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As simple as that?: tween credibility assessment in a complex online world

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Abstract

Purpose – The purpose of this paper is to focus on disadvantaged tweens' (ages 11 through 13) strategies for making predictive and evaluative judgments of the credibility of health information online. More specifically, this paper identifies the features of Google search results pages and web sites that signal credibility (or lack thereof) to this population and the reasons behind their perceptions.

Design/methodology/approach – The authors employed an ethnographic approach (using various types of data collection methods) targeted to generate in-depth descriptions of tweens making predictive and evaluative judgments of credibility, focussing on the ways in which these tweens naturally assess the credibility of online information.

Findings – The research has yielded novel findings concerning the types of factors that influence disadvantaged tweens' credibility assessment strategies, such as limited English-language vocabularies, lack of familiarity with perhaps otherwise well-known sources, and forced reliance on (and/or general preference for) non-textual modalities, such as audio and video.

Practical implications – The findings indicate a need for implementing digital literacy programs in a naturalized setting, building on tweens' existing heuristics and thereby resulting in strategies that are simultaneously compatible with their natural inclinations within the online environment and likely to consistently lead them to accurate credibility-related judgments.

Originality/value – This study provides novel insights into how disadvantaged tweens interact with online health information in a natural context, and offers invaluable information regarding the ways in which credibility assessment processes should be facilitated within formal or informal digital literacy programs.

Keywords Digital literacy, Health literacy, Credibility assessment, Digital youth, Health information seeking, Information seeking behavior

Paper type Research paper

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Introduction

Although the study of people's perceptions regarding the credibility of information has been around for centuries, the rise of digital information has prompted scholars to investigate the ways in which people's credibility assessment processes differ when they're interacting with information online (Rieh, 2010). Because online information is increasingly separated from its original source, its provenance is often "murky" (Lankes, 2008; Sundar, 2008). Research regarding credibility assessment of online sources is therefore particularly important. To date, much of this work has focussed on adults. However, as young people are increasingly relying on web sources for their information needs – both at school and at home – it is essential to extend this scholarship to younger users.

Research shows that young people face unique barriers when assessing credibility. Although, the dominant narrative of youth as digital natives suggests that young people are avid technology users and the processes of information seeking are now an integral part of their everyday lives (Jenkins, 2006a; Palfrey and Gasser, 2008), researchers have found that this generalization is problematic (Ahn *et al.*, 2012; Subramaniam *et al.*, 2014a). Findings from recent research studies demonstrate how youth display varying information and digital literacy skills (Ahn *et al.*, 2012; Bennett *et al.*, 2008; Foss *et al.*, 2012) and thus, these findings contest the characterization of youth as digital natives. Youth often lack the developmental characteristics (Eastin, 2008), knowledge of a wide range of topics (Rieh and Hilligoss, 2008), and critical literacy skills (Eastin, 2008; Flanagin and Metzger, 2008) that would help them determine credibility. Furthermore, youth have been found to occasionally sacrifice credibility for the sake of speed and convenience (Rieh and Hilligoss, 2008) and to base their credibility judgments on surface features, such as site design (Agosto, 2002a, b; Fidel *et al.*, 1999; Sundar, 2008). Additionally, the novelty of a new technology can sway young people's credibility judgments, particularly if they are not invested in the topic at hand (Sundar, 2008). Young people may be "missing much of the richness of an environment saturated with information because of poorly developed information seeking skills or a propensity to take the easiest path possible" (Dresang, 2005, p. 181).

This paper describes an informal approach to digital literacy education, specifically focussing on investigating and improving the ways in which young people make predictive judgments of credibility based on search results and the ways in which they make evaluative judgments of credibility based on webpage content. The term digital literacy has been in use since the 1990s to describe a person's ability to read and comprehend hypertext documents (Bawden, 2001; Koltay, 2011). The term was popularized through Paul Gilster's (1997) seminal book, *Digital Literacy*. While Gilster's (1997) definition set the initial general parameters for digital literacy, there have been many controversies and debates surrounding the term since this time (see Bawden, 2001; Bawden, 2008; Koltay, 2011; Kope, 2006; Martin, 2006; Williams and Minnion, 2007, for a review of definitions and variations on this term). For the purpose of this research, we utilize Bawden's (2001) itemized list of suggested competencies for digital literacy for the Internet, derived from a close examination of Gilster's (1997) work. This list includes "the ability to make informed judgments about what is found online […] [and] […] a balanced assessment by distinguishing between content and its presentation"(p. 247), a skill directly applicable to the concepts discussed in this paper.

We are running an eight-week after-school program, HackHealth, in three Title I middle schools, in collaboration with the school librarians. Title I schools are schools that participate in a "federal program that provides financial assistance to local school

systems and schools with high percentages of poor children to support the academic achievement of disadvantaged students" (MSDE, 2003). The tweens (ages 11 through 13) participating in HackHealth identify a personally relevant health issue they would like to focus on throughout the program and the librarian and researchers assist them in investigating this topic on the web. Simultaneously, we explore many research questions regarding the digital literacy and the information seeking behavior of tweens in the program. However, the focus of this paper is to examine the ways in which disadvantaged tweens make predictive and evaluative judgments of the credibility of information as they search for health information online in a natural context (i.e. seeking information about their own or a family member's health), prior to us providing them with any specific instructions regarding searching online and formulating predictive and evaluative credibility judgments.

