SURFING BLIND: A STUDY INTO THE EFFECTS OF EXPOSING YOUNG ADOLESCENTS TO EXPLICIT SEARCH ENGINE SKILLS

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Abstract

The Internet provides today's students with the world's greatest library. It is in their homes, their schools and even in their pockets. Yet this powerful educational tool, with its practically infinite opportunities, is increasingly going under-utilized research suggests. Several studies report a skill-deficit exhibited by adolescents when using online search engines in particular. Little is known, however, about the potential benefits of exposing students to explicit search engines skills. This paper discusses the findings of a mixed method study exploring the degree to which exposure to such skills affects adolescents' online searching. It seeks to provide new knowledge by analyzing searching behaviours through a semiotic lens. Semiotics provides the study with a language with which to discuss the changing role of students when using digital technologies and the different communication inherent when using search engines. The study reveals a tendency on the students' behalf to view their role as subordinate when conducting online searches, and a reluctance to change this view despite intervention. The paper also reports that adolescents are, however, willing to change and attempt to improve their searching behaviours post exposure to explicit skills.

Introduction

The nature of today's digital age and the educational affordances that come with it would have been hard to imagine even a few decades ago. This, our "most rapid period of technological transformation ever", sees students granted the capacity to instantaneously and independently access a practically infinite amount of information (Palfrey & Gasser, 2010, p. 3). Indeed, the prolific impact the internet has had causes many to draw parallels between this invention and that of Gutenberg's 15th century printing press (Prensky, 2001; Worzell, 2012). And just as the printing press heralded in an era demanding new skills if people were to benefit from its capacities, so too does the internet. This era has also said to have witnessed the birth of a new breed of learner, what Prensky coined the 'Digital Native' (Palfrey & Gasser, 2010). Current Australian estimates suggest that these 'Digital Natives' have spent in excess of 3 500 hours online by the time they are seventeen (Australian Communications and Media Authority [ACMA], 2008). Despite such usage, there exists much research which suggests that the younger generations, who "live and breathe technology", are far from epitomising cyber-expertise (Nelson, Courier & Joseph, 2011, p. 104). Many studies, in fact, report a skill-deficit amongst them, particularly when it comes to using search engines (Argelagos & Pifarre, 2012; Gui & Argentin, 2011; Macpherson, 2013; Quintana, Pujol, & Romani, 2011).

Given that we now conduct an average 4.7 trillion searches every day on Google alone, it is perhaps not surprising that search engine use is receiving increasing academic attention (Google Annual Search Statistics, 2013). Such a focus could also reflect an understanding that the future 'information saturated' world awaiting out students is only advantageous once they have the skills to expediently locate information in an overwhelming online environment; the skills to effectively use a search engine. Several studies report, however, that these skills are not being taught to students (Combes, 2009b; Walraven, Brand-Gruwel, & Boshuizen, 2008), despite recent Australian expenditure of over $2 Billion on classroom digital technologies (Ladbrook & Probert, 2011). This environment; one where students are inhabiting an unprecedented world which requires new skills, skills they do not have and are not being taught (where they are 'Surfing Blind'); served as the catalyst for a small scale study which examined the impact of delivering explicit search engine skills to a group of young Australians. The study contributes to the existing literature by measuring the impact of pedagogies aimed at bridging the divide between the indispensable abilities needed by our 'Digital Natives', and those they already possess. This paper reports some of the more pertinent findings of the study which posed the question 'To what extent does exposure to explicit skills for using search engines affect young adolescents' online searching?'

Many studies report a skill-deficit exhibited by young adolescents when using online search engines (Argelagos & Pifarre, 2012; Gui & Argentin, 2011; Macpherson, 2013; Mathewson, 2013; Quintana, Pujol, & Romani, 2011). Little is known, however, about the potential benefits of exposing students to explicit search engines skills, nor the students' desire for such exposure or the way they view their role when searching online. Utilizing semiotics, this study begins to answer these questions by examining the online search process as one of communication. Semiotics, and its place in educational research has long been established (Bakardjieva, 2005; Pikkarainen, 2011; Stables, 2008; Taylor, 2013), and there exists some work on semiotics and computer systems (Belew, 2000; de Oliveira & Baranauskas 2000). No hitherto study, however, has attempted to utilise semiotic theory to design (and measure the efficacy of) lessons aimed at improving online searching skills.

Literature Review

Search Engine use

Searching online has been the single most popular use of the internet since the PEW Research Centre began collecting data in 2002 (Young, 2011). Google's increasing popularity, in fact, has caused many to come to think of it as synonymous with the internet itself. A somewhat forgivable stance given Google alone now consists of over "60 trillion individual pages" (*How search works,* 2016, para. 1). Yet it is not solely the incomprehensible size of these browsers which have seen their

usage become such a popular topic for educational researchers the world over (Bilal, 2012; Knight & Mercer, 2015). Search engine use specifically has been credited with higher scores in reading and math tests (Casey et al., 2012), with providing cognitive scaffolding (Johnson, 2010), with altering what we know and what knowledge we value (Halavais, 2009; Schroeder, 2014) and with displacing other forms of information seeking (Schroeder, 2014). Some researchers claim, moreover, that our interest in the search process is inspired by the unique nature of the skills demanded by browsers. These skills, it is suggested, change our role and "turn the reader of any text […] from a passive human being to an active one" (Hashemi & soltanifar, 2011, p. 368).

