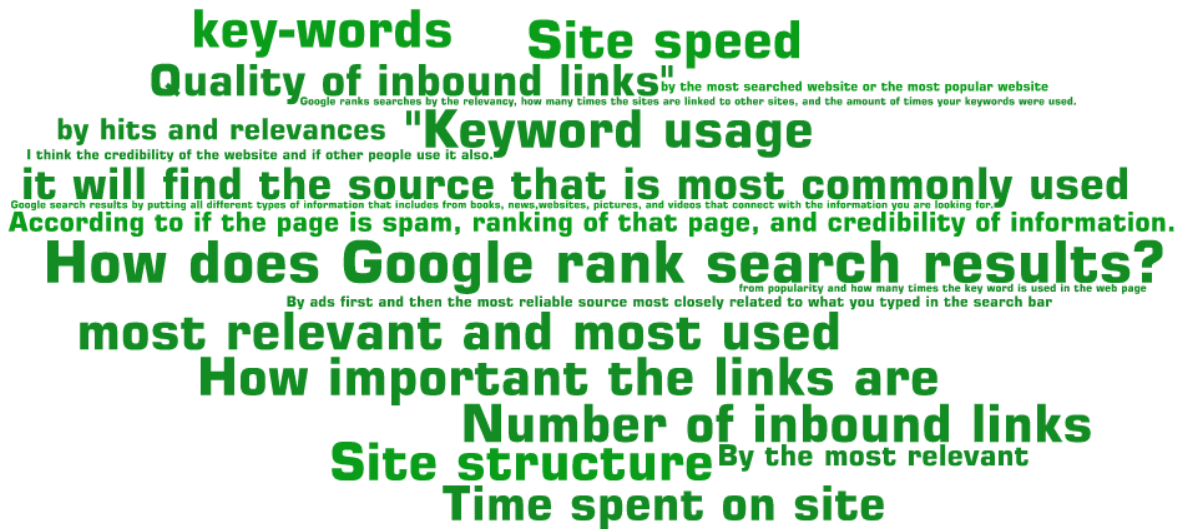Site structure By the most relevant
Time spent on site

Figure 4 - "How does Google rank search results?" Post-Test Responses

Analysis of these word clouds suggest that that students significantly increased their understanding how Google search ranks results between the pre- and post-tests. For example, in the pre-test one student made the comment "that I would have no idea on", which typified most of the initial responses. Many students simply responded "idk" or "I don't know". In contrast, the post-test cloud included words such as links, structure, keywords, and relevance. One student was able to identify that "Google ranks searches by the relevancy, how many times the sites are linked to other sites, and the amount of times your keywords were used," which is a level of understanding that was not evident in the majority of the responses to the pre-test. The comparison of these two word clouds suggest that the "Exploring the Googlesphere" intervention did have a positive impact on most students' understanding of how Google ranks search results.

The impact of the intervention on student understanding of the basic structure of the online information landscape is more mixed. Figures 5 and 6 present the word clouds generated

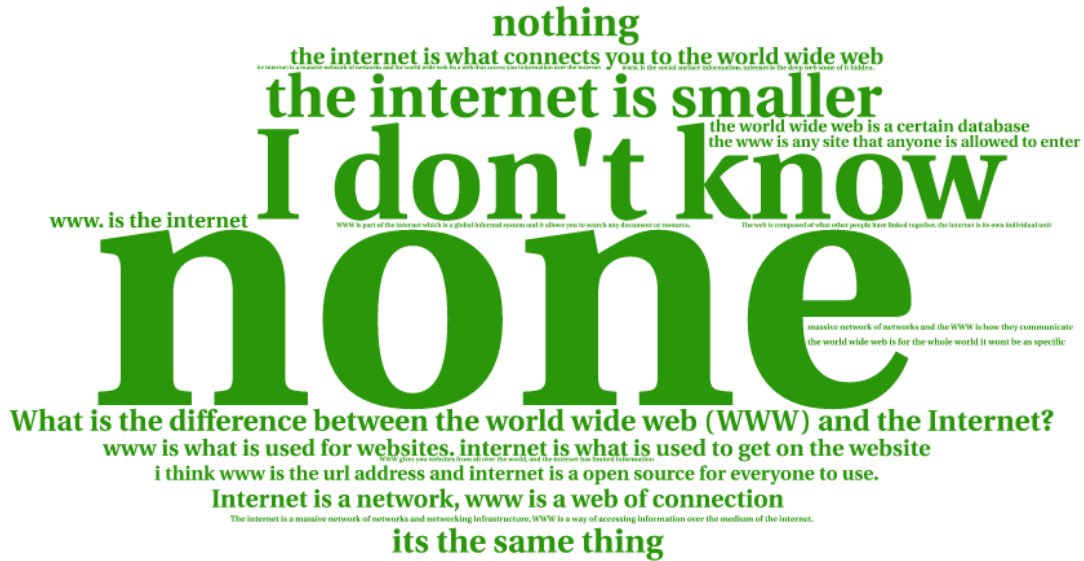from responses to the question "What is the difference between the World Wide Web (WWW) and the Internet?".

Figure 5 - "What is the difference between the World Wide Web (WWW) and the Internet?"
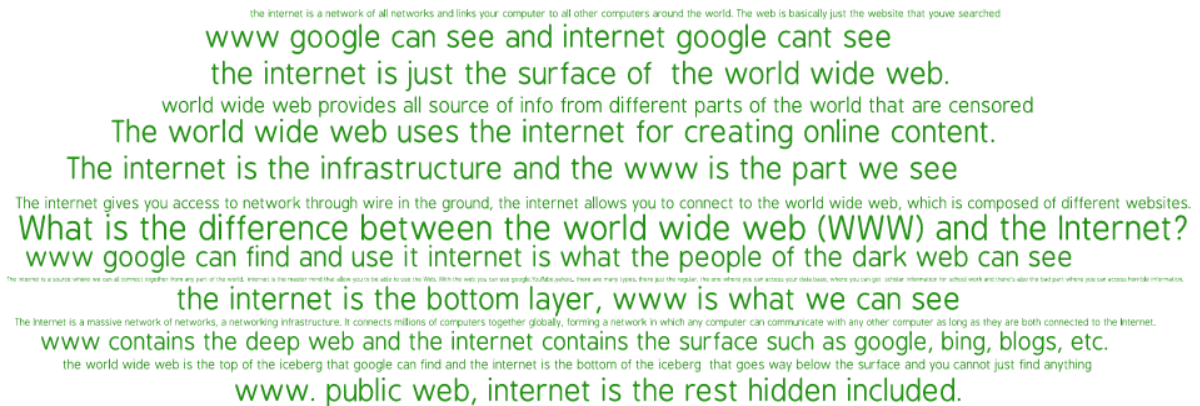Pre-Test Responses

Figure 6 - "What is the difference between the World Wide Web (WWW) and the Internet?"
Post-Test Responses

This pair of word clouds does provide some evidence of learning. Responses to the Google Search pre-test indicate most students had no real idea that there was a difference between the Internet and the World Wide Web, let alone what that difference might be. The most common answer was that there was no difference. In contrast, the second, post-test, word cloud reveals that students have learned that there is in fact a difference. However, most students were unable to correctly identify that difference. The word cloud provides indicates that students were confused about the role and structure of both the Internet and the WWW, although many of the students were able to distinguish between the surface and deep web. In short, based on this visualization, the intervention had a real but limited impact on student learning and understanding.

A more significant impact on student learning and understanding can be found in an examination of the responses to the open-ended question of how Google search operates. Figures 7 and 8 present the word clouds generated from responses to the question "How does Google search work?".

Figure 7 - "How does Google search work?" Pre-Test Responses

Figure 8 - "How does Google search work?" Post-Test Responses

This final pair of word clouds shows the clearest evidence that students have learned

something fundamental about how Google search operates as a tool for research. In the first word

cloud, from the Google Search pre-test, a lack of conceptual understanding is clear. While two

students did correctly identify the role of algorithms in the Google search process, most student responses were of the "you type in what you're searching for and press search" variety. This simplistic acceptance of Google as fundamentally unknowable or unfathomable and the resultant lack of critical thought and conceptual understanding of how Google functions means that students must "simply put their faith and trust in the algorithm and the people who designed it" (Asher, 2011, p. 3). This is antithetical to developing Google and information literacy habits of mind, knowledge practices, and dispositions which was a major component of the "Exploring the Googlesphere" intervention.

As part of the "Exploring the Googlesphere" class, students watched a three-minute video produced by Google on how the search algorithm works and then listened to a mini-lecture, which included and built on the following description: "In addition to Page Rank [Google's proprietary ranking and relevancy algorithm], the Google search algorithm uses a total of more than 200 "signals" to rank its search results - including measures related to localization, personalization, timeliness, and quality…" (Asher, 2011, p. 2). The value of both the video and mini-lecture as tools for learning is evident when comparing the pre- and post-test responses to the question of how Google search operates.

In the second word cloud in the set, students were able to identify many of the relevant ideas, concepts, words and phrases from both the video and the mini-lecture. This is particularly evident in the number of times that the words *spider* and *index* appear. For example, students made statements such as, "asks over 200 questions" and "spiders go through the index of info to find what you're looking for". One student could combine the search operators and techniques together with an understanding of how Google works to remark that, "you must be descriptive of

what you want to find". These statements are more informed and reflective than the responses to the pre-test and provide evidence that some learning has taken place.

Drawings. In addition to the impressions gained from the pre-test/post-test word clouds, results, the before and after pictures drawn by the students give insight into the changes in student understanding about the nature of information embedded in the Internet and the World Wide Web and how Google searches and retrieves that information. The following figures represent a sample of the drawings that students made at the beginning and the end of the "Exploring the Googlesphere" class in response to a prompt asking the students to create a visual representation of how Google search works.