Working with young people from relatively disadvantaged backgrounds, we can observe how youth may use online resources in the absence of adequate formal or informal digital literacy instruction. Beyond being asked to look for and use "credible information" by their teachers and librarian at schools, the tweens in this study seem to have had little directed instruction on evaluating the credibility of information they find online. Many previous studies of youth interaction with the Internet do not explicitly mention the socio-economic backgrounds of the young people participating in their studies (e.g. Agosto, 2002a, b). Several studies have been conducted with children and teens from more privileged backgrounds (Druin *et al.*, 2010; Foss *et al.*, 2012, 2013; Kuhlthau, 1988; Madden *et al.*, 2006). While most youth struggle with critically assessing online information, disadvantaged youth with less access and instruction often further experience what Jenkins (2009) terms "the participation gap," or "the fundamental inequalities in young people's access to new media technologies and the opportunities for participation they represent" (p. 15).

Through this study, we are able to highlight how parameters such as degree of access, familiarity with the Web, and digital literacy instruction contribute to the mastery of digital literacy skills, particularly in information search and use. The findings from this research will help inform the next iterative design of credibility instruction for our after-school program, and potentially provide invaluable information regarding how credibility assessment should or can be facilitated within other informal or formal digital literacy programs for disadvantaged youth.

Related frameworks

This study builds on a long history of information credibility research, drawing from a variety of scholarly traditions. In this section, we will briefly discuss: examples of the ways in which credibility has been defined in the literature; the specific characteristics of predictive and evaluative judgments of credibility; credibility-related research focussing on youth information behavior; and facilitating credibility assessment in a naturalized context (such as personal health information). This breadth of research informs the methodologies chosen for this study, as well as the findings and discussion to follow.

Defining credibility

Credibility is a multi-dimensional concept. Trustworthiness and expertise are the two main aspects of credibility (Metzger, 2007; Rieh, 2010), with trustworthiness defined as "the perceived goodness and morality of the source" (Rieh, 2010, p. 1337) and expertise

focussing more on the user's perceptions about the knowledgeability, skill, and experience of the source, and thus, the source's ability to provide accurate and valid information. Credibility has also been defined using many other related concepts, including "believability, trustworthiness, fairness, accuracy, trustfulness, factuality, completeness, precision, freedom from bias, objectivity, depth, and informativeness" (Rieh, 2010, p. 1337).

Rieh (2010) expands on these concepts with a credibility typology that distinguishes between source credibility, message credibility, and media credibility. Source credibility describes the believability of the person providing the information, while message credibility is about the believability of the information. The former is influenced by people's judgments regarding the speaker's "dynamism, composure, sociability, qualification, reliability, animation, poise, and good-naturedness" (p. 1339), with expertise of the source being deemed the strongest, most objective, and easiest-to-assess dimension. The latter is influenced by people's analysis of aspects of the message, such as its "content, structure, language, and presentation" (p. 1339). If source information is lacking, people tend to focus on message cues in order to assess credibility. Media credibility pertains to people's relative judgments about the credibility of information provided through a particular medium, such as television, newspapers, radio, etc. Recently, web credibility has appeared as a new form of media credibility.

Various other "types" of credibility identified in the literature include presumed, reputed, surface, and experienced. Presumed credibility involves a person deeming information credible merely based on their preexisting general assumptions. Reputed credibility pertains to the influence of third-party reports, such as endorsements, referrals, or awards. Surface credibility has to do with the influence of surface characteristics, such as the design of a web site. Experienced credibility refers to the influence of a person's past first-hand experience on his/her credibility judgments (Rieh, 2010). Related to experienced credibility, Tseng and Fogg (1999) have coined the term earned credibility, which is a person's perception of "credibility based on first-hand experience that extends over time" (p. 62).

More recently, some credibility researchers have begun to focus on the role of social endorsement processes in people's credibility assessments. They distinguish between conferred credibility, tabulated credibility, and emergent credibility (Flanagin and Metzger, 2008; Rieh, 2010). Conferred credibility has to do with trusting information not because of the information itself or even the direct source of the information, but because of trust in the indirect source of the information. For example, people may trust ads that appear in Google results pages, simply because they trust Google or because they are unaware that these ads are paid advertisements. Tabulated credibility involves relying on aggregated ratings across multiple users. Emergent credibility is relevant when working with a pooled resource, such as Wikipedia. These more social processes of credibility assessment suggest that people do not assess credibility completely in isolation of each other.

Predictive vs evaluative credibility judgments

Apart from the different definitions of the general concept of credibility, several frameworks have been developed to differentiate between the various stages of the credibility assessment process (Fritch and Cromwell, 2001; Rieh, 2002; Wathen and Burkell, 2002). Rieh's (2002) Model of Judgment of Information Quality and Cognitive Authority, which was based on an empirical study of people's judgments while

searching the web, posits that people make two types of judgments within this context – predictive judgments and evaluative judgments. From a search results page, people make predictive judgments regarding which links they think will take them to credible information. Once people select a link, they make evaluative judgments regarding the usefulness, trustworthiness, and accuracy of the information they find on that particular web site. If a user finds that his or her predictive judgments do not match his/her evaluative judgments, he or she is likely to return to a previous page or start with a new search all together. Through iteration, people eventually reach a point where these two types of judgments match and they use the information they have found.

Users rely on a variety of cues to help them predict the likely credibility of a site. Many of these cues align with the types of credibility defined above, such as evaluating surface characteristics of the site (surface credibility) or using information about the believability of the source (source credibility). Depending on the user, these assessments may be more or less robust. In order to reduce cognitive effort or the effects of information overload, some users may rely on heuristics, which are mental shortcuts or rules of thumb, when making credibility judgments. These shortcuts are triggered by cues in either the content itself or the user's own cognition (Rieh, 2010).