Much of the existing research, however, suggests that people are not embracing this role change effectively. Most literature reports findings suggesting "that individuals of all age levels demonstrate deficiencies across most phases" of online searching (Brand-Gruwel, Wopereis, & Walraven, 2009; van Deursen & van Diepen, 2013; Walraven, Brand-Gruwel, & Boshuizen, 2013). This body of research has also seen many studies seek to profile search engine users. Much of the work suggests that searchers both here in Australia and abroad exhibit homogenous behaviours (Fallis, 2008; Metger, 2007). Ruthvern (2010) reports findings from an Australian Senate Inquiry which suggests that "information seekers take the line of least effort and that information provided immediately to the desktop is preferred to that which takes longer" (p.32). Misirli, Karakoyun and Kuzu (2009) similarly report that more than 50% of search engine users only ever look at "the first 1-2 pages or 10-20" results displayed and most "give up searching after the first unsuccessful trial" (p. 383). These behaviours, it has been suggested, keeps searchers "stuck on the surface of the information age" (Nicholas, Rowlands, Clark & Williams, 2011, p. 44) resulting in "biased or uninformed decisions, reduced satisfaction or other undesirable consequences", not the least of which include educational disadvantage (Roscoe et al., 2016, p. 104).

Such an environment has spurred some computer specialists to propose changes be made to the way that search engines function. Portmann, Kaufmann and Graf (2012) present a conceptual design for web information retrieval that better emulates the way humans think, where search engines not only offer web documents, but make explicit the 'map' of knowledges or 'structural semantics' used to come at them. Semantic search engines, like those proposed, would see sites not just offer the user potential web pages, but highlight the most pertinent information, identify document type and help users script further queries. These new browsers, according to O'Connell (2011), are "literally changing the search experience" and arguably, demand less and less of the human operator (p. 45). The now stock-standard tracing of users' online behaviours, which lead to more personalised results and individualised banners, similarly see the browsers do more of the 'searching' than the searchers themselves.

This body of literature regarding search engines, though informative, has several limitations. A heavy reliance on self-reporting as opposed to skill testing is evident (ICILS, 2013; Sweeney & Geer, 2011), and many studies have a narrow scope focusing solely on one step of the online search process (Kammerer & Bohnacker, 2012; Dinet, Christian Bastien, & Kitajima, 2010). There also exists a lack of comparative and longitudinal studies and little research investigating the social context of search engine use (Schroeder, 2014). The field is also categorized by much work that primarily measures search 'success' as opposed to skill-base (Foss & Druin, 2014).

Young Adolescents' search engine use

There does exist, however, a relatively robust literature on young adolescents' search engine use specifically (Cordes, 2012; Guinee, 2004; Ladbrook & Probert, 2011; Lei et al., 2013; Rasmusson & Eklund, 2012; Waller, 2011). Much of this research publishes findings which question their frequently presumed digital proficiency. Several key themes in the literature have emerged including: recognition of the online search process as complex and difficult (Johnson, 2007); the existence of an apparent skill-deficit among teenage searchers (Argelagos & Pifarre, 2012; Gui & Argentin, 2011; Macpherson, 2013; Mathewson, 2013; Quintana, Pujol, & Romani, 2011); a discrepancy between student (as well as teacher and parent) perception of skill versus actual ability (Macpherson, 2013); and a failure on the part of schools to explicitly teach search engine skills (Ladbrook & Probert, 2011).

Many adverse attributes found to be characteristic of teenage search engine users are repeatedly reported (Cordes, 2012; Ladbrook & Probert, 2011; Lei et al., 2013; Rasmusson & Eklund, 2012). Common disadvantageous behaviours among adolescent searchers include: an over-reliance on Google and Wikipedia (Blikstad-Balais & Hvistendahl, 2013; Georgas, 2013; Foss & Druin, 2014; Macpherson , 2013); difficulty in scripting effective search queries (Foss et al., 2012; Kammerer & Bohnacker, 2012; Torres & Weber, 2011; van Deursen et al., 2014); erratic and ineffective looping or backtracking (van der Sluis, & van Dijk, 2010); clicking on "whatever is presented in a prominent position" (Torres & Weber, 2011); spending only a short time on each page (Torres & Weber, 2011); and failure to consider the credibility of sites (Blikstad-Balas & Hvistendahl, 2013; Keil & Kominsky, 2013; Kuiper et al, 2008; Lei, Lin & Sun, 2013). Failure to first spend time considering the question at hand, relevant key words or even existing content knowledge is also common among the participants in many studies (Georgas, 2013; Ladbrook & Probert, 2011). These behaviours may reflect what Georgas (2013) refers to as a belief on behalf of the students (and indeed, among many searchers) that "the onus is on the search tool" itself rather than themselves when searching online (p. 177).