Figure 9 demonstrates that at the beginning of the class the student clearly lacked an understanding of how Google search functions. In fact, this student seems to have had difficulty in responding to the prompt at all and drew a picture representing what Google search does, rather than how Google search works. Nor was this student alone; three other students also drew thought bubbles that described Google's function as a search engine, rather than representing how that search engine operates. Likewise, thirteen out of twenty students (65%) drew the Google search box and results list as their initial visual representation (as seen in Figures 10, 11, and 12), which indicates that students were drawing the process of conducting a Google search rather than drawing a representation of the process Google uses to retrieve search results. This is clearly demonstrated in Figure 12, in which the student drew the process of searching, rather than a picture of how search results are retrieved. Two students were able to identify that Google searches something, and in both cases this something was represented by a globe (as in Figure 13). Taken together, these pre-class drawings show the students' fundamental lack of knowledge about and inability to envision or represent how Google search works.

In contrast, the drawings completed after the "Exploring the Googlesphere" class show a marked increase in students' knowledge and understanding of how a Google search operates. For example, three students progressed from an initial inability to even respond to the prompt to a rudimentary understanding that there is some sort of global interconnected web that Google is searching as in Figure 9. Most students' drawings showed a more sophisticated understanding of how Google search works and included visual representations of the more complex factors involved in a Google search. For example, ten students drew spiders (as in Figure 10), nine students drew linked pages (as in Figure 11), five students drew or wrote something about the deep web (as in Figure 10 and Figure 12), three students drew a web (as in Figure 12), and two students specifically mentioned an index (as in Figure 13).
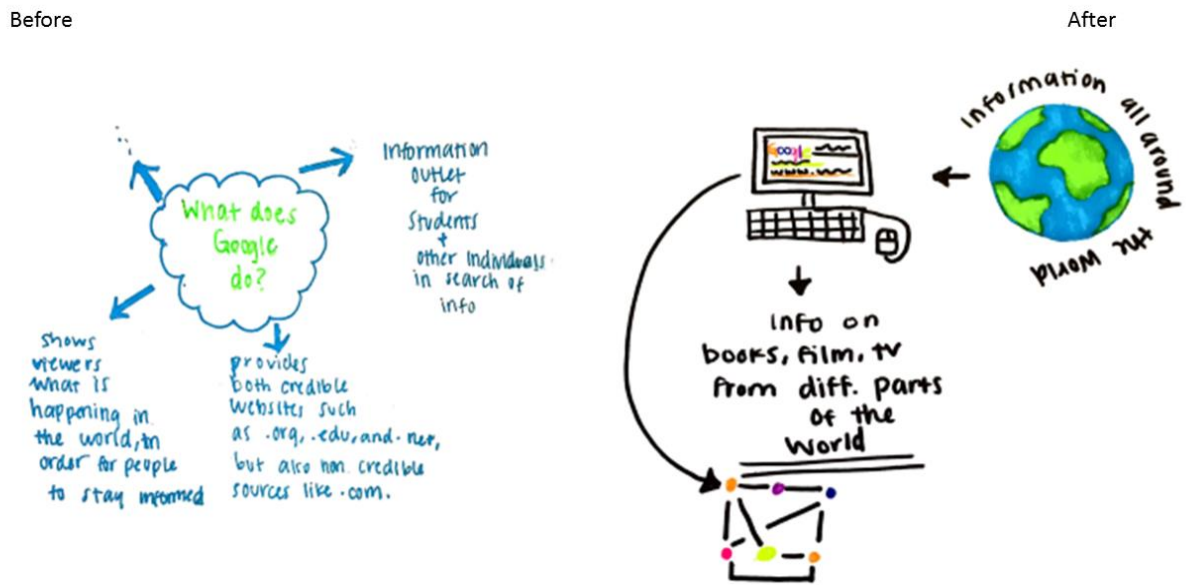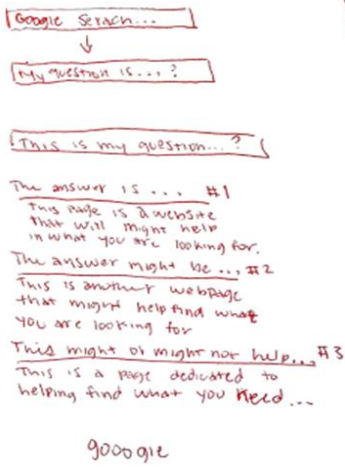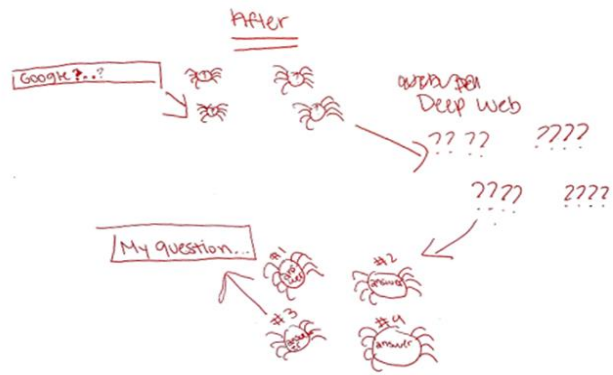

Figure 9 - Student Drawing 1
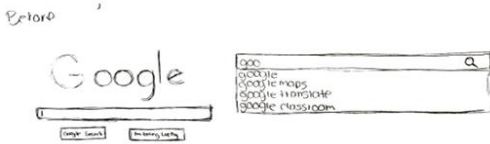
Figure 10 - Student Drawing 2

Figure 11 - Student Drawing 3

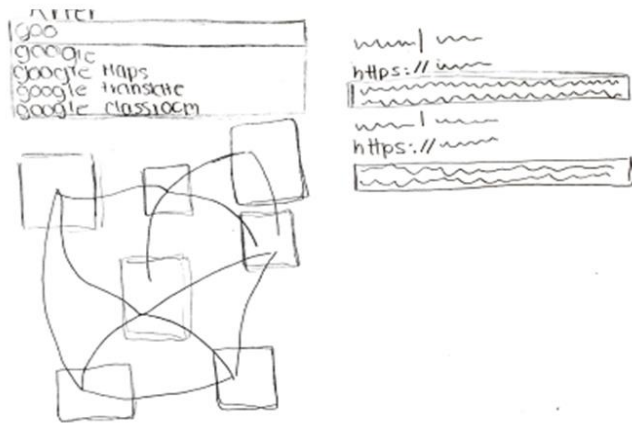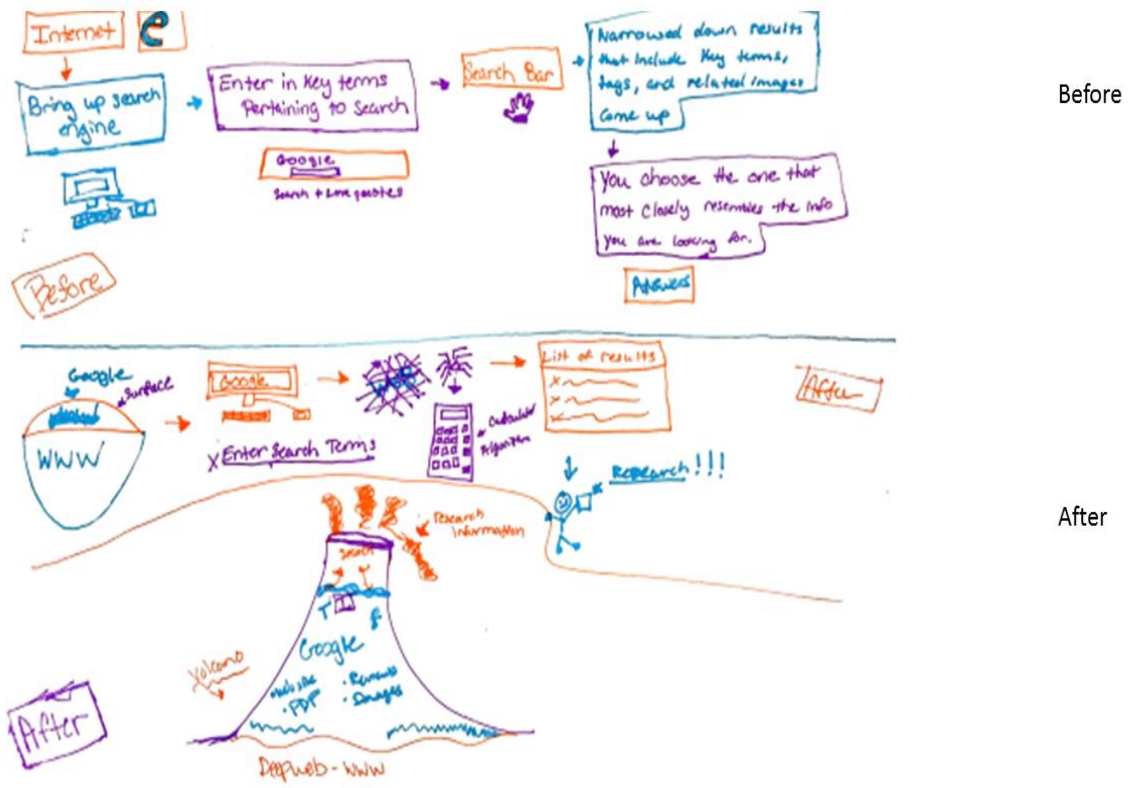Before