Sundar's (2008) MAIN Model posits that there are four types of technological affordances that prompt people's cognitive heuristics in regard to credibility assessment – modality, agency, interactivity, and navigability. These affordances, along with the characteristics of the actual content itself, influence people's credibility assessments by triggering different types of heuristics. The MAIN Model outlines how an affordance conveys a certain cue, which in turn triggers a certain heuristic, which then leads to a judgment regarding the quality of the information on the site, and finally a judgment regarding the credibility of the site. Rieh and Hilligoss (2008) discuss heuristics somewhat similarly to Sundar (2008), dividing people's assessment strategies into four categories: media-related (the format or channel of the information), source-related (familiarity or primacy of the source – primary sources seem more credible, like "official sites"), endorsement-based (whether the information has been recommended by a knowledgeable or trusted individual), and aesthetics-based (whether the information is presented with a coherent visual design). Although cues and heuristics may not lead to the most accurate credibility assessments, people seem to turn to them when experiencing information overload (Rieh, 2010).

Youth and online credibility assessment

Although research on youth credibility assessment is rare (Rieh and Hilligoss, 2008; Flanagin and Metzger, 2008), the few studies that do exist have shown that youth struggle with the concept of credibility, particularly in choosing and evaluating online resources. In one study, Foss *et al.* (2013) reports that nearly 40 percent of the adolescent participants selected a search result just because it was the first one listed. In another study (Large, 2005), young people expressed frustration at the difficulty they had in determining relevance of sources from the information displayed in results sets. Once past the search results page, many researchers report that youth look mainly to the design and graphical elements of web sites to assess credibility (Agosto, 2002a, b; Fergie *et al.*, 2013; Fidel *et al.*, 1999; Gasser *et al.*, 2012; Sundar, 2008). Other researchers note that adolescents tend to equate information quantity with quality (Agosto, 2002b;

Gasser *et al.*, 2012). Still other researchers find that youth assess credibility on social media sites by looking at social metrics, such as likes, dislikes, and user ratings (Fergie *et al.*, 2013).

Results are mixed regarding the ways in which young people's credibility assessments are impacted by the context of their information searches. Rieh (2010) highlights the importance of context in credibility assessment, defining context as "the social, relational, and dynamic frames surrounding people's information-seeking processes, creating boundaries around the information-seeking activity or the credibility judgment itself" (p. 1342). Flanagin and Metzger (2010) find that children are primarily influenced by "contextual-level credibility clues" (p. 242), which may indicate that kids are drawn more toward peripheral cues rather than the actual content, particularly when no obvious errors stand out. Gasser *et al.* (2012) on the other hand, posit that context is less important to young users than whether or not search results are clearly related to their topic.

Despite some disagreement over the primacy of what youth use to assess the credibility of web sources, it is clear that their evaluation skills are not adequate for the mixed quality of information available on the web. This may be partly related to developmental stages, as Piaget described them. Eastin (2008) connects Piaget's stages to young people's credibility evaluations:

- preoperational stage (ages 2-7): children face difficulty evaluating source bias, due to not understanding that people may have perspectives and motivations that differ from their own;
- concrete operational stage (ages 7-11): children are "likely to focus on rather superficial indicators of credibility (e.g. site attractiveness or design) given their propensity to reason based on physically tangible information" (p. 34); and
- formal operational stage (ages 11-adolescence): youth can begin to assess credibility based on other factors, but it will be an iterative process.

Although youth may seem largely unconcerned about credibility when searching for information using digital media (Agosto, 2002a, b; Flanagin and Metzger, 2008; Hirsh, 1999), they do have some reservations about the people they meet online, the information they find and use for schoolwork (Flanagin and Metzger, 2008), and the potential impact of the information they find on other people (Rieh and Hilligoss, 2008).

Facilitating credibility assessment in naturalized context (i.e. health information seeking)

Rieh and Hilligoss (2008) find that youth may take the evaluation of the credibility of sources somewhat more seriously when dealing specifically with health-related information. Young people in the USA recognize the importance of health information and are interested in searching for this information online. According to a 2010 Pew Research Center report, 31 percent of teens (ages 12 through 17) who use the Internet look for information about health, dieting or physical fitness. Furthermore, 17 percent of these teens use the Internet to look for information regarding health topics of a sensitive nature (Lenhart *et al.*, 2010, p. 26). This Pew study also found that looking for health information online is far more prevalent among teens from low-income (annual household incomes less than $30,000) families. While 11 percent of teens from households earning more than $75,000 per year reported looking for health information

online, this figure more than doubles (to 23 percent) among teens from low-income families.

The need for health information, particularly sensitive health information (Fergie *et al.*, 2013; Franck *et al.*, 2008; Smart *et al.*, 2012) combined with the lack of ability in many youth to accurately assess the credibility of information (Gray *et al.*, 2005; Francke *et al.*, 2011; Hirsh, 1999; Pierce, 2007; Shenton and Dixon, 2004) indicates a strong need for instruction on online credibility assessment. However, this type of literacy is difficult to teach (Harris, 2008). School filtering policies and procedures can keep youth from freely exploring web resources and thereby developing web evaluation skills (Harris, 2008). Filtering policies, for example, are designed to block certain sites on school district internet networks. These policies aim to keep children from seeing "inappropriate" content, but in practice the filters are often seen as overly restrictive and poorly designed (Ahn *et al.*, 2011; DiScala and Weeks, 2013). Because of these filters, youth are restricted from accessing large portions of the web and are therefore limited in their opportunities to assess information that has not been pre-selected for them. The current trend in digital literacy education involves curation of resources done for or by teachers and librarians, wherein they suggest fee-based resources (such as databases) or develop collections of selected resources ("pathfinders") in order to try to circumvent the problem of youth citing or using non-credible resources (Harris, 2008; Lankes, 2008). While these techniques are useful in scaffolding the selection of credible online resources, they do not teach youth skills in assessing credibility outside of the safe confines of these selected resources, such as at home or for their own personal needs. Some educators have moved in the direction of teaching the use of checklists for evaluating resources on the web. The use of a checklist is time-consuming, however, and is unrealistic (Sundar, 2008), difficult to implement (Meola, 2004) and unlikely to be regularly practiced by youth (Metzger, 2007). Several researchers have called for making web environments open and available for student learning and self-directed evaluation (Harris, 2008; Lankes, 2008).