Despite reporting skill-deficits in adolescent search engine users, most research in the field also describes a confidence held by the cohort in their searching abilities (Kammerer & Bohnacker, 2012; Kuiper et al., 2008). One study comparing the internet literacy of student, parents and teachers

in Iran reports less than seven per cent "of students consult […] qualified people like teachers and adults" when searching online (Hashemi & soltanifar, 2011, p. 370). Such potentially misplaced self-assurance in their use of search engines, and a resulting dismissal of the need for help is also reported by a more recent University of Canberra (2013) study. It highlights the strong student self-efficacy witnessed as problematic given "only approximately half of the students [sampled] were able to correctly identify concepts or ideas to use in searching" (Macpherson, 2013, p. 37). Researchers have found that parents and teachers also frequently hold an inflated confidence in teenagers' abilities to seek information online (Ladbrook & Probert, 2011; Macpherson, 2013; Meggarrity, 2010; Quintana et al., 2012). A confidence, it is suggested, which could reflect confusion between hardware skills and those required to be an effective search engine user; the former of which many young adolescents possess. Indeed, given much literature into adolescent search engine use measures internet access or use instead of the effectiveness of such use or associated skills, it is not surprising that discourses prevail describing the younger generations as innately tech savvy and where around every corner a baby is successfully manipulating an I-pad. Such literature fails to address calls (even 20 years ago) for educators and researchers to "distinguish between the effects of using technology and the effects of using information" (Windschitl, 1998).

This confidence in our teenagers' searching abilities, if misplaced, undoubtedly has real and far-reaching educational implications and may "result in underestimating the support students need when using the web" (Kuiper et al., 2008, p. 1). Several international studies, in fact, all share evidence that many teachers are not explicitly teaching digital literacies like using a search engine (Combes, 2009b; Walraven, Brand-Gruwel, & Boshuizen, 2008). Closer to home, the National Curriculum in Australia, as set out by ACARA, fails to include any search engine use or instruction in the classroom prior to Grade 6. This context, once again, helps to justify the experimental, mixed methods study conducted, whose aim was to measure the impact of exposing young adolescent Australians to explicit search engine skills. It sought to provide a better understanding of any skill deficits present and the potential for improved searching by analyzing students' online searching behaviours through a semiotic lens.

Semiotic Theory

The discipline of semiotics deems all social phenomena, including for example using a search engine, as processes of communication. Though its origins date back as far as two thousand years, modern-day development began with the work of Charles Sanders Peirce (1839 – 1915) and that of Ferdinard de Saussure (1857-1915). Both seminal figures saw meaning as being produced through a fluid process where one entity (a word, picture, sound, person, or object) refers to something else.

The word 'flower' for example, be it written or spoken, has only an arbitrary and socially-built connection to the attractive seed-bearing part of a plant. See Figure 1. In this instance, the word 'flower' is the *signifier* and the more concrete object, the *signified*. The signifier (when written or heard) is also the first part of the communicative process.

Figure 1 – Process of signification or "meaning making": an example*.*

Flower

Signifier   Signified

The 'sign' is made up of these two parts and 'signification', the process that sees the connection being made. At the heart of semiotic literature is the suggestion that "any successful communicative act sees the sign successfully unite what the signifier was trying to express with what the receiving listener thinks they are" trying to express (Belew, 2000, p. 252). One can imagine, therefore, given this belief, that a classroom setting, whose ultimate goal is this very transference of ideas, is rife with opportunities for semiotic analysis. The process of using a search engine, which also depends on successful communication between user and computer, again lends itself to a semiotic interpretation.
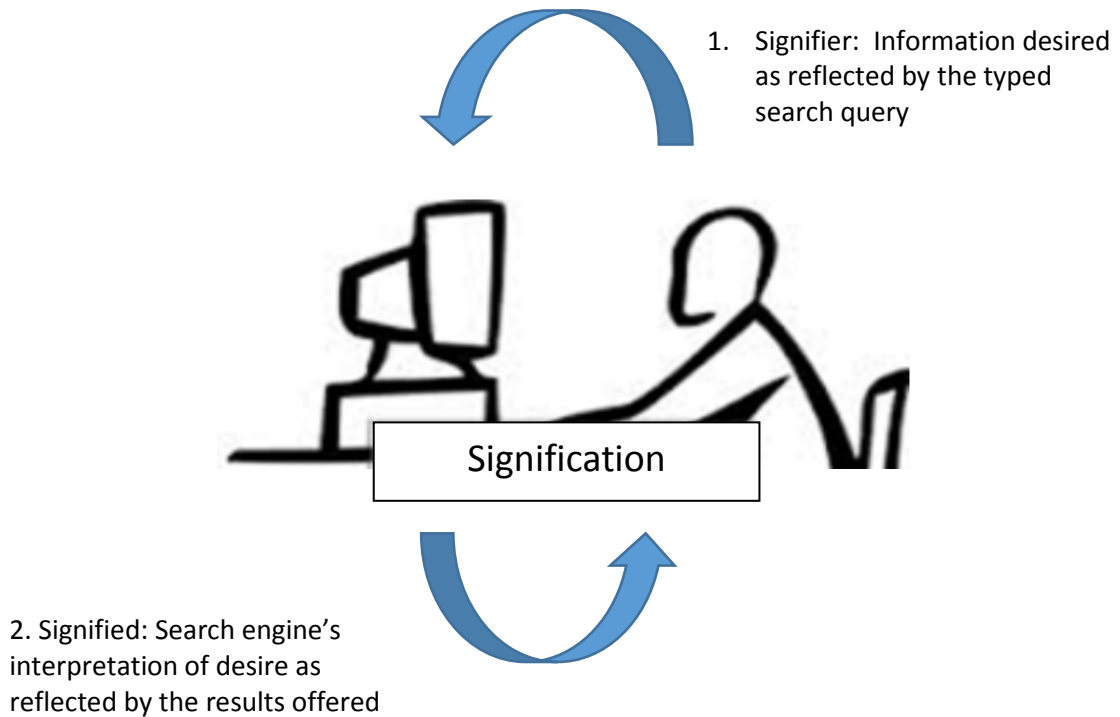
Semiotics: its place in educational research and in this study