After

Figure 12 - Student Drawing 4
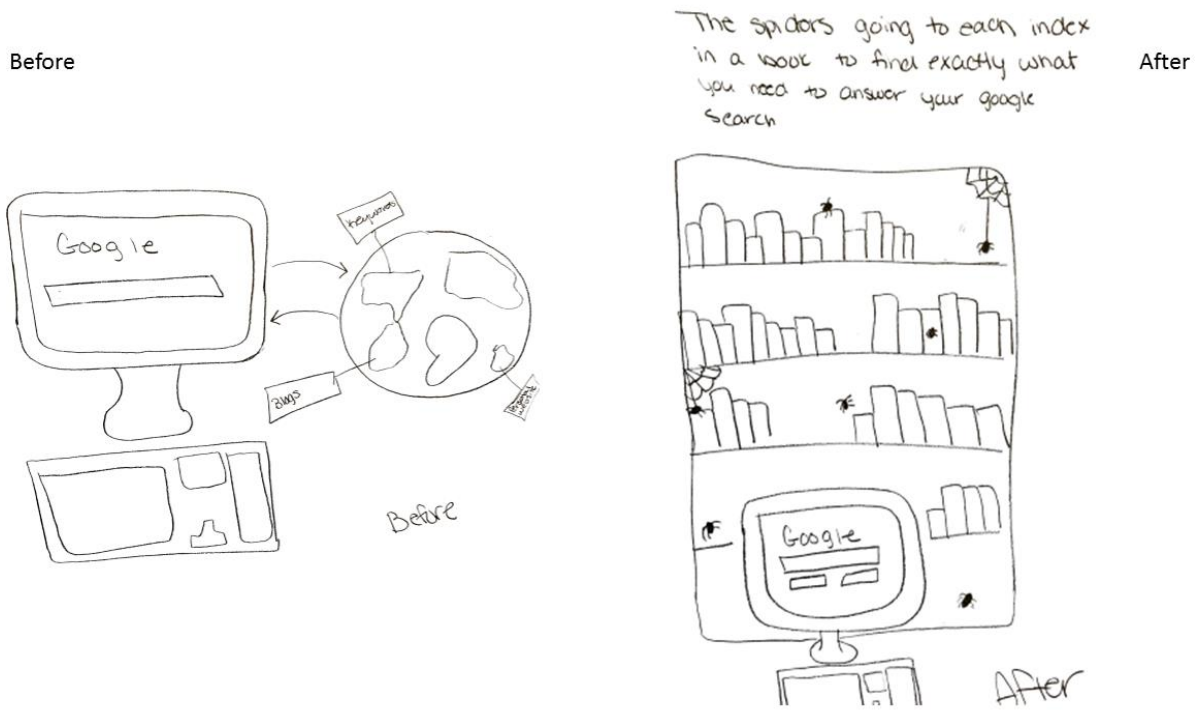
Figure 13- Student Drawing 5

These drawings demonstrate that some students started with a very low level of understanding (i.e. those who drew thought bubbles and pictures of the search box) while others had a more developed mental model (those who drew globes and computers). However, the intervention improved understanding for both groups of students. Those who began at the lower level universally included globes and clouds in their post-class drawings, while those who started at a more developed level often included spiders, links, webs and other evidence of an increased level of understanding in their drawings. Based on these before and after drawings, the intervention seems to have had a positive impact on students' fundamental conceptual knowledge of the structure of the information landscape and how Google search operates within that landscape. The before and after visual representations also indicate that having students complete conceptual drawings is a useful way to gauge learning in the information literacy classroom. Therefore, in response to the second research question of this study ("What impact

65

does this intervention have on students ability to accurately depict and describe how information is organized online and how Google indexes, organizes, searches, retrieves, and ranks that information?") it is evident that participating in the "Exploring the Googlesphere" intervention had a positive impact on students' ability to construct and depict more complex mental models of the structure of the information landscape and how Google search works within that landscape.

Developing Confidence

The third theme that emerged from an analysis of the data was related to an increased level of confidence on the part of the students with regard to their skills and knowledge of Google searching and to an improved perception of themselves as Google searchers. This theme emerged largely from open-ended responses to questions on the Critical Incident Questionnaire. Six students (50% of participants) reported that learning to use Google to its full potential as a tool for research was the most engaging aspect of the class and that this information would make them better researchers and better students. As one student put it *"I learned that there's many ways to use Google in our day to day lives"*. Another commented that, "Learning about how to search things on Google more specifically will be valuable to me in the future". A third student reported that, "I think I am a better user of Google as a result of this week". My favorite comment was from the student who responded that, "It was so informative that I went home and showed my family".

The third research question of this study asks: "What impact does this intervention have on students' perceptions of themselves as information-seekers and on Google as a tool for information-seeking?". Eleven out of twelve students reported that the intervention had a positive impact on their perceptions of themselves as researchers and of Google as a tool for research. For example, one student responded that, "I feel like I have learned things today that I

will carry with me forever. I use Google daily, everyone does and this helps tremendously*"* while another reported that, "I will be using these tips daily… For future research as a student and in my career. This is information that you carry with you for life and is something that you can also teach others." A third student said, "I feel like I can actually use Google and find things easier and faster". Only one student was neutral/negative and reported that, "I knew most this stuff". However, even that student recommended that the "Exploring the Googlesphere" intervention be used in future classes because "some students don't know how to use Google properly".

Usefulness of Intervention

The fourth and final theme that emerged was related to the usefulness of the intervention itself. Six students (50% of participants) responded that the entire lesson was engaging and three students specifically commented that the most surprising part of the class was how engaging and informative the class lectures and activities were. For example, one student reported that, "I was more interactive to the speaker than I expected to be". A second student responded that "I was surprised how engaged everyone seemed. It was nice to see that everyone really wanted to be there and learn". A common theme in these responses was captured by the student who said, "I was surprised by the fact that we were learning more in depth about Google, I found it very funny but very important". Not only did the students find the class engaging, they also found it useful and informative, as can be seen in Figure 14, a word cloud generated in response to the Google Search post-test question "What was the most useful thing you learned about Google
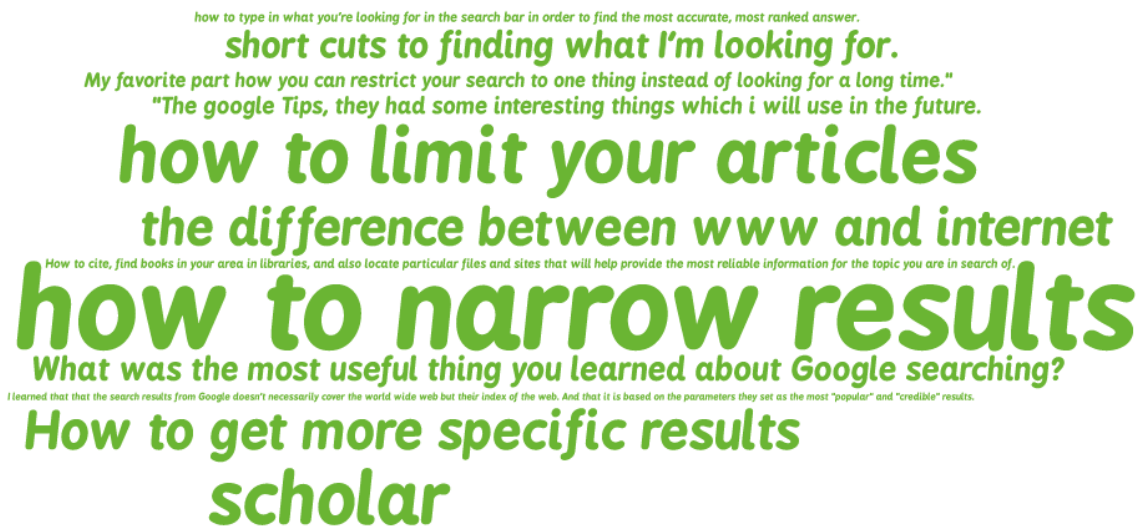
searching?".

how to type in what you're looking for in the search bar in order to find the most accurate, most ranked answer.
short cuts to finding what I'm looking for.
My favorite part how you can restrict your search to one thing instead of looking for a long time."
"The google Tips, they had some interesting things which i will use in the future.
how to limit your articles
the difference between www and internet
How to cite, find books in your area in libraries, and also locate particular files and sites that will help provide the most reliable information for the topic you are in search of.
how to narrow results
What was the most useful thing you learned about Google searching?
I learned that that the search results from Google doesn't necessarily cover the world wide web but their index of the web. And that it is based on the parameters they set as the most "popular" and "credible" results.
How to get more specific results
scholar

Figure 14 - "What was the most useful thing you learned about Google searching?" results

Students overwhelmingly reported that learning how to build more effective search strategies using advanced search operators and specialized resources like Google Scholar was the most valuable part of the learning experience. As one student said "I thought I was doing very well, especially on Google Scholar but her tips and tricks have really showed me that I have a TON to learn. I have already saved those to my laptop and will keep those for future use". Several students replied to the effect that, "I learned that I was not using Google to its full abilities".

The final question on the adapted Critical Incident Questionnaire was "Should the lesson on Google searching be a part of future GGC 1000 courses? Why or why not?". Response to this question was very positive. All twelve students responded affirmatively and recommended that the "Exploring the Googlesphere" intervention be included in future classes. One student replied that, "I think this will help me everyday! It was super useful and i think everyone should have to take it". Another responded, "Yes, It was helpful for me to learn different search strategies. And

Google searching is very prominent in our society so it would help to learn how to use it in a more efficient way" while a third student commented that "Most definitely, it is a great tool for college students to use, to help them become successful in their classes". The most enthusiastic response was from the student who said "Absolutely!! 100% yes. As a matter of fact, this should be on the MAIN GGC student page. I feel like this is very important information that everyone needs to know".

The "Exploring the Googlesphere" intervention was designed to help students gain conceptual knowledge and practical skills for improved Google literacy and these findings indicate that those objectives were met. It succeeds in meeting several of the learning outcomes identified by both the Association of College and Research Libraries (ACRL) and the Association of American Colleges & Universities (AAC&U). As such, this intervention as it stands can serve as the foundational building block in an integrated and scaffolded approach to information literacy instruction across the curriculum and throughout the college experience. As to fourth research question ("How can the intervention itself be refined to improve the learning experience of future students?"), this pilot run of the intervention and this study revealed several areas for refinement and improvement.

CHAPTER 5: DISCUSSION

If the question is how to best prepare students for college level research and how to help first-year students begin to develop the information literacy knowledge practices and dispositions that they need for living, learning, and working in the 21st-century, this study suggests that one first step may be to provide an intervention designed to increase first-year students' Google literacy. The responses to the Google Search pre-test and the pre-class drawings indicate that, in keeping with much of the extant literature, the first-year students who participated in this study lacked some of the foundational information literacy and Google literacy skills and understanding they need to succeed in college (Hargittai, 2010; Taylor & Keeter, 2010; Change the Equation, 2015; Goodman, Sands, & Coley, 2015). The "Exploring the Googlesphere" intervention provided an in-depth exploration of how Google works and how students can use that understanding to search for required information more effectively as recommended by much of the literature on improving students' Google literacy (Smallwood, 2015; Porter, 2015; Asher, 2015). The fourth phase of the action research process is to share the results of the research and any insights that the researcher has gleaned from the analysis of and reflection on the data and evidence. This provides the researcher the opportunity to explicitly connect the research findings to the purpose of the study and to connect her research to the practice of information literacy within the discipline of first-year studies and to contribute to the body of knowledge in those fields.