The growing societal focus on the central role of the patient in health maintenance and disease prevention/management calls for making sure that young people, especially disadvantaged tweens who lack exposure to the online environment and digital literacy, comprehend how to evaluate the credibility of online health information. Concomitantly, there is a significant need for empirical studies on how tweens interact with online information in a natural context, such as that of seeking personally relevant health information. Findings from such studies can be used to tailor digital literacy instruction by starting with their existing preferences and tendencies when interacting with online material and building on these natural behaviors to develop more effective credibility assessment processes.

Context and research questions

We conceived and designed the HackHealth after-school program with the goal of discovering innovative ways to educate youth in digital literacy, including credibility assessment processes, with specific attention to health literacy. Our overarching goals for the after-school program are to increase the interest of youth in the health sciences, their health information literacy, their health-related self-efficacy, and their understanding of the crucial link between their daily health-related behaviors and their ability to maintain their health and prevent disease.

The HackHealth after-school program runs for eight consecutive weeks in Title I middle schools in the mid-Atlantic region of the United States. Middle schools in this

region include grades six through eight – with the typical ages of attending students between 11 and 13. Each after-school session lasts between 60 to 90 minutes. We have completed a full iteration of the after-school program in three schools so far. Each school is staffed with a full-time school librarian, all three of whom have participated in designing and implementing the HackHealth program at their school library along with the research team. At each school, we begin by running an introductory meeting where we explain the program to interested tweens (recruited by the librarians using various methods such as daily announcements, consultation with health teachers and counselors, and referrals by tweens' homeroom teachers) and distribute parental and tween consent forms.

All three schools have high Free and Reduced Meals participation rates, ranging between 81 and 89 percent (Maryland State Department of Education, 2013). These indicators suggest that our research participants are from lower socio-economic backgrounds. Six tweens participated at the first school, seven tweens participated at the second school, and 17tweens participated at the third school, with fairly equal distribution across the three grade levels. Of the 30 tweens engaged in HackHealth, all of them belong to minority race categories in the USA – 10 (33.3 percent) self-reported their race as African American, 15 (50 percent) are Hispanic/Latino, 4 (13.3 percent) selected "Other," and 1(3.3 percent) is Asian. In total, 22 (73 percent) of the tweens have a computer at home and 21 (70 percent) have accessed the Internet from home using some form of device, such as their own computer, a parent's computer, their own cell phone, a parent's cell phone, and/or a tablet. Although the majority of these tweens seem to have physical access to the internet at home, the motivation for this study comes primarily from our preliminary observations and conversations with these tweens while they browse for online health information during the first week of the HackHealth program and from our informal interviews with the school librarians at these schools. Preliminary observations during "computer time" during the first week at each school revealed that tweens have various innate credibility assessment strategies that are not well-matched to the mixed-quality content one tends to encounter online and that they are simultaneously convinced about the accuracy of their credibility judgments. Informal interviews with the school librarians confirmed that these tweens have received little directed instruction on digital literacy, including strategies for evaluating the credibility of information they find online. There are various reasons behind the lack of digital literacy instruction, including the inaccurate perception that the librarian is not the person responsible for facilitating the learning of digital literacy skills and the false assumption that teachers often already teach digital literacy skills in their classrooms. Although teachers in these schools do their best to point the tweens to credible resources for their school assignments, it is often in the form of directing them to specific types of resources, such as .gov resources and articles from the school's subscription databases. This study was prompted by our observation that tweens are receiving insufficient instruction/guidance on digital literacy, particularly on how to assess the credibility of online health information available on the open Web.

The overarching research question for this study is:

RQ1. How do disadvantaged tweens assess the credibility of health information online and what implications do their existing strategies have for the design of digital literacy instruction for this population?

More specifically, we explore the following questions:

(1) What are the specific features of both the search results page as a whole and the homepages of various health-related web sites that signal credibility (or lack of credibility) to these tweens?

(2) Why do tweens feel that these particular features signal credibility (or lack thereof)?

(3) How can we use our findings to better design digital literacy instruction so that it is simultaneously more compatible with the ways in which youth naturally engage on the Internet and more effective in helping youth to efficiently reach sound credibility-related judgments?

Methodology

We employed an ethnographic approach to data collection targeted to generate in-depth description of our tweens' information practices and to obtain multifaceted empirical material through several techniques (Francke *et al.*, 2011). These techniques include (but are not limited to): specially designed activities to elicit participating tweens' credibility judgments of the credibility of online resources; in-situ observations compiled in the form of detailed observation notes by each researcher (three to four researchers are present at each session), search logs (a researcher-developed instrument where the researcher records the keywords entered by the student, the search results clicked, and the tweens' ratings of the trustworthiness, usefulness, and ease-of-use of each site visited), and audio recordings (from both whole session activities and one-on-one discussions between researchers and participating tweens).