The value of semiotic theory in researching educational practices has long been established (Bakardjieva, 2005; Pikkarainen, 2011; Stables, 2008; Taylor, 2013). The emergence of new, more interactive learning tools like the internet, however, which dramatically shift possible classroom interactions and methods by which learning is communicated, demand further semiotic investigation.

This study examined the online search process in semiotic terms; as essentially a process of communication between the search engine and the user. A successful search was said to have occurred when the search engine offers results (or '*signifieds*') which reflect an accurate discernment of what the user is seeking/expressing via the search query (the '*signifier*'). The findings of many studies suggest that the most effective search processes are cyclical in nature, or involve turn taking

like that inherent in any act of communication (Johnson, 2007; Portmann et al., 2012; Prensky, 2001). The most successful search processes therefore (and those that the current study tried to entice) are those where serious attention is given to creating search queries or 'signifiers' which assist a search engine in offering relevant results or 'signifieds'. Figure 2 illustrates what an *ideal* search process may look like in semiotic terms.

Figure 2   Using an online search engine: an ideal semiotic interpretation

1. Signifier: Information desired as reflected by the typed search query

Signification

2. Signified: Search engine's interpretation of desire as reflected by the results offered
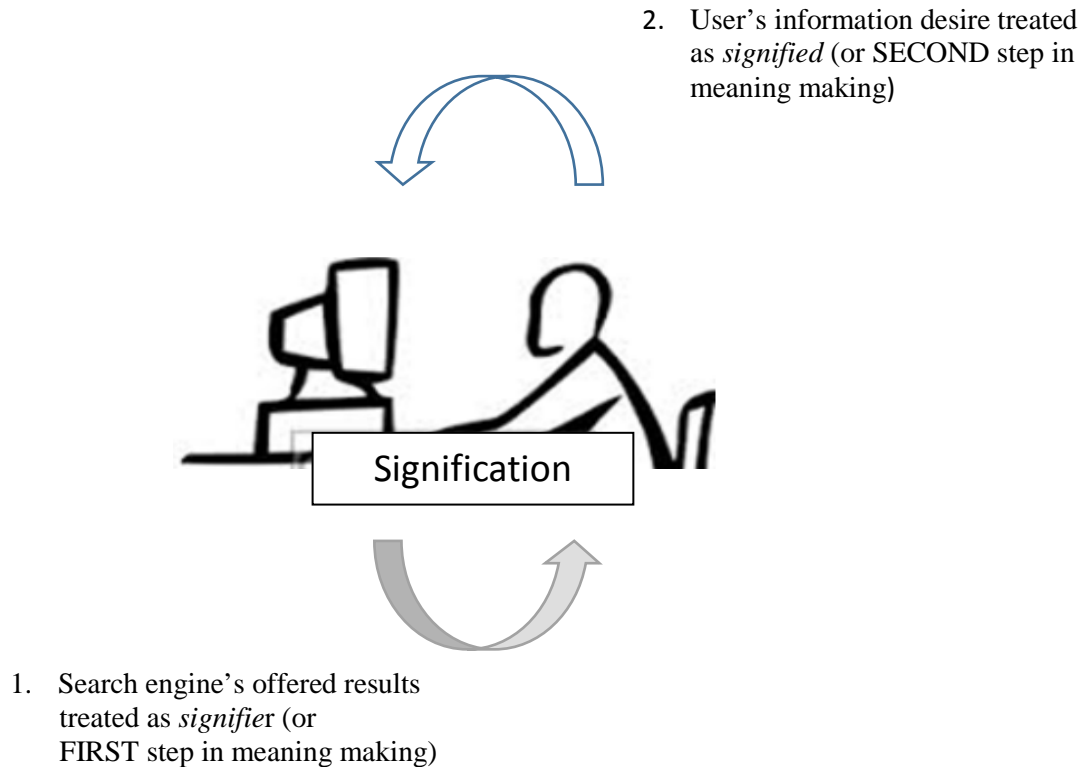
In his work on Internet mediated communication, Yus (2011) suggests that when online, "just as in face-to-face communication, the *addressers* have communicative intentions and have to devise their messages in such a way that the intended interpretation is selected" by the addressee, in this instance, the search engine (p. 2). Other researchers agree, explaining that the online search process is similar to that of any form of communication, wherein a "common language" is required (Pikkarainen, 2011, p. 1141) and success is measured by a reciprocal understanding.