The purpose of this pilot study was to explore how participating in the Google literacy intervention impacted the research skills and attitudes of first-year students enrolled in a first-year seminar course. The results of this pilot study indicate that the intervention was successful in helping students to expand their conceptual and practical research toolkits, as recommended

by the literature on best practices in information literacy instruction (Head, 2013a; Cole, Napier, & Marcum, 2015; Asher, 2015; Gross & Latham, 2012). For example, the pre- and post-class drawings provide evidence that this goal of the intervention was met because students drew more nuanced and informed conceptual representation of how Google works following the intervention. The results of the Google Searching pre- and post-test also reveal an increased ability to define and articulate their understanding of the Google search process and an increased ability to construct effective search strategies using search operators and limiters.

The findings in response to the questions related to the students' perceptions of themselves as researchers and Google as a tool for research indicate that participating the in the intervention was an information literacy learning experience that encouraged students to see themselves (intellectually and psychosocially) as apprentice scholars in an academic community, in keeping with much of the literature on increasing students' self-concept (Jackson, 2007; Orme, 2008; Cook & Klipfel, 2015; Purdy & Walker, 2013; Gatten, 2004). This literature is also relevant to the findings that indicate that the intervention successfully demonstrated the value and relevance of Google literacy in particular and information literacy in general to the study participants (Cook & Klipfel, 2015; Gatten, 2004; Asher, 2015; Badke, 2015).

A secondary purpose of this study was to determine the effectiveness and appropriateness of the Google literacy intervention ("Exploring the Googlesphere") materials and activities. As the research indicates, a Google-specific information literacy intervention that connects readings, activities, and assessments to students' interests and that taps into students' prior knowledge and experience in a way that authentically connects to their personal and academic lives is a meaningful approach to learning and to developing the information literacy, knowledge, practices and dispositions that educators want first-year students to embody (Porter, 2014; Cook

& Klipfel, 2015). The pilot test of the "Exploring the Googlesphere" intervention is promising since it met its goals and demonstrated the hallmarks of significant learning experience for the students.

Following Fink's (2013) model for creating significant learning opportunities, the intervention itself was evaluated by asking the following questions:

- Did the intervention provide foundational knowledge?

- Did the intervention provide opportunities for practical application?

- Did the intervention encourage students to integrate learning with other academic and personal experiences?

- Did the intervention encourage students to find value in becoming more Google literate?

- Did the intervention help students learn more about how they learn and encourage other metacognitive habits?

These questions provide a framework with which to discuss the impact and effect of the "Exploring the Googlesphere" intervention in terms of its success in creating meaningful learning experiences that engage attention, are transferable to other contexts, have relevance for real life, improve students' confidence as searchers and scholars, and increase student satisfaction with the research process as recommended by the literature on best practices for information literacy instructional design (Hess, 2015; Keller, 1987; Fink, 2013).

Did the intervention provide foundational knowledge?

The first learning goal of the intervention was to help students develop an accurate understanding of how information is organized online and how Google operates as a tool that retrieves and ranks information sources from across the World Wide Web using a proprietary

algorithm. This goal aligns with the first research question of this study ("What impact does this intervention have on first-year students' ability to accurately depict and describe how information is organized online and how Google searches retrieve that information?"). In both the Google Searching post-test and the post-class drawings students were able to discuss, describe, and depict that Google searching relies not on magic but on algorithms and spiders, as predicted in the relevant literature on information literacy and Google searching (Asher, 2011; Asher 2015; Porter, 2014; Brier & Lebbin, 2014). The intervention seems, therefore, to have succeeded in providing students with some foundational knowledge and indicates that the answer to the first research question of the study is that the intervention had a positive impact on students' understanding of how Google search operates.

Did the intervention provide opportunities for practical application?

The second goal of the intervention was to teach first-year students how to use Google search operators and filters to construct effective search strategies. This goal aligns with the second research question of this study ("What impact does this intervention have on first-year students' ability to construct effective and efficient Google search strategies?"). The pre-class drawings and the Google Searching pre-test results both confirmed what the literature suggests, that students struggle with understanding how Google search works at a fundamental level and that they lack the skills to conduct advanced search strategies (Head, 2013a; Cole, Napier, & Marcum, 2015; Head & Eisenberg, 2010; Asher, 2015; Smallwood, 2015; Porter, 2014; Holman, 2010; Bloom & Deyrup, 2012). The "Exploring the Googlesphere" mini-lecture on search operators proved to be an effective instructional strategy and met this goal of the intervention as evidenced by students' increased ability to correctly identify and use advanced Google search operators on the Google Searching post-test. The intervention included opportunities in class and

73

after class for practical application when students were asked to perform actual Google searches using the search operators to which they were introduced during the class. That students were able to perform these more advanced search strategies successfully indicates that the answer to the second research question is that the intervention had a positive impact on students' abilities to construct more effective and efficient search strategies.

Did the intervention encourage students to integrate learning with other academic and personal experiences?

The Google Search pre-test and the pre-class drawing both required the first-year students to tap into their prior knowledge of and experience with Google searching. This is in keeping with the literature on best practices in information literacy instruction for first-year students which recommends that educators build bridges between where are students are and where we faculty, staff, and librarians want them to be (Badke, 2015; Smallwood, 2015; Porter, 2015; Asher, 2015). The "Exploring the Googlesphere" intervention also laid the groundwork for students' future experiences as academic researchers by providing a springboard for the exploration of academic resources by introducing students to the many uses of Google as a research tool. By starting with a familiar source that students have used in their personal and academic lives before and by acknowledging that source to be a valuable resource for future academic research, students were encouraged to take what they have learned from the intervention and apply it to the future personal and academic experiences (Connaway, et al., 2011; Purdy, 2012; Hartsell-Gundy et al., 2009; Head & Eisenberg, 2011; Holman, 2011).

Did the intervention encourage students to find value in becoming more Google literate?

The third goal of the intervention was to encourage first-year students to begin to answer their own questions about the usefulness of Google as a tool for research. This goal was

predicated on the idea that increasing students' Google literacy was one way to begin moving them into the liminal space where they could begin to cross the threshold into understanding and valuing searching for information as a strategic process of exploration.

The Framework for Information Literacy in Higher Education lists several dispositions that first-year students who are developing their information literacy will hopefully adopt as they grow towards valuing the process of searching for information and viewing themselves as researchers. These include students being able to understand and appreciate that "first attempts at searching do not always produce adequate results" and that "information sources vary greatly in content and format and have varying relevance and value, depending on the needs and nature of the search" (ACRL, 2016, p. 9). The Framework also encourages educators to find ways to help first-year students "recognize the value of browsing and other serendipitous methods of information gathering" and to "persist in the face of search challenges" (ARCL, 2016, p. 10). Responses to the Critical Incident Questionnaire responses reveal that students were beginning to adopt some of these dispositions. The responses to the Critical Incident Questionnaire also indicated that students found value in process of learning more about Google as a tool for research and that they planned to use what they learned in the class to continue improving as researchers in the future. These responses seem to indicate that these first-year students did come to care more about their level of Google literacy as a result of participating in the "Exploring the Googlesphere" intervention. In examining students' ability to transfer and apply learning to other contexts and situations and the increased value they attached to becoming Google literate both indicate that in answer to the third research question ("What impact does this intervention have on first-year students' perceptions of themselves as information-seekers and on Google as a tool for information-seeking?") the intervention had a positive impact.

Did the intervention help students learn more about how they learn and encourage other metacognitive habits?

This intervention was specifically and intentionally designed to meet first-year students where they are experientially and cognitively as set forth in the literature on cognitive development and information literacy for first-year students (Skipper, 2005; Tomlinson & Johnson, 2014; Orme, 2008; Gatten, 2004; Weiler, 2005; Jackson, 2007; Porter, 2014). For example, the "Exploring the Googlesphere" mini-lecture on search operators provided clear directives that could be understood and appreciated by dualists while also introducing multiplists to the inherent ambiguity involved in effective search strategies. Many of the open-ended questions on the Google Search pre- and post-tests and the Critical Incident Questionnaire invited students to reflect on what they had learned and how they might use their new knowledge and skills moving forward. The Critical Incident Questionnaire in particular, asked students to consider how their perceptions of themselves as researchers had changed based on their experience in the class. While the intervention was designed to encourage students to develop more sophisticated metacognitive approaches to searching for information, it is difficult to determine the extent to which this occurred. Thus, in answer to the fourth research question of the study ("How can this intervention be refined to improve the learning experience of future first-year students?"), it is recommended that the action research design process for future iterations of this study develop an instrument or method by which to determine whether the intervention impacts students' metacognition.

Recommendations for Future Research

In addition to the specific recommendation made in the paragraph above, future research is encouraged to determine the extent to which participating in a Google literacy intervention

76

impacts the development of more traditional academic research skills and understandings for first-year students and to determine the longitudinal impact of participation in the "Exploring the Googlesphere" intervention on both students' "habits of mind" and their self-concept as scholars.

Further research should address the limitation arising out of the brevity of the pilot intervention. Trying to teach students about the underlying structure of the Internet and the difference between the Internet and the World Wide Web, introducing new concepts and knowledge about Google search, including search algorithms, Page Rank, spider bots, etc., and helping students develop advanced search skills and strategies all in a forty minute time period was too much. As one student commented, "I just wish we had more time with her. I feel like we just touched the surface on what she is capable of showing us". Or as another student said, "I'm intrigued and would like to learn more, the session went too fast". The intervention could have students watch the instructional videos before class rather than in class, and the in-class lesson could be devided into two parts, one covering the structure of the information landscape and a second class devoted to learning more about Google searching specifically. The intervention could be expanded into a three-class sequence that includes a lesson on using Google Scholar specifically as a bridge between Google and more academic resources (e.g. library electronic collections and subscription databases).

A third recommendation for future research is related to the in-class drawings. Student reactions to the drawing activity were mixed. Four students responded that the drawing activity was the most engaging part of the class and one student wrote, "I was most engaged when we had to draw our before and after perspective of Google searching". On the other hand, two students responded that the drawing activity was the least engaging part of the class. One thought the drawing activity was the most helpful part of the class while another thought it was the most

confusing part of the class. A future study could alter the intervention to refine the process of completing the before-class and after-class drawings. For example, it may be more fruitful in the future to have students complete the drawings in pairs or to share their drawings with one another in order to provide peer feedback that can help clarify and expand thinking and learning.