Data collection

This paper relies only on data collected prior to any formal instruction was given regarding credibility assessment of content available on the open web. To elicit participating tweens' judgments of credibility, we designed two activities – a credibility screenshot poster activity and a search results activity. For the credibility screenshot poster activity, the research team identified six web sites on the same health topic (i.e. obesity) and printed poster-size (24 × 36") screenshots of each web site. The web sites included a government site ("Let's Move!"), a health information site popular among adults in the USA (WebMD), a site based on a television show that features a doctor providing health advice to the general public (Dr Oz), a Wikipedia site, a personal health narrative site that focusses on the author's experiences as an overweight teen and young adult ("Coffee Cake and Cardio"), and a web site specifically targeted toward kids (KidsHealth). The complete URLs for these sites are:

- Government: www.letsmove.gov/obesity
- WebMD: www.webmd.com/diet/what-is-obesity
- Dr Oz: www.doctoroz.com/blog/jodi-sawyer-rn/childhood-obesity
- Wikipedia: http://en.wikipedia.org/wiki/Obesity
- Health narrative: www.coffeecakeandcardio.com/category/weight-loss/
- Health-related information specifically targeted toward kids: http://kidshealth.org/teen/diseases_conditions/obesity/obesity_overweight.html

The posters were laid out on tables and tweens were asked to circulate amongst them, placing green sticky notes on various sections of each of the six posters/sites that they thought made the site trustworthy and pink sticky notes on various sections of the posters/sites that they thought made the resource untrustworthy. In addition, the tweens wrote on each sticky note the reason(s) why the features/sites seemed trustworthy or not trustworthy and their initials/pseudonym (see Figure 1). Prior to this activity, the researchers briefly explained that credible resources are resources that one can trust and that provide accurate health information. Once all tweens had the chance to visit all posters, the researchers engaged them in a group discussion as to why they had identified various features as either trustworthy or untrustworthy. We took close-up photographs of each poster, and recorded the contents of the tweens' notes.

The following week, we gave each tween a printout of a Google Search results page from a search conducted by one of the researchers using the keyword "obesity." We informed the tweens that this was a search results page from our search to locate information about defining obesity. We asked the tweens to put a star next to the three links they would most likely click on. Once all tweens completed this activity, we engaged them in a group discussion regarding which features they believed signaled credibility (or lack of credibility) and asked them to explain the reasons for their choices. We collected these marked printouts (see Figure 2 for an example), and recorded them in a spreadsheet.

Figure 1.
Credibility screenshot poster (with sticky notes)

Figure 2.
Portion of search result page marked by student

Additionally, we observed the indicators of credibility (or lack thereof) that tweens noticed as they interacted with health information during their free computer time and during group discussions by analyzing audio recordings, researchers' observation notes, and participants' search logs. The research team created data logs by collating data from all the sources mentioned above into one document for each tween. In this way, we had a complete data set for each tween, which facilitated triangulation of data from each of these disparate sources.

Data analysis

We used open coding and selective coding techniques (coding mechanism derived from Strauss and Corbin, 1998) to analyze the data log for each tween individually. Then, the entire research team met for a group data analysis session, during which we wrote our individually identified codes and emerging themes on sticky notes, and then worked together to categorize and sub-categorize emerging themes on a wall (the sticky noting method was adapted from Guha *et al.*, 2012). In this way, a group codebook was created. The group coding session was audio-recorded, which documented the reasons why certain themes emerged and their relationships (if any) to the literature. The emergent themes were then used to identify specific passages in the data logs for further analysis and interpretation. In this paper, we utilize the pseudonyms personally selected by each participating tween.

Findings and discussion

In this section, we reveal the specific features of both the Google search results page as a whole and the homepages of various health related web sites that signaled credibility (or lack of credibility) to these tweens. As we share these features, we explicate the reasons why tweens felt these particular features signaled credibility (or lack thereof).

Influence of tweens' basic literacy skills on credibility assessment

We noted that participating tweens' credibility assessment processes often reflected a lack of one or more basic information literacy skills. For example, we found that our tweens made predictive judgments based on the words they understood in the snippets and/or the titles of the pages as they appeared on the Google search results page. Although we found evidence that these tweens were using cues other than the superficial or physical look of the site (Eastin, 2008), these tweens relied heavily on word familiarity in making credibility assessments. For example, while examining the Google search results printout generated by the keyword-search "obesity," the tweens paid attention to words such as facts, information, and treatment in the titles and snippets provided, which matched with the vocabulary they knew and were familiar with when it came to managing a disease. One participant (Andy Sixx) mentioned that she chose the link Obesity Facts, Statistics, Cases, Symptoms, Treatment – MedicineNet because "people needs **facts** about it [obesity] and people would want to know how to **treat** it," with these two words evident in the link she selected. Similarly, Nicole pointed out that she selected "Obesity **Information,**" which is the first advertisement in the right column of the search results page, simply because it said "**information**."

Similarly, the tweens' selections sometimes reflected their awareness of relevant synonyms. For example, Andy Sixx's second choice was the third link on the Google Search list (Overweight obesity – Donorschoice.org) because "obesity does mean

overweight." Her prior knowledge that connected "obesity" to "overweight" contributed to her decision to choose this link. Nunu said she would not pick the mayoclinic.org link because "it doesn't really give you information, because the name itself is like "mayonnaise," which itself can contribute to obesity," again pointing to the prior knowledge that she has. Most of the tweens we worked with scanned the entire search results page, using various word cues to make their judgments about which sites they wanted to view. HackHealth tweens indicated that they would "search around for things [words] that they do recognize," when choosing from a selection of search results.

Many (more than half) of the tweens in our study come from backgrounds where Spanish is the primary language spoken at home, and these participants sometimes seemed to interpret the availability of Spanish translation on webpages as an indication of credibility. These tweens exhibited limited English reading skills. We noticed that these tweens in particular had trouble identifying and making use of textual cues to assess the credibility of resources. During the credibility screenshot activity, we found that tweens laid out green sticky notes stating "It is in Spanish" next to the health narrative site because of the availability of Spanish translation on this site. As one of our researchers noted in her observation notes, "I saw Jennifer laying out green sticky notes on the Café Cardio screenshot that says something like […] 'It is in Spanish' […] I asked her if that means that the information can be trusted and is credible, and she said 'Yes, because it is in Spanish.'" Macedo-Rouet *et al.* (2013) found a correlation between fourth- and fifth-graders' word reading ability and their ability to evaluate the source of a text narrative. Likewise, we reached similar findings with children who are older (in our case up to 13 years old), which suggests the persistence of such a relationship even among older children, especially among non-native English speakers.