The relationship between a web surfer and search engine is, however, different to more traditional author/audience relationships (albeit one inherently reliant on effective communication). The student, it is argued, is "no longer a passive entity that processes a single text mode in linear sequence" (Yus, 2011, p. 49). Far from a book where the 'signifiers' (in semiotic terms) are already created by the absent author and offered to the student for 'signification', search engines await the users to create the 'signifiers' for them. Some literature suggests, however, that students continue to

perceive of Google as the 'starting point' for their information seeking, rather than recognizing their own responsibility in first formulating a question or 'signifier' (Georgas, 2013; Ladbrook & Probert, 2011). Figure 3 illustrates what this 'less than ideal' interaction may look like in semiotic terms. The chronology of the interaction is reversed and less credence is given to the user's information desire.

Figure 3   Using an online search engine: Young adolescents' view (in semiotic terms)

2. User's information desire treated as *signified* (or SECOND step in meaning making)

Signification

1. Search engine's offered results treated as *signifie*r (or FIRST step in meaning making)

Note. The transparent arrow indicates students devaluing their role as 'signifier' makers

This study begins to address calls for studies which use semiotics to consider the specific signifiers (like search queries) made by students (Pesce, 2011). The existing literature, it has been said, "make[s] little explicit or details, and certainly no extended reference to particular instances of sign-making deployed during classroom events, and the part played by them in the orchestration of meaning-making" (Taylor, 2013, p. 3).

Methods

This mixed methods study employed Action Research (see Figure 4) to examine the extent to which exposing young adolescents to explicit skills for using search engines affected their online searching. Three sub-questions guided the research:

(a) How do young adolescents currently use search engines?;

(b) How do young adolescents currently view their role when using search engines?;

(c) To what extent do young adolescents perceive exposure to the skills demonstrated as being beneficial?
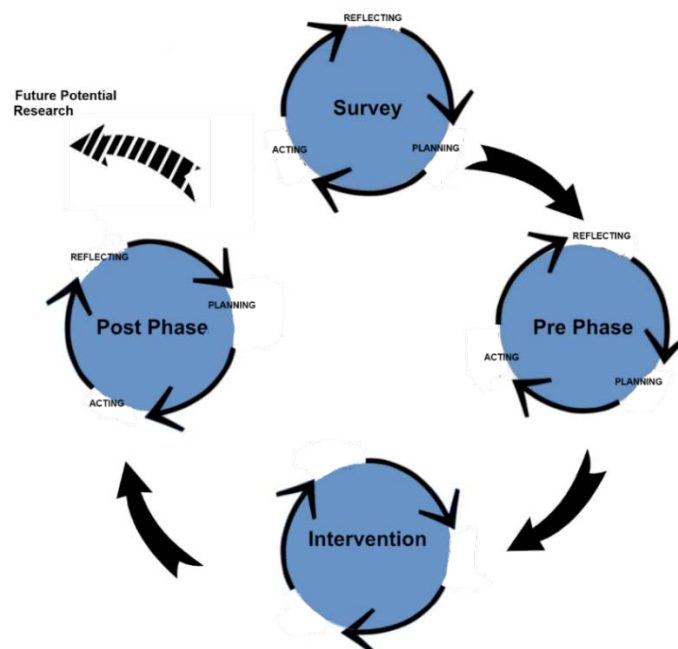
Participants

All participants were Grade 8 students at a co-educational, government secondary school located in Queensland, Australia. Consent and information forms were distributed to all students attending Grade 8 in an effort to recruit participants. The first three girls and first three boys to return the required documentation were selected as participants for the study. One participant withdrew before the intervention took place.

Data Collection

The study drew on both qualitative and quantitative data in an "experimental one group pre-test, post-test design" (Creswell, 2014, p. 172). Data was collected in three phases over the course of six weeks. Methods included an initial survey item, pre and post tests and pre and post interviews (See Figure 4). A single two-hour intervention designed to expose students to explicit search engine skills was also developed and conducted but data was not collected during this phase *per se*. The limited scope of this paper makes the discussion of all phases impractical, and hence data from the initial survey item will be addressed in subsequent publications.

Figure 4   Action Research Cycle

Pre & Post interviews

Individual pre and post interviews were conducted over approximately half an hour in a classroom on the students' regular school site. Participants were asked a series of open and closed questions in largely standardized open-ended interviews. Questions sought insight into: students' knowledge of search engines; their use of search engines and the assistance offered by anyone mentoring them in such use. Quantitative data were also collected during these interviews via questions asking participants to indicate: how often they performed certain online searching behaviours; which search terms they would most likely use given a certain informational need; and how they perceived the communicative process between them and a computer during a variety of scenarios. This last question was unique in that it asked students to choose one of two simplistic and stylised images (see Figure 5) to best describe their interaction with a computer. Discussed in semiotic terms, or as illustrating a process of signification, the arrows could be said to indicate who (the user or the computer) is offering the 'signifier' in this interaction.