Finally, this study is limited due the small sample size and even smaller number of participants who successfully completed all of the data collection tools of the current study. A larger sample would allow for more meaningful quantitative and qualitative analysis. Future studies using more class sections and seeking ways to bolster voluntary participation or employing more refined study procedures to increase the number of participants and the completion of all the data collection tools is recommended.

Implications for Practice

The results of the current study can be used to refine the "Exploring the Googlesphere" intervention and the data collection instruments and procedures but these results also provide evidence of the efficacy of a Google literacy intervention and of the usefulness of conducting an action research study. The rationale behind and the ADDIE design model process involved in creating the "Exploring the Googlesphere" intervention can serve as a model that can be adopted and adapted by other first-year educators and practitioners (whether faculty, staff, or librarians) of how to create similar or related interventions. Likewise, the study itself can serve as a model for educators of how to design and conduct an action research project for their own first-year experience programs and courses.

In addition, and more specifically, the findings of this particular study provide support to the argument that incorporating Google literacy as an explicit point of instruction for those students is both useful and necessary. The findings from this study provide evidence for first-

year educators that Google literacy instruction can be a valuable part of information literacy instruction and that there is a need for explicit information literacy instruction in the first-year experience, a point which is reinforced in much of the literature on information literacy for first-year students (Head & Eisenberg, 2011; Chambers et al., 2013; Raven, 2012; Sorenson & Dahl, 2008; Bloom & Deyrup, 2012; Smallwood, 2015).

Conclusion

There is a need to redefine and redesign our information literacy interventions to reflect that first-year college students are novice researchers who struggle with the research process and to recognize that these students need scaffolded and intentional guidance and support if they are to engage with the interconnected concepts, knowledge practices, and dispositions that define information literacy. These powerful practices in searching for and locating information are critical competencies, but novice searchers have few, if any, of these research practices and dispositions (Asher, 2015).

This study sought to determine if an information literacy intervention targeted at improving Google search understandings and skills could be successful in getting first-year college students to engage in the process of learning essential Google literacy skills. It also sought to demonstrate to educators that meeting students at their developmental level using technology with which they are familiar (in this case Google search which is the default mode for many first-year students) is more likely to lead them to embrace more complex research methods than simply telling them to forget Google and become "real researchers". This study suggests there are ways educators can encourage students to use Google more effectively without encountering undue resistance. It provides modest evidence of the efficacy of the "Exploring the foundation from which to scaffold future information literacy instruction. Expecting first-year

students to become expert searchers in the vast and unknown pool of academic library resources is akin "to showing them the pool and then shoving them into the deep end" and "is more likely to foster despair than self-reliance" (Kolowich, 2011, para. 10). Instead, educators can use interventions like "Exploring the Googlesphere" to encourage students start wading in to academic research.

REFERENCES

Ainsworth, S., Prain, V., & Tytler, R. (2011). Drawing to learn in science. *Science*, *333*(6046), 1096-1097.

Allen, M. J. (2004). *Assessing academic programs in higher education*. Boston, MA: Anker

Alleyne, R. (2011, February 11). Welcome to the information age: 174 newspapers a day. *The Telegraph*. Retrieved from http://www.telegraph.co.uk/.

Asher, A. (2015). Search epistemology: Teaching students about information discovery. In Swanson, T. & Jagman, H. (Eds.), *Not just where to click: Teaching students how to think about information* (pp. 139-154), Chicago: Association of College and Research Libraries.

Association of American Colleges & Universities. (n.d.). *Information literacy VALUE rubric*. Retrieved from https://www.aacu.org/value/rubrics/information-literacy

Association of College & Research Libraries. (2015). *Framework for information literacy in higher education*. Retrieved from http://www.ala.org/acrl/sites/ala.org.acrl/files/content/issues/infolit/Framework_ILHE.pdf

Badke, W. B. (2015). Expertise and authority in an age of crowdsourcing. In Swanson, T. & Jagman, H. (Eds.), *Not just where to click: Teaching students how to think about information* (pp. 191-215), Chicago: Association of College and Research Libraries.

Badke, W. (2008). A rationale for information literacy as a credit-bearing discipline. *Journal of information literacy*, *2*(1), 1-22.

Bloom, B., & Deyrup, M. (2012, Nov.). *The truth is out: How students REALLY search.* Paper presented at the Charleston Library Conference, Charleston, SC. Retrieved from http://dx.doi.org/10.5703/1288284315103

Bohn, R., & Short, J. (2012). Measuring consumer information. *International Journal of Communication, 6*, 980-1000.

Brier, D. J., & Lebbin, V. K. (2015). Learning information literacy through drawing. *Reference Services Review, 43*(1), 45-67.

Brookfield, S. D. (1995). *Becoming a critically reflective teacher*. San Francisco: Jossey-Bass.

Brookfield, S.D. (n.d.). *The critical incident questionnaire*. Retrieved from https://static1.squarespace.com/static/5738a0ccd51cd47f81977fe8/t/5750e567f699bbceac6e97f5/1464919400130/CIQ.pdf

Brooks, B., Gilbuena, D., Krause, S., & Koretsky, M. (2014). Using word clouds for fast, formative assessment of students' short written responses. *Chemical Engineering Education*, *48*(4), 190-198.

Bruce, C. S. (2004, June) Information literacy as a catalyst for educational change. A background paper. In Danaher, Patrick A. (ed.) *Lifelong Learning: Whose responsibility and what is your contribution?*, Proceedings of the 3rd International Lifelong Learning Conference, Yeppoon, Queensland.

Bruce, C. (1997). *The seven faces of information literacy*. Adelaide: Auslib Press.

Caruso, J. B., & Kvavik, R. (2005). *ECAR study of students and information technology 2005: Convenience, connection, control, and learning*. CO: EDUCAUSE Center for Applied Research.

Carr, N. G. (2010). *The shallows: What the Internet is doing to our brains*. New York: W.W. Norton.

Chambers, W. L., Smith, L. P., Orvis, J. N., & Caplinger, C. (2013). Developing a topic-centered

    first-year seminar with an emphasis on information literacy at a large regional university.

    College & Undergraduate Libraries, 20(1), 52-71.

Change the Equation. (2015). *Does not compute: The high cost of low technology skills in the*

    U.S.--and what we can do about it. Retrieved from http://changetheequation.org/does-not-

    compute%20

Cidell, J. (2010). Content clouds as exploratory qualitative data analysis. *Area*, *42*(4), 514-523.

Cole, A., Napier, T., & Marcum, B. (2015). Generation Z: Facts and fictions. In Swanson, T. &

    Jagman, H. (Eds.), *Not just where to click: Teaching students how to think about*

    information (pp. 139-154), Chicago: Association of College and Research Libraries.

Cook, D. B., & Klipfel, K. M. (2015). How do our students learn? An outline of a cognitive

    psychological model for information literacy instruction. *Reference & User Services*

    Quarterly, *55*(1), 34-41.

Connaway, L. S., Dickey, T. J., & Radford, M. L. (2011). "If it is too inconvenient I'm not going

    after it:" Convenience as a critical factor in information-seeking behaviors. *Library &*

    Information Science Research, *33*(3), 179-190.

Davis, A. L. (2013). Using instructional design principles to develop effective information

    literacy instruction: The ADDIE model. *College & Research Libraries News, 74*(4), 205-

    207.

Denscombe, M. (2014). *The good research guide: for small-scale social research projects*.

    Berkshire, UK: McGraw-Hill Education.

Doherty, J. and Ketchner, K. (2005). Empowering the intentional learner: A critical theory for information literacy instruction. *Library Philosophy and Practice*. Paper 70. Retrieved from http://digitalcommons.unl.edu/libphilprac/70

Fallows, D. (2005). *Search engine users: Internet searchers are confident, satisfied, and trusting - but they are also unaware and naive*. *Pew Internet & American Life Project.* Washington DC: Pew Research Center. Retrieved from http://www.pewinternet.org/files/old-media/Files/Reports/2005/PIP_Searchengine_users.pdf.pdf

Fink, L. D. (2013). *Creating significant learning experiences: An integrated approach to designing college courses*. San Francisco: Jossey-Bass.

Fosnacht, K. (2015, March 25-28). *Information use during the first college year: Findings from the NSSE experiences with information literacy module*. Paper presented at ACRL 2015, Portland, Oregon. Retrieved from http://nsse.indiana.edu/pdf/presentations/2015/ACRL_2015_Fosnacht_paper.pdf

Gaffney, M. (2008). Participatory action research: An overview--what makes it tick? *Kairaranga*, *9*, 9-15.

Gatten, J. N. (2004). Student psychosocial and cognitive development: theory to practice in academic libraries. *Reference Services Review*, *32*(2), 157-163.

Georgas, H. (2013). Google vs. the library: student preferences and perceptions when doing research using Google and a federated search tool. *portal: Libraries and the Academy, 13*(2), 165-185.

Georgia Gwinnett College. (n.d.). *GGC fast facts*. Retrieved from http://www.ggc.edu/about-ggc/at-a-glance/ggc-facts/.

Goodman, M. J., Sands, A. M., & Coley, R. J. (2015). *America's skills challenge: Millennials and the future*. Retrieved from http://www. ets. org/s/research/30079/index. html.

Google. (n.d.). *Google search education: Power searching with Google*. Retrieved from https://coursebuilder.withgoogle.com/sample/course?use_last_location=true

Greenfield, G. M., Keup, J. R., & Gardner, J. N. (2013). *Developing and sustaining successful first-year programs: A guide for practitioners*. San Francisco, CA; Jossey-Bass.

Gross, M., & Latham, D. (2012). What's skill got to do with it?: Information literacy skills and self- views of ability among first- year college students. *Journal of the American Society for Information Science and Technology, 63*(3), 574-583.

Gross, M., & Latham, D. (2009). Undergraduate perceptions of information literacy: defining, attaining, and self-assessing skills. *College & Research Libraries, 70*(4), 336-350.

Gross, M., & Latham, D. (2007). Attaining information literacy: An investigation of the relationship between skill level, self-estimates of skill, and library anxiety. *Library & Information Science Research, 29*(3), 332-353.