These findings suggest that these HackHealth tweens relied heavily on their familiarity with English vocabulary (both topic-related terminology and wording that seemed to evoke instrumentality, such as informativeness and objectiveness of the information) and that their potential limitations in this regard likely influenced their credibility judgments, for better or for worse.

Influence of tweens' media preferences on their credibility assessment processes

The literature identifies one form of credibility, media credibility, that is based on people's perceptions of the medium through which they receive information, such as television, newspapers, and radio, with Web credibility being the newest form of media credibility (Rieh, 2010). HackHealth participants perceived the availability of videos, the ability to listen to the content of the site read aloud, and the presence of social media links on a web site (all elements of new media – see Ito (2010) and Jenkins (2006b) for further definition) as signals of the credibility of a web site. For example, in almost every information search that one tween (Phenomenal) had conducted in relation to his selected health topic (diabetes) during the program, he primarily looked for YouTube videos. Upon reaching more text-heavy web sites, he immediately clicked on a link that would initiate an automatic reading aloud of the text on the page. For Phenomenal, the author and the organizational affiliation of the site consistently took a secondary position to media format in his credibility assessment processes. For example, when one of the research team members asked him the reason why he favors videos, he answered, "Because sometimes videos might have information that web sites may not have." He preferred the kidshealth.org site during the credibility screenshot activity because "it does have a listen [option] […] so you can listen to the story."

Participating tweens also often labeled sites as credible when they included pictures that reflected the facts, treatments or symptoms of the disease.

Nicole explained that the Let's Move site is credible, not exclusively because it is a .gov site, but "[…] because there are web sites that you can go on if you like [the site], like Facebook, YouTube, Twitter." These tweens' credibility judgments seemed to be swayed by these types of media affordances, either because they connected with these new media personally or they were mesmerized by the novelty of such technology. Sundar (2008) indicates that youth "ascribe higher credibility to the content [that is delivered through a new technology] than if they had received the same content through a non-novel delivery mechanism" (p. 82). Among our participants, we observed a coalescence of their reading/comprehension skills (discussed above) and the media with which they resonated that influenced their judgments regarding the credibility of web sites. Although they sometimes assessed the credibility of information resources correctly (such as the credibility of the "Let's Move" site), deeper probing often revealed that their assessments were sometimes made for an incorrect reason (for example, this judgment was based not on source credibility, but on the types of media affordances available on the site). We discuss participants' views regarding source credibility in the next section.

Influence of tweens' source preferences on their credibility assessment processes

Tweens' perceptions regarding the credibility of web sites increased when they could make connections with the speaker or sponsor of the site. These connections were in the form of words that are often associated with credibility in health-related contexts, such as "hospital," "Dr," "medicine" and ".gov." The tweens that we worked with paid attention to the existence of such sources in their health information searches. Almost all of the tweens associated the use of the words "hospitals," "med," "health" and/or ".gov" in the titles, snippets or URLs with the likely credibility of the information provided. This is a clear example of source credibility, as the tweens relied upon the expressly stated and/or implied qualifications of the source in determining the believability of the information they provided (Rieh, 2010).

Marleny mentioned, "I picked the first one […] the Obesity Prevention Center because it comes from a children's hospital [as indicated by the URL]." When probed by the researcher, she mentioned that she chose it not because it was the first link, but because she recognized the hospital as a credible source of health information and noticed that it has an .org extension. In all three schools, almost all of the tweens chose this link as one of their top three choices for the same reason. Cherry Marshmallow picked this link as her first choice because "hospitals have doctors and nurses and […] they must be the ones to edit the Website and put true facts on it." Another participant (Little Man) stated that he would click on the URL that says "medicinenet.com" because it is medicine-related. We observed that most of the tweens also chose the link that had a "Dr Jerry Balentine" in the snippet as one of their top three choices, explaining that they selected it because he's a doctor. The doctor designation was expressly stated and a photo of the doctor was also provided within the snippet (see Figure 3). Here, we witnessed a coalescence of source credibility (doctor) and media preference (the photo) among these tweens.

During the credibility screenshot activity, Kaylee, unaware of the celebrity status of Dr Oz, still honored him as an expert due to his status as a doctor, and thus believed he could be trusted. Interestingly, Tia completely dismissed the MD designation in some of the authors of the sites she visited during personal computer time because she

thought this was an indication that the person who wrote it was from Maryland, and thus deemed it irrelevant to the credibility of the source.

It appears that the only technique for assessing credibility that almost all tweens employed and agreed upon is that all ".gov" sites are credible. However, their reasons for feeling this way are varied. For example, Phenomenal stated, "Because […] it's the government […] who's giving you a little bit of some facts that can help you out and you know you can trust him because he's well-known and he does serious work." In contrast, the tweens had divergent opinions regarding the credibility of sites with other types of suffixes, such as ".com" and ".org." The tweens' most common descriptions about the potential credibility of ".org" sites expressed that these sites are maintained by organizations – thus, the information provided is credible. If the ".org" site was suggested by a trusted source such as a teacher, then tweens were more generous in their designation of the site as credible. For example, Betty Boop mentioned that her health teacher recommended kidshealth.org for school-related work, so she is certain that this source is credible. This is an example of reputed credibility, in which a person's credibility assessments are influenced by the fact that they have been referred to a particular source or site by a trusted source (Rieh, 2010). In contrast to the majority consensus regarding the credibility of .org sites, however, there were disagreements among our tweens as to whether ".com" sites are credible.