Figure 5   Question (m) in Pre and Post-interviews

Drawing A   Drawing B

Student as Passive   Student as Active
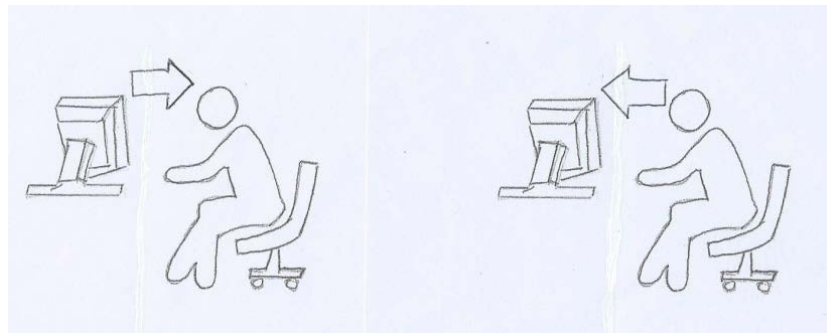
In the pre-interview students were also asked to rate their prior knowledge of ten potential research topics in an attempt to establish a similar 'content' knowledge base for the subsequent tests. Students in the post-interview were shown selected portions of their 'screen captures' or search behaviours from the post-test and asked questions pertaining to these behaviours.

Pre & Post tests

Participants completed a custom-designed search engine proficiency test both before and after the intervention. These were completed in pairs. The tests consisted of two sections: one where questions were completed on paper and one which required students to complete nine online 'search tasks' using a search engine of their choice in twenty minutes. *CamStudio*, an open source screen capture software, was installed on three laptops (identical to the students' regular laptops) to record the students' activities during the tests whilst video recorders were utilized to capture the students' interactions during their online searches.

Intervention

Two weeks after the initial pre-tests and pre-interviews, the sample participated in a group intervention lesson conducted in the school library. The teacher introduced concepts about search engines and searching and explicitly introduced some skills identified in the literature to improve search performance. Students also completed some activities allowing them to practise these new skills during the intervention. Most of the skills included were designed to address the specific difficulties experienced by students in searching as identified in earlier phases.

Discussion

Discussion of the findings are presented in accordance with the three sub-research questions. Each section draws on multiple data sources including: interview transcripts; pre and post test video footage and screen capture recordings, as well as written answers obtained in the tests and interviews. Findings will also be discussed through a semiotic lens.

1.   How do young adolescents currently use search engines?

Data from the study suggests that young adolescents are using search engines increasingly independently. Not one student in the pre-interview identified a teacher as a helpful person who aids them with online searching. This confirmed the findings of previous research (Green & Brady, 2013; Hashemi & soltanifar, 2011; Ladbrook & Probert, 2011). A unique finding, however, saw many participants in the study state they would use a search engine itself, rather than a human mentor when experiencing trouble searching online. This appears to reflect a strong conviction that any problem (experienced whilst searching) could not possibly be with the browser, but in the way the students are using it. A conviction that the search engine must be performing its 'role' correctly and that the problem therefore, lies in the student's role being performed incorrectly. This willingness to accept a more subordinate role when searching will be discussed further later. These behaviours (of not seeking help and searching solo) could also be a reflection of the increasing availability and relative inexpense of smartphone technology which has resulted in 95 per cent of Australian students now owning a mobile phone (Green & Brady, 2013; Macpherson, vi). Such isolated and independent use

necessitates a greater understanding of the searching skills students have and those educators should continue to be addressing.

Findings from the study also suggest that young adolescents are using search engines in limited and ineffective ways. In terms of 'search success' (as identified by students accurately attaining the information requested in the online component of the pre and post tests) participants performed poorly both before and after the intervention. Only two of the possible nine search tasks were successfully completed by all groups in the pre-test, and this success rate reduced to just one task in the post-test. While students finding the 'correct' answers to the nine search tasks was not necessarily the primary goal, nor chief data set, it was interesting (if not disconcerting) to see that the students as a whole performed worse in the post-test. What was observable, nonetheless, as will be discussed further, was a tendency on behalf of the students to attempt the skills taught as part of the study in the post-test, albeit not very successfully.

Table 1 reports the frequency with which students stated they conducted certain beneficial processes whilst searching the internet prior to the intervention. Very few of the beneficial behaviours were *always* completed by even some of the students. Many steps, furthermore, were reported to be *rarely* or *never* conducted by participants. 80%, for example, admitted *rarely* or *never*: making a list of possible search words; using inverted commas in their search; using advanced searches or looking at the date web pages were last updated. All participants, furthermore, explained they *never* look at who wrote the web pages they browse. In semiotic terms, this could be said to imply a trust that the search engine has adequately and accurately offered the 'signified' most befitting their search query. The pre-tests similarly revealed some disadvantageous but common searching habits among the sample. These included: poor abilities in scripting search queries and in manipulating number of results returned; failure to use advanced searches; a poor understanding of tabs; an unwillingness to look beyond the first page of results; overlooking correct information or useful websites; and a willingness to quickly stop searching. These findings, taken collectively, paint a grim picture regarding the capacity of young adolescents to capitalize on the education benefits brought about by search engines. The aforementioned data obtained in the post-test, however, revealed that, given the opportunity and skills, students were willing to change the way they searched; but needed more than one lesson for such changes to improve performance.