Hargittai, E. (2010). Digital na(t)ives? Variation in internet skills and uses among members of the "net generation". *Sociological inquiry*, *80*(1), 92-113.

Hargittai, E., Fullerton, L., Menchen-Trevino, E., & Thomas, K. Y. (2010). Trust online: Young adults' evaluation of web content. *International journal of communication, 4*, 27.

Hartsell-Gundy, A., Resnis, E., Misco, M., & Gibson, K. (2009, May). *What information literacy means to me: Collaborating with faculty to understand student perceptions of information literacy.* Paper presented at LOEX Annual Conference, Denver, CO. Retrieved from https://sc.lib.miamioh.edu/bitstream/handle/2374.MIA/5238/resnis%20slides%20loex.pdf?sequence=1&isAllowed=y

Head, A. J. (2013a). *Learning the ropes: How freshmen conduct course research once they enter college.* Project Information Literacy Research Report. Retrieved from http://www.projectinfolit.org/uploads/2/7/5/4/27541717/pil_2013_freshmenstudy_fullreportv2.pdf

Head, A.J. (2013b). *Learning curve: How college graduates solve information problems once they join the workplace.* Project Information Literacy Research Report. Retrieved from http://www.projectinfolit.org/uploads/2/7/5/4/27541717/pil_fall2012_workplacestudy_fullreport-1.pdf

Head, A. J. & Eisenberg, M. B. (2010). *Truth be told: How college students evaluate and use information in the digital age*. Project Information Literacy Research Report. Retrieved from http://www.projectinfolit.org/uploads/2/7/5/4/27541717/pil_fall2010_survey_fullreport1.pdf

Head, A. &. Eisenberg, M. (2011). How college students use the Web to conduct everyday life research. *First Monday, 16*(4). Retrieved from http://www.firstmonday.org/ojs/index.php/fm/article/view/3484/2857#p5

Hess, A. N. (2015). Motivational design in information literacy instruction. *Communications in Information Literacy*, *9*(1), 44-59.

Holman, L. (2011). Millennial students' mental models of search: Implications for academic librarians and database developers. *The Journal of Academic Librarianship, 37*(1), 19-27.

Hilbert, M. (2012). How much information is there in the "information society"?. *Significance, 9*(4), 8-12.

Ito, M. (2013, Mar. 8). What teens get about the Internet that their parents don't. *The Atlantic*.

    Retrieved from https://www.theatlantic.com/technology/archive/2013/03/what-teens-get-

    about-the-internet-that-parents-dont/273852/

Jackson, R. (2007). Cognitive development: the missing link in teaching information literacy

    skills. *Reference & User Services Quarterly*, *46*(4), 28-32.

Keller, J. (1987). Development and use of the ARCS model of instructional design. *Journal of*

    Instructional Development, 10(3), 2-10. Retrieved from

    http://www.jstor.org.proxy.kennesaw.edu/stable/30221294

Kellner, D., & Share, J. (2007). Critical media literacy, democracy, and the reconstruction of

    education. In D. Macedo & S.R. Steinberg (Eds.), *Media literacy: A reader* (pp. 3-23).

    New York: Peter Lang Publishing.

Kember, D. (2000). *Action learning and action research: Improving the quality of teaching and*

    learning. London : Sterling, Va.: Kogan Page.

Kim, Y. (2011). The pilot study in qualitative inquiry: Identifying issues and learning lessons for

    culturally competent research. *Qualitative Social Work*, *10*(2), 190-206.

Klipfel, K. & Carroll, A. "Librarians as action researchers: A practical framework for evidence-

    based information literacy instruction." LOEX 2015 Annual Conference, Denver, CO,

    May 1, 2015.

Kolowich, S. (2001, August 22). What students don't know. *Inside Higher Ed*. Retrieved from

    https://www.insidehighered.com/news/2011/08/22/erial_study_of_student_research_habit

    s_at_illinois_university_libraries_reveals_alarmingly_poor_information_literacy_and_skil

    ls

Kuh, G. D., & Gonyea, R. M. (2003). The role of the academic library in promoting student

    engagement in learning. *College & Research Libraries*, *64*(4), 256-282.

Kuh, G. D., Kinzie, J., Schuh, J. H., & Whitt, E. J. (2010). *Student success in college: Creating*

    conditions that matter. San Francisco, CA: Jossey-Bass.

Latham, D., & Gross, M. (2013). Instructional preferences of first-year college students with

    below-proficient information literacy skills: A focus group study. *College & Research*

    Libraries, 74(5), 430-449.

Lerner, N. (2007). Drawing to learn science: legacies of Agassiz. *Journal of Technical Writing*

    and Communication, *37*(4), 379-394.

Niu, X., Hemminger, B. M., Lown, C., Adams, S., Brown, C., Level, A., McLure,M., Powers,

    A., Tennant, M., & Cataldo, T. (2010). National study of information seeking behavior of

    academic researchers in the United States. *Journal of the American Society for*

    Information Science and Technology, *61*(5), 869-890.

Orme, W. A. (2008). Information literacy and first- year students. *New Directions for Teaching*

    and Learning, *2008*(114), 63-70.

Perry, W. G. (1999). *Forms of intellectual and ethical development in the college years: A*

    scheme. San Francisco, Calif: Jossey-Bass Publishers.

Porter, B. (2014). Designing a library information literacy program using threshold concepts,

    student learning theory, and millennial research in the development of information literacy

    sessions. *Internet Reference Services Quarterly, 19*(3-4), 233-244.

Purcell, K., Rainie, L., Heaps, A., Buchanan, J., Friedrich, L., Jacklin, A., & Zickuhr, K. (2012).

    How teens do research in the digital world. Pew Internet & American Life Project.

Washington DC: Pew Research Center. Retrieved from

http://www.pewinternet.org/2012/11/01/how-teens-do-research-in-the-digital-world/

Purdy, J. P., & Walker, J. R. (2013). Liminal spaces and research identity: The construction of

introductory composition students as researchers. *Pedagogy*, *13*(1), 9-41.

Purdy, J. P. (2012). Why first-year college students select online research resources as their

favorite. *First Monday, 19*(7). Retrieved from

http://www.firstmonday.org/ojs/index.php/fm/article/view/4088/3289#1

Quillin, K., & Thomas, S. (2015). Drawing-to-learn: a framework for using drawings to promote

model-based reasoning in biology. *CBE-Life Sciences Education*, *14*(1), es2.

Raven, M. (2012). Bridging the gap: Understanding the differing research expectations of first-

year students and professors. *Evidence Based Library and Information Practice, 7*(3), 4-

31.

Sagor, R. (2000). *Guiding school improvement with action research*. Alexandria, VA: ASCD.

Shirky, C. (2008, September 19). *It's not information overload. It's filter failure* [Video file].

Retrieved from https://youtu.be/LabqeJEOQyI.

Skipper, T. L. (2005). *Student development in the first college year: A primer for college

educators*. National Resource Center for the First-Year Experience and Students in

Transition, University of South Carolina.

Smallwood, C. (Ed.). (2015). *The complete guide to using Google in libraries: instruction,

administration, and staff productivity* (Vol. 1). London: Rowman & Littlefield.

Sorensen, C., & Dahl, C. (2008). Google in the research and teaching of instruction librarians.

The Journal of Academic Librarianship, 34(6), 482-488.

Swanson, T. (2005). Teaching students about information: Information literacy and cognitive authority. *Research strategies, 20*(4), 322-333.

Swanson, T. & Jagman, H. (Eds.), (2015). *Not just where to click: Teaching students how to think about information.* Chicago: Association of College and Research Libraries.

Spence, L. D. (2001). The case against teaching. *Change: The magazine of higher learning*, *33*(6), 10-19.

Taylor, P., & Keeter, S. (2010). Millennials: A portrait of generation next. *Pew Internet & American Life Project.* Washington DC: Pew Research Center. Retrieved from http://assets.pewresearch.org/wp-content/uploads/sites/3/2010/10/millennials-confident-connected-open-to-change.pdf

Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation, 27*(2), 237-246.

Tomlinson, C., & Johnson, C. (2015). Crafting the perfect blend: Student cognitive development theory and threshold concepts for student success. *LOEX Quarterly*, *41*(4), 5.

Trondsen, M., & Sandaunet, A. G. (2009). The dual role of the action researcher. *Evaluation and program planning*, *32*(1), 13-20.

Upcraft, M. L., Gardner, J. N., & Barefoot, B. O. (2004). *Challenging and supporting the first-year student: A handbook for improving the first year of college*. San Fransisco, CA; Jossey-Bass.

U.S. News & World Report. (n.d.). *Campus ethnic diversity: Regional colleges (South).* Retrieved from http://colleges.usnews.rankingsandreviews.com/best-colleges/rankings/regional-colleges/campus-ethnic-diversity

Van Teijlingen, E., & Hundley, V. (2002). The importance of pilot studies. *Nursing standard*, *16*(40), 33-36.

Vezzosi, M. (2006). Information literacy and action research. *New Library World, 107*(7), 286-301. Retrieved from doi:http://dx.doi.org/10.1108/03074800610677272

Weiler, A. (2005). Information-seeking behavior in generation Y students: Motivation, critical thinking, and learning theory. *The Journal of Academic Librarianship, 31*(1), 46-53.

Weinberger, D. (2014). *Too big to know: Rethinking knowledge now that the facts aren't the facts, experts are everywhere, and the smartest person in the room is the room*. New York: Basic Books.

WhatIs. (n.d.). *Definition: search operators*. Retrieved from http://whatis.techtarget.com/definition/search-operator

Wiggins, G. P., & McTighe, J. (2005). *Understanding by design*. Alexandria, VA: ASCD.

Wilkinson, L. (2015). Theories of knowledge in library and information science. In Swanson, T. & Jagman, H. (Eds.), *Not just where to click: Teaching students how to think about information* (pp. 13-36), Chicago: Association of College and Research Libraries.