We found some interesting designations of source credibility, whereby sites promoting or featuring popular individuals or celebrities that already have a trusted position in society, were deemed credible by these tweens. For example, the Let's Move web site is endorsed by the First Lady of the USA, Michelle Obama. Therefore, the site has the "source credibility" that affirms credibility. One researcher observed a HackHealth participant (Little Man) placing a green sticky-note on the Let's Move screenshot on which he had written "I saw an ad of First Lady talking about Let's Move" during the credibility screenshot activity. The researcher observed: "I was with Little Man for a bit, and he was simply staring at the Let's Move poster. I asked him if he knows about the site, and he said he does. He had seen an ad on TV that features Mrs Obama promoting the site. I asked him if he thinks that the information on the site can be trusted, and he said to me, 'Of course, Mrs Obama is doing an ad on it'." Similarly, Betty Boop and her mother are big fans of Dr Oz's television show, "My mom got me into the show, and I trust him because he is a doctor, and when one is on TV and have a bunch of people watching you, I don't think […] he will be stupid enough to make up lies just so that he can make his own TV show […] he gives [medical] advice and other people use them, he can get sued because he is giving false information, and

Figure 3.
Google search result page indicating source credibility and media preference ("Dr")

most of the time, my mom has tried [his advice] and [it] works for her […] so I believe him." The use of Michelle Obama and Dr Oz are additional examples of reputed credibility, as described in the preceding paragraph. However, the latter part of Betty Boop's statement is an example of the strongest form of credibility – experienced credibility – in which a person's credibility judgments are based on their past first-hand experience with a particular source of information (Rieh, 2010).

From the findings above, we see an amalgamation of words, media types, and sources that these disadvantaged tweens either relate to or are familiar with influencing their predictive and evaluative judgments regarding the credibility of web sites (see Table I for a summary of the web site features that participating tweens perceived as signaling credibility). We believe many of the features pointed out by the HackHealth tweens as evidence of credibility may stem from lack of mastery of the dominant language on the Web (i.e., English), lack of access to digital literacy instruction, and a complete absence of the voice and needs of disadvantaged tweens in the design of currently available digital literacy instruction, such as the Google Search Education sites. We provide some general recommendations in this regard in the following section.

Implications for the design of digital literacy instruction

In the current era, one in which health-related information is necessary in order to fully participate in one's own health maintenance and disease prevention and management, and in which an overabundance of potentially relevant information is instantly accessible online, digital literacy skills are of paramount importance. We found evidence that a combination of a lack of basic literacy and digital literacy skills strongly influences the ways in which these disadvantaged tweens look for and evaluate health information online. Although these tweens' credibility judgments often seemed correct at the surface level, we found that these judgments, at times, stem from faulty reasoning. These findings emphasize the need for digital literacy instruction related to credibility assessment. We provide several recommendations for the design of digital literacy instruction that is not focussed exclusively on fee-based resources, checklists, and pathfinders, but includes contextualization and personalization where young people can learn credibility assessment processes within their natural contexts that take into account their natural preferences and tendencies within the digital environment.

Table I.
Web site features perceived to signal different types of credibility

Type of credibility	Web sites features that signal this type of credibility
Message credibility	Familiar words (i.e. facts, information, treatment, etc.)
	Familiar language (i.e. Spanish)
Media credibility	Availability of video
	Availability of audio (i.e. read-aloud, etc.)
	Availability of social media links
	Availability of pictures
Source credibility	Words such as "hospital"; "Dr", "medicine"; "med"; ".gov"; ".org"; "health" indicated in the URL, site name, or author name and bio:
Reputed credibility	Teacher-recommended
	Celebrity-endorsed
Experienced credibility	Prior experience with the site and/or the author of the site

The need for digital literacy instruction for disadvantaged tweens in a naturalized context

Although we cannot claim that our findings alone pertain to tweens from lower socio-economic backgrounds, we found evidence of a lack of familiarity with the web and its features (such as not being aware that search engines can translate search results), misinterpretation of cues (such as those pertaining to media and source) and dominance of rationales that related to either experienced, reputed, and media credibility. Most importantly, our study reveals that tweens have limited credibility assessment strategies and that they make inaccurate assessments while seeking for personal health information that could potentially lead to negative impacts on their health behaviors. These findings signal the need for consistent and targeted digital literacy instruction that goes beyond information seeking for a school assignment and that is immersed within disadvantaged tweens' natural environments. We do not anticipate that these disadvantaged tweens will independently visit online searching tutorials to learn how to search for and evaluate information found on the open Web. What we do expect is that these tweens will exercise the various types of credibility assessment strategies that we have highlighted in this study to evaluate the credibility of information that they find, and will use (or not use) this information to make potentially life-altering decisions. Due to a lack of adult mentors at home and school-based digital literacy instruction, the availability of libraries, librarians, and free after-school programs such as HackHealth may be the only avenues for digital literacy development available to these disadvantaged tweens. We recommend leveraging the library as a space and the librarian as a digital literacy facilitator to create naturalized settings wherein disadvantaged tweens can be exposed to digital literacy skills while they are engaged in personally relevant and interest-driven practices (Subramaniam *et al.*, 2014b, 2015). In such naturalized settings, we recommend an increased emphasis on the practice of making assessments based on media, source, reputed and experienced credibility during Piaget's concrete and formal operational stages (that is from ages seven onwards) (Eastin, 2008). We further recommend assisting young people with developing heuristics which will enable them to successfully perform both predictive and evaluative credibility assessments.