This leads to another key finding: that students are not typically using search engines in the classroom during explicit instruction or during lessons where effective use of the internet itself is the focus. In Australia one would be hard pressed finding an educational policy documents, syllabi, audit or guidelines for teachers which does not include substantial promotion of e-learning and the use of ICTs.

*Table 1*   Self-reported frequency of conducting certain searching behaviours

Searching behaviour	Always	Often	Some times	Rarely	Never
1. I use search engines OTHER THAN Google	0%	0%	40%	60%	0%
2. I come up with "sub-questions" (smaller questions) for the task	0%	0%	80%	20%	0%
3. I make a list of possible search words before going online	0%	20%	0%	20%	60%
4. I use words from the task sheet in my search phrase	0%	20%	60%	20%	0%
5. I use inverted commas or speech marks in my search	0%	0%	20%	40%	40%
6. I use "Advanced searchers" (Usually by clicking on a separate tab)	0%	20%	0%	60%	20%
7. I look at the number of results my query (search) produces	20%	20%	0%	20%	20%
8. I look beyond the first page of results offered (2nd page of results / 3rd page etc.)	0%	20%	60%	20%	0%
9. I change the search terms if unsuccessful	20%	60%	20%	0%	0%
10. I use the top listed results	20%	20%	60%	0%	0%
11. I search for key words WITHIN web pages selected	0%	40%	40%	20%	0%
12. I look at the URL (www web address) of web pages offered	0%	40%	20%	40%	0%
13. I look for the date any selected web page was "last updated"	0%	0%	20%	0%	80%
14. I look for who WROTE / MADE the web page	0%	0%	0%	80%	20%
15. I use more than one web page to find my information	20%	60%	20%	0%	0%

ACARA's inclusion of 'Information and Communication Technology Capability' as one of seven overarching General Capabilities, as well as the recent roll out of a new separate subject area, 'Digital Technologies', also reflect an appreciation that including new digital skills in Australia's curriculum is essential. This study found, however, in line with much international research (Combes, 2009; Hashemi & soltanifar, 2011; Oblinger & Oblinger, 2005; Walraven, Brand-Gruwel, & Boshuizen, 2013), that some Australian students are not being exposed to explicit skills for using search engines in the classroom, even in Grades 6,7 and 8 where it forms part of the curriculum. *"No, there wasn't any of that"*. One participant recalled in the pre-interview. *"Just they expect you to know it"*. This potentially misguided belief (that instruction is not necessary for effective use of a search engine) may, in semiotic terms, leave students to believe that creating signifiers, and indeed the signification process, is an easy one.

2.   How do young adolescents view their role when using search engines?

Students in the sample were found to view their role as subordinate (to the computer) when using search engines and did not see themselves as initiating or being 'in control' of the search process. Their choice of stylized images in one question of the pre-interview reflected a common belief that they play a passive role when interacting with search engines. As can be seen in Figure 6, when the scenario given related to students manipulating hardware (for example, installing a printer or adjusting volume), most respondents (80%) chose Drawing B, which represents them being in charge or directing the communication. Similarly, students chose Drawing B (reflecting an active role) more often than not when asked to describe using Facebook or YouTube to search. When the scenario involved searching for information via a search engine like Google, however, most students (60%) selected the more 'passive' picture, Drawing A, in the pre-phase interviews.

Figure 6 Reponses to Pre Interview Question (m)

Drawing A   Drawing B
Student as Passive   Student as Active
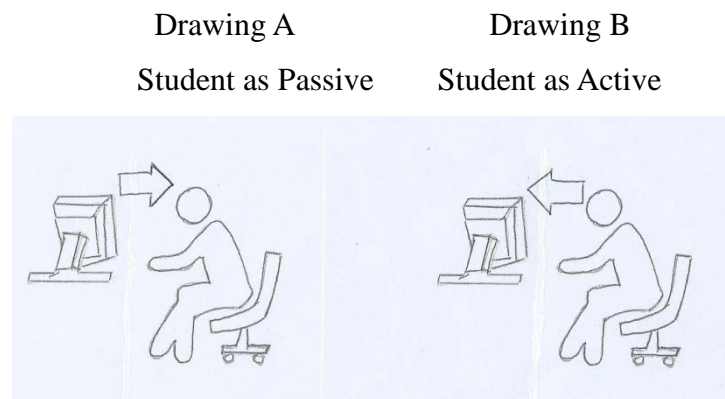
Scenario Given	Drawing A selected	Drawing B selected
Installing a new printer	20%	80%
Turning the volume down	20%	80%
Copying a file to a USB	20%	80%
Using a shopping center touch screen	60%	40%
Using a banking website to check balance	60%	40%
Searching YouTube for a video clip	20%	80%
Searching Facebook for a friend	40%	60%
Searching Google for information on a school assignment	60%	40%