Appendix A

Design of the "Exploring the Googlesphere" Intervention

The design process of the "Exploring the Googlesphere" intervention used several interconnected theories and related practical models of instructional design. The design process was influenced in part by Wiggins & McTighe's (2005) *Understanding by Design* and their model of backwards design. This model begins by identifying the enduring understandings and essential questions that frame the purpose of the intervention and in determining what students will know and be able to do as a result of participating in the intervention. The second step in this model is to decide what authentic assessments (performance tasks, written responses, self-assessments, etc.) will provide evidence of student learning. Finally, the learning plan that will guide students to mastery of the assessments and the content is developed.

The design of the intervention was also influenced by Dee Fink's (2013) *Creating Significant Learning Experiences.* The relevant parts of the design model for this intervention are establishing learning goals, designing authentic mechanisms for feedback and instruction, and developing teaching and learning activities. Both of these models were used in conjunction as part of the larger design process based on the ADDIE model of instructional design.

The ADDIE model is a comprehensive and widely used model of instructional design that connects and extends the components of the backwards design and significant learning design. The ADDIE model consists of five phases: analysis, design, development, implementation, and evaluation (Davis, 2013). Figure 15 indicates the ways in which these three models of instructional design are aligned and integrated with one another.
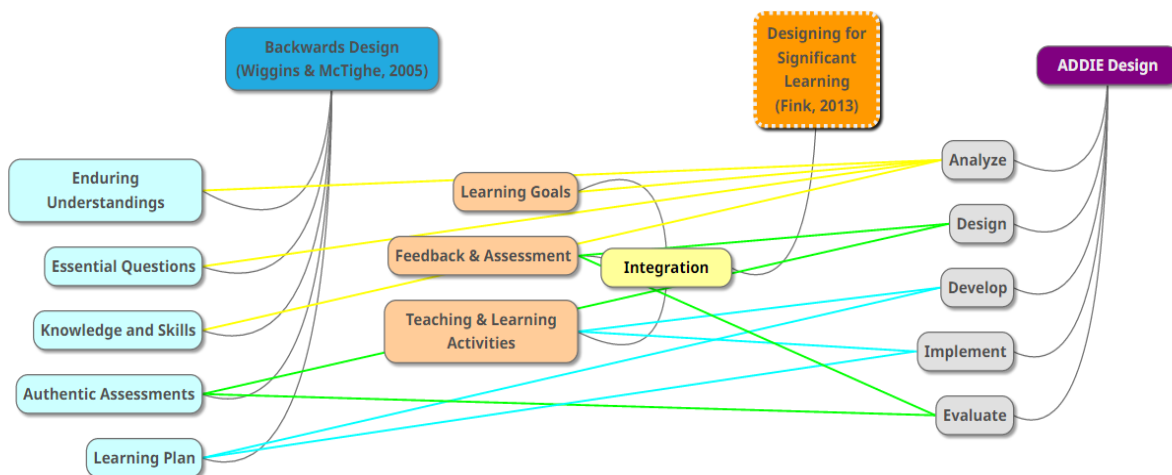
Figure 15 - Instructional Design Model Alignment

The ADDIE model provided the foundation for the holistic design and development of the "Exploring the Googlesphere" intervention. An examination of each phase and how it was applied to the development of the intervention follows.

Analyze Learning Goals & Outcomes

In this phase, the instructor determines the goals and desired outcomes of the learning experience (Davis, 2013). This process of analysis is focused on determining what enduring understandings, essential questions, knowledge and skills comprise the learning goals of the related learning experience and on specifying the goals for the instruction and the student learning outcomes to be achieved (Gross, Latham, and Armstrong, 2012). The enduring understandings and essential questions of the "Exploring the Googlesphere" intervention were drawn largely from the Georgia Gwinnett College Information Literacy Omnibus, a document that aligns the Framework for Information Literacy in Higher Education and the AAC&U VALUE rubrics for Information Literacy and Critical Thinking to the GGC information literacy program of instruction and specifically to the research process as we teach it on our campus. In particular, the outcomes for this intervention were drawn from the following:

ACRL Framework "Searching as Strategic Exploration", students will be able to:

- match information needs and search strategies to appropriate search tools;

- design and refine needs and search strategies as necessary, based on search results; and

- understand how information systems are organized in order to access relevant information (ACRL, 2015, p. 9).

AAC&U VALUE Information Literacy Rubric, students will be able to:

- "accesses information using simple search strategies" (Access the Needed Information – Milestone 2) and

- "demonstrates ability to refine search" (Access the Needed Information – Milestone 3)

Based on the standards, knowledge practices, dispositions, and skills outlined and adapted in the GGC Information Literacy Omnibus and in analyzing the information literacy goals and objectives for the first-year students enrolled in GGC 1000 led to the development of the following student learning outcomes:

After completing the "Exploring the Googlesphere" intervention, students will begin to:

- Develop an accurate understanding of how information is organized online and how Google operates as a tool that retrieves and ranks information sources according to a proprietary algorithm from across the World Wide Web. (Enduring Understanding)

- Determine their own answers to questions such as:
    - How does the WWW work?
    - How does the Internet work? What's the difference?
    - What is the difference between the open web and the hidden/deep web, and the dark web?
    - How does Google search work?
    - How are results returned?
    - How can we use Google more effectively?
  (Essential Questions)

- Use Google search operators and filters to construct effective search strategies (Knowledge & Skills)

Design of Authentic Assessment, Feedback Mechanisms, and Teaching/Learning Plan

In this phase "an outline of instructional strategies is created and learning activities and assessment are determined" (Davis, 2013, p. 205). Wiggins & McTighe (2005) and Fink (2013) recommend that after determining what you want students to learn the next step should be determining how to assess learning. For the "Exploring the Googlesphere" intervention, students were asked to complete a pre-test to gauge pre-existing levels of knowledge and skill and a post-test to gauge the learning that took place as a result of participating in the information literacy class. Students also created two drawings using the prompt "How does Google Search operate?", one at the beginning of the class and one at the end. Finally, students completed an adapted Critical Incident Questionnaire (Brookfield, 2005). Because these assessment measures were completed and collected anonymously as part of a pilot study on the efficacy of this intervention, formal summative feedback was not given. However, informal feedback in the form of class discussion was provided.

The final stage of the design phase is to determine the teaching/learning plan, including what activities and assignments to include. The "Exploring the Googlesphere" class was designed using the ARCS model of motivational design. This model is a framework that can be used in conjunction with instructional design to increase both intrinsic and extrinsic motivation for learning and to improve information acquisition and retention (Hess, 2015). The ARCS model consists of four overlapping categories: attention, relevance, confidence, and satisfaction. Each of these categories is has a number of subcategories and related process questions as
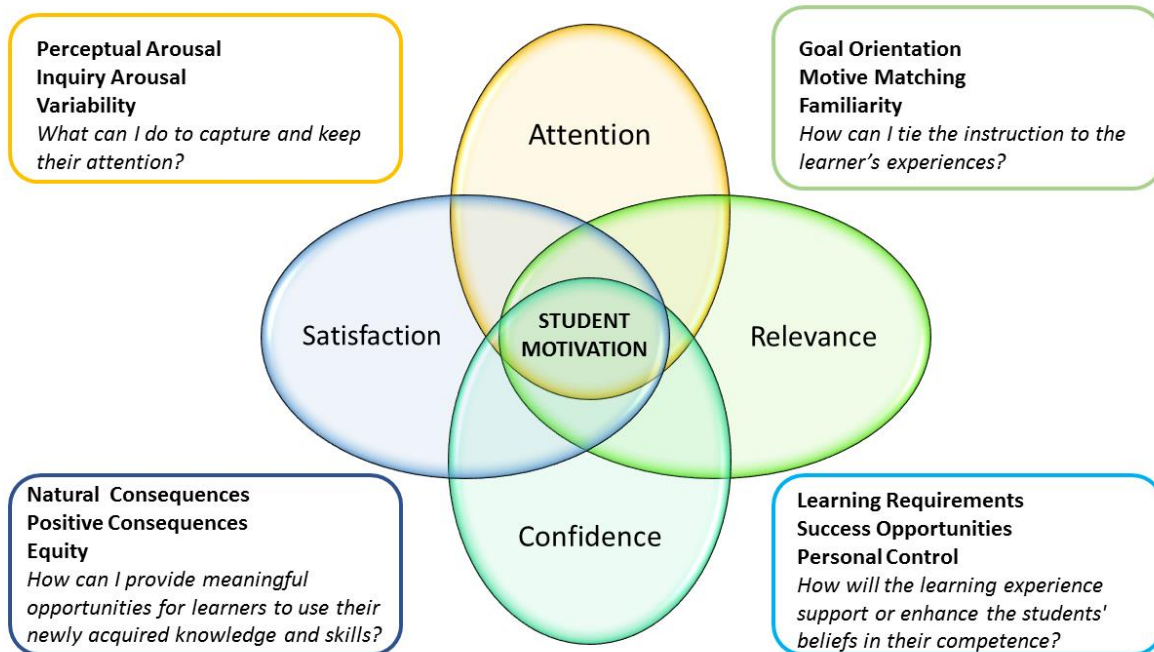
95

detailed in Figure 16.

Figure 16 - ARCS Model of Motivational Design

These process questions and categories were used to enhance the design of the in-class information literacy session. As Keller (1987) points out, the purpose of motivational design is to complement instructional design so that the content is engaging and interesting. This is especially important for motivating learning in the information literacy classroom, where students generally lack motivation for learning because they assume they already know the material to be covered, are overconfident in their searching abilities, and regard the content as essentially boring or irrelevant (Gross & Latham, 2012; Hess, 2015; Cole, Napier, & Marcum, 2015; Asher, 2015).

Development of Supporting Materials

In order to support student learning, a library research guide was developed (http://libguides.ggc.edu/ggc1000_google). This guide includes several tabbed pages (Google

Quiz 1 (Pre-Test), How Google Works, Google Tips, Google Infographic, Google Quiz 2 (Post-Test), and Critical Incident Questionnaire) that are used before, during, and after the in-class Google literacy lesson. The research guide contains infographics, videos, images, links, and text that supply additional information to students to support the in-class lesson.