The development of heuristics in everyday information seeking

As suggested by Sundar (2008) and Rieh and Hilligoss (2008), we found that media and source preferences play an important role in the credibility assessments of HackHealth tweens. We propose transitioning from the predominant credibility assessment teaching approach – using checklists or restricting students to the use of fee-based resources or pathfinders – to one that builds on students' existing heuristics on the open Web, especially with regard to media and source credibility. Working in collaboration with learning scientists, information experts, instructional designers, librarians, and disadvantaged tweens themselves, we propose leveraging existing heuristics that tweens are already using in their natural context, facilitating the development of supplemental heuristics that will ultimately broaden and improve their existing heuristics. For example, in the case of one of our tweens, Phenomenal, who perceives any video to be credible, we may focus on encouraging him to also consider the source of each video he views, as well as the message(s) it contains. As a result of regulation and facilitation, we hope that these tweens will end up with broad-based

heuristics that will lead to consistent and correct judgments about the credibility of online resources. In addition to conditioning tweens to such heuristics from an early age within formal or informal literacy learning environments, heuristics-based instruction can be adopted by sites that are dedicated to search instruction, such as Google Search Education and Common Sense Media, which are freely available to everyone.

Basic literacy serves as a pre-cursor to digital literacy

As evidenced in our research, the credibility assessments of tweens who are English Language Learners were heavily influenced by their limited familiarity with English vocabulary. As English is the dominant language on the Web, it is essential that these tweens are introduced to features such as the availability of language translation services on search engines and individual sites, as well as other types of language support that are available. We recommend that digital literacy instruction be interwoven with language and vocabulary development, in addition to leveraging the expertise of English as Second Language (ESOL) educators, if available. Ideally, many types of educators, including literacy educators (such as librarians), English teachers, and ESOL educators, could come together to offer authentic personal/everyday information-seeking experiences and scenarios for these tweens. As a result of these experiences/scenarios, tweens could broaden their English vocabularies, become more familiar with different types of media and sources, and begin to develop more informed heuristics that are simultaneously compatible with their natural inclinations within the online environment and likely to consistently lead them to accurate credibility-related judgments.

Conclusion

The credibility assessment processes of the disadvantaged tweens who participate in the HackHealth program exhibited some novel influences, such as the effects of limited English-language vocabularies, lack of familiarity with perhaps otherwise well-known sources, and forced reliance on (and/or general preference for) non-textual modalities, such as audio and video. Overall, familiarity (or lack thereof) seemed to predominantly rule these tweens' credibility judgments. Recognizing words that they knew – whether they were related to the topic at hand or merely related to the instrumentality (i.e., the informativeness or factualness) of the information – prompted them to nearly automatically trust (or not to trust) the information. This automaticity is potentially dangerous, as these tweens sometimes trusted a site merely because it contained generic words such as "information" or "health" in the URL and/or the Google search results snippet. In fact, when we asked one of our participants how she can tell whether or not a site is credible, she indicated that she trusts sites that are ".med."

As our study is ethnographic in nature, our findings are subject to the natural limitations of such research, including a relatively small sample size and a resulting lack of generalizability of the findings beyond the particular samples of tweens with whom we have worked. Future research could extend to other samples of disadvantaged tweens and to samples of tweens from other types of backgrounds. Another more general idea for future research in this area concerns investigating the heuristics that tweens ultimately rely on when encountering conflicting indicators of

credibility across different types of credibility. For example, on what heuristics do tweens overridingly rely when indicators related to media credibility suggest the presence of credibility, while indicators related to source credibility suggest the lack of credibility? Similarly, how do tweens ultimately assess credibility when a web site clearly has reputed credibility (as, e.g. when they've been referred to a web site by one of their teachers), but lacks surface credibility? One last suggestion for future research pertains to the increasingly popular tendency, particularly of young people, to rely on social indicators of credibility. An investigation could seek to identify how emergent and tabulated credibility figure into the suite of heuristics that tweens use when assessing the credibility of information online. Such research can further contribute to the development of a credibility assessment model and typology specifically for young people and/or inexperienced information seekers that not only describes actual usage of particular cognitive heuristics and the impact of these heuristics on the ultimate credibility judgments reached, but also designates the types of heuristics that need to be activated when certain types of credibility judgments are exercised by young people. Sundar's (2008) MAIN model hypothesizes that this heuristics-based approach is superior to the checklist approach to credibility assessment. The next recommended step will be to extend this model to include a comprehensive list of heuristics (including the ones that can be inferred from this research with disadvantaged tweens), and examine competing heuristics to determine how negotiation of conflicting heuristics can be aided. Most importantly, such a model will need to be translated into practical pedagogical approaches that can be implemented to facilitate the development of successful credibility assessment strategies among young people.

Overall, our findings stress the need for digital literacy instruction, particularly instruction that focusses on assisting these tweens with their credibility assessment strategies. Ideally, such instruction would work with these disadvantaged tweens within their everyday life contexts, attempting to simultaneously work with their preferences and their natural proclivities within the online environment and around the limitations they face, thereby improving the tools with which they can successfully navigate their information environments. In the next iteration of HackHealth, we intend to overhaul our strategies for facilitating credibility assessment, using the alternate approaches described above to facilitate the learning of credibility assessment among these disadvantaged tweens. We encourage educators of all types that request their students to look for/use online information to reconsider their instructional strategies, moving away from requiring the use of checklists and prescribing fee-based resources and pathfinders, to a practice that aims to develop basic and digital literacy together and that builds digital literacy blocks that are centered around broadening and improving students' credibility assessment heuristics, including (but not limited to) those based on media, source, reputation, and their own personal experience. This study also opens up possibilities for information scholars to rethink the design, development and implementation of digital literacy learning environments. While our findings suggest that this population tends to use oversimplified strategies to assess the credibility of information while navigating online, these strategies can be leveraged to tailor digital literacy instruction to meet these tweens where they are at, facilitating the further development of their existing heuristics and the adoption of additional heuristics that can help to lead them to more accurate and more efficient credibility-related judgments.

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