Implementation of Intervention

At the beginning of the in-class session, students are asked to draw a visual representation of how Google search operates as a way to gauge students' prior knowledge of and experience with Google searching and to uncover any misconceptions and misunderstandings about this process on the part of the students. Several misconceptions were uncovered both from the completion of the Google Search pre-test survey and from initial inspection of the pre-class drawings. These misconceptions were addressed in the mini-lectures and lesson activities. One of the misconceptions addressed is that Google can not and does not search the entire Internet or the Deep Web and that there is more to the Internet than the World Wide Web. This concept is introduced by displaying the image below (Figure 17), which serves as the entry point for a mini-lecture that discusses the structure of the Internet and the WWW using the analogy of the Internet as an ocean and Google as a fishing ship that nets information/websites by trawling the surface.
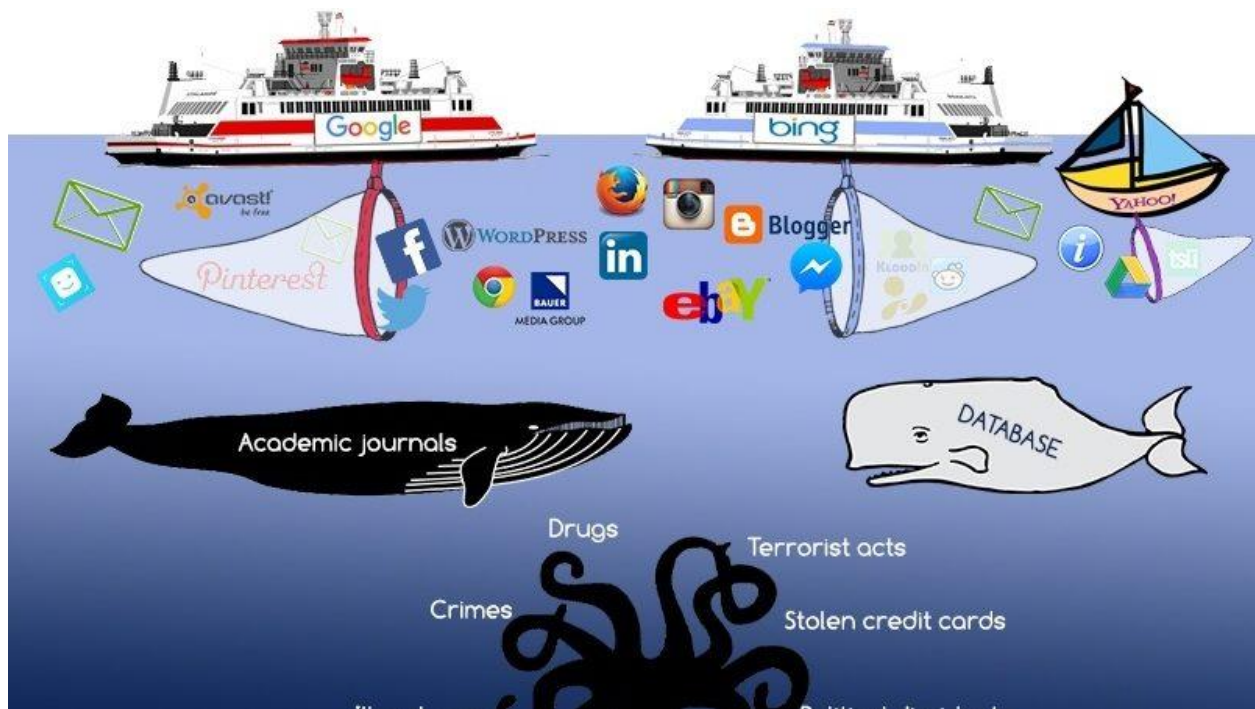
Figure 17 - Deep and Surface Web

After the mini-lecture, students watch a brief video produced by Google that gives an overview of how Google's search algorithm and information retrieval system operates. This instructional video addresses common misconceptions students have about how Google search fundamentally operates (i.e. by magic). The video explains that Google has indexed millions of webpages and websites and that conducting a Google search means that Google's proprietary algorithm sends search bots (spiders) looking through that index to retrieve results based on more than 200 factors, including how many times your search terms appear on the page, the word proximity order, whether the word is in the title or the URL of the page, etc (Asher, 2015). The video also introduces students to Google's Page Rank algorithm and details how that algorithm determines a website's placement in the results list that is generated from a Google search, which addresses a third misconception that students have related to how Google ranks search results, namely that Google ranks result based on the popularity of the site. After the video, a general

class discussion is conducted to clarify any remaining misconceptions about how information is structured online and how Google's search algorithms retrieve that information.

Taken together these conceptual understandings provide a foundation that is instrumental to introducing students to the idea that searching is a process of strategic exploration (one of the threshold concepts in the Framework for Information Literacy in Higher Education). The expectation is that once students have a more clear and accurate understanding and conceptual knowledge of how Google searching works (i.e. not by magic), then they will be motivated to conduct more efficient searches using search operators and advanced search strategies. These search skills and techniques are introduced in a second mini-lecture. This mini-lecture details the functionality of several Google search operators (a character, string of characters, or series of words/phrases used in a search engine query to narrow the focus of the search in specific, algorithmic ways that makes searches and results more precise) that allow searchers to limit results by date, numeric range, filetype, and type of website (Google, n.d.; WhatIs, n.d.). These advanced search techniques are demonstrated first in Google and then in Google Scholar and additional information regarding Google Scholar, such as how to add library links and how to generate citations, is covered in greater depth. The mini-lecture is followed by some hands-on guided practice in using the search operators to answer three challenge questions from Google's Advanced Power Searching course: Challenge 1 - Mimicking presidential voices, Challenge 2 - Turtle fossils, and Challenge 3 - Which festival? (Google, n.d.). The class concludes by having students draw a second visualization of how Google search operates based on their new knowledge and understanding.

Evaluation

Following Fink's (2013) model for creating significant learning opportunities, the intervention was evaluated by asking the following questions:

- Did the intervention provide foundational knowledge?

- Did the intervention provide opportunities for practical application?

- Did the intervention encourage students to integrate learning with other academic and personal experiences?

- Did the intervention encourage students to find value in becoming more Google literate?

- Did the intervention help students learn more about how they learn and encourage other metacognitive habits?

In order to answer these questions and to find evidence of student learning, a comparison of students' pre-and post-test quizzes and drawings and an examination of student responses to the Critical Incident Questionnaire was conducted. Students' knowledge of, skills in, and attitudes towards Google literacy as well as their experiences in learning about the Google search process were investigated before, during, and after the "Exploring the Googlesphere" class (Vezzosi, 2006).

Appendix B

Google Search Pre-Test

How do you search on Google? (Pre-Test)

Add your student participant code (this will ensure that your responses and participation remain anonymous). Your code is the two digits of the day you were born and the last two digits of your 9000#. For example, if you were born March 5 and the last two digits of your 9000# are 89, your code is 0589

1. How confident are you in your Google searching abilities?

Not very confident, I could use some pointers
1
2
3
4
5
Very confident, I'm an expert at using Google

2. How does Google search work?

3. How does Google rank search results?

4. You want to search exclusively within college websites for resources about student success strategies in the first year of college. What would be the best query to type into the search box?

- site:edu students success strategies first year of college
- education websites about student success strategies in the first year of college
- what helps students succeed in first year of college
- I don't know

5. You run two searches: [student success] and [successful students]

- The top results would be the same
- The top results would be different
- I don't know

6. You are doing a search in Google Scholar on student success. You're mainly interested in academic scholarly articles, but your search is turning up lots of books. What do you add to the search box [student success in college] to exclude results that are books?

- no books
- without books
- -book
- exclude book

7. You want to limit your search results in Google Scholar to just items that are available as full-text pdfs. What should you add to the search box to limit your results to full-text pdf files?

8. How do you evaluate the results list and the information that you find using Google searches?

9. What is the difference between the World Wide Web (WWW) and the Internet?

10. The modern first-year seminar course was launched in 1972 at the University of South Carolina as a response to what?

- fewer students graduating from college
- more students dropping out in the first year of college
- student protests of the Vietnam War
- students asked for a class to help them learn how to be successful in college

Appendix C
Google Searching Post-Test
How do you search on Google? (Pre-Test)

Add your student participant code (this will ensure that your responses and participation remain anonymous). Your code is the two digits of the day you were born and the last two digits of your 9000#. For example, if you were born March 5 and the last two digits of your 9000# are 89, your code is 0589

1. How does Google search work?

2. How does Google rank search results?

3. You want to search exclusively within college websites for resources about student success strategies in the first year of college. What would be the best query to type into the search box?

- site:edu students success strategies first year of college
- education websites about student success strategies in the first year of college
- what helps students succeed in first year of college
- I don't know

4. You run two searches: [student success] and [successful students]

- The top results would be the same
- The top results would be different
- I don't know

5. You are doing a search in Google Scholar on student success. You're mainly interested in academic scholarly articles, but your search is turning up lots of books. What do you add to the search box [student success in college] to exclude results that are books?

- no books
- without books
- -book
- exclude book

6. You want to limit your search results in Google Scholar to just items that are available as full-text pdfs. What should you add to the search box to limit your results to full-text pdf files?

7. How do you evaluate the results list and the information that you find using Google searches?

8. What is the difference between the World Wide Web (WWW) and the Internet?

9. What was the most useful thing you learned about Google searching?

10. You are in the city that is home to the House of Light and a museum in a converted school featuring paintings from the far-away Forest of Honey. What city are you in? Record and share your search strategy along with your answer.

103

Appendix D
Critical Incident Questionnaire

1. Add your student participant code (this will ensure that your responses and participation remain anonymous). Your code is the two digits of the day you were born and the last two digits of your 9000#. For example, if you were born March 5 and the last two digits of your 9000# are 89, your code is 0589

2. At what moment in class this week did you feel most engaged with what was happening?

3. At what moment in class this week were you least engaged with what was happening?

4. What action did someone (professor or student) do this week that you found most affirming or helpful?

5. What action did someone (professor or student) do this week that you found most puzzling or confusing?

6. What about our class this week surprised you the most? (This could be about your own reactions to what went on, something that someone did, or anything else that occurred)?

7. How has your perception of yourself as a Google user and your perception of Google as a tool for finding information changed as a result of our class this week?

8. In what ways was class this week a valuable experience for you? What could you have lived without?

9. How will you use what you've have learned in a future class or for your personal benefit?

10. Should the lesson on Google searching be a part of future GGC 1000 courses? Why or why not?