The sample also did not appear to change this passive view of themselves as search engine users in the post- interviews. After the intervention students were again asked to describe their interaction with

the computer during various (new) scenarios using the same stylized pictures in Figure 5. When compared with those selected in the pre-phase, only minor variations were witnessed. Students at large continued to view their role as largely 'active', or one where they direct the communication (choosing Drawing B) when manipulating hardware. There was some swing with regard to how students viewed their role when searching for information online using Google in this question, however this change was inconsistent. That is, whilst in one scenario (searching Google for an instructional film) more students chose an 'active' role than in a comparable question in the pre-interview, in another scenario (searching Google for a recipe) less students chose the 'active' drawing than in the pre interview. If students are to truly capitalize on the unprecedented amounts of information search engines make available, and on the resulting educational benefits, they must it is suggested, begin to recognize their role as the more dominant one when searching. The true value of the internet is surely lost if searchers do not put their informational needs first. Moreover, by continuing to see (and accept) browsers like Google as directing their search, students are unlikely to develop the skills needed to distinguish between quality, reliable and current information and that which is inaccurate, biased or commercially driven.

3. To what extent do young adolescents perceive exposure to the skills demonstrated as being beneficial?

Overall, data from the study suggests that students perceive benefit in being exposed to explicit search engine skills. In the post-interview every student spoke in positive terms of the chance to participate in further search engine-based lessons. They expressed a keenness for their own teachers to continue such lessons, most suggesting these would be welcomed once a week. Welcoming such lessons, it could be speculated, reflects a newfound understanding on the part of the students that they still have much to learn about using search engines. Screen capture and video footage of the post-tests also showed students spending time conducting some of the behaviours encouraged in the intervention. This likewise appears to reflect a view on the students' behalf that the intervention was beneficial. Of interest, was an apparent preference by the sample for being slowly taught how to use search engines quickly. Whilst typically in the study, all things quick and fast were described positively, when asked about future lessons, students in the study described a preference for slower, more incremental instruction. This patient attitude among the students in terms of learning search engine skills should prove useful in facilitating lessons which must, according to researchers (Jones & Hafner, 2012; Nelson et al., 2011), focus on the search process not content acquisition, on application of skills, not mastery, and must see students taught skills they can use "in different situations […] while solving different tasks" (Walraven et al., 2013, p. 128).

An important finding in the pre-phase interviews was that students did not always feel their teachers had an accurate understanding of their current skillset pertaining to search engines. This may help to explain the earlier finding that teachers are rarely covering internet searching in class. A situation often attributed to a common misconception about those who have been "born digital […] and [who, apparently] do not have to learn ICT but merely experience it" (Nelson et al., 2011, p. 95). Qualitative data from this phase confirmed that this is, indeed, a misconception, in that despite everyday use, students in the study did not have a great understanding of how to use search engines. The students' desire post intervention for further instruction, not to mention their attempts to utilise their newfound skills, likewise challenges these theories about the needs of Digital Natives.

Data from the post phase did not reflect improvements in terms of searching success, but highlighted a willingness on the students' behalf to attempt new skills for utilizing search engines once taught. This finding, while preliminary, suggests that the intervention lesson, which exposed students to a variety of skills and encouraged flexibility in searching was appreciated. An appreciation which may support previous literature which claims educators who teach flexibility in using search engines will be most effective (Jones & Hafner, 2012; Ng, 2012; O'Connell, 2011; Quintana et al., 2012; Rasmusson & Eklund, 2013).

Conclusion

Today adolescents have at their disposal unprecedented access to knowledge. However, having the internet in one's pocket it seems, does not guarantee internet proficiency. Nor does it negate the need for lessons on explicit skills. There is growing consensus that online search engine proficiency is correlated with several educational and social benefits (Casey et al., 2012; Halavais, 2009; Johnson, 2010; Schroeder, 2015; van Deursen & van Dijk, 2010). Regrettably, this study contributes to a body of knowledge which suggests that young students are, thus far, not likely to benefit from these due to ineffective searching (Kammerer & Bohnacker, 2012; van der Sluis, & van Dijk, 2010). Results made all the more concerning by another common finding; that teachers are rarely explicitly covering these skills in the classroom (Ladbrook & Probert, 2011). Such an oversight could be related to a commonly reported misplaced confidence in students' searching capacities; a confidence sometimes attributed to a confusion between computer hardware skills and information skills (Quintana et al., 2012; Walraven et al., 2013).

By analyzing the data through a semiotic lens, this study contributes new knowledge to the field and presents findings which suggest that students themselves perceive a difference in these skillsets. In particular, the study suggests that when conducting searches online, young adolescents view their role as more subordinate or passive than when conducting other computational tasks. The sample appeared to devalue their role as 'signifier' makers when using search engines like Google. It

is perhaps reassuring then, that students in the study also appeared highly receptive to being taught explicit skills aimed at improving their searching experience. If we are to ensure the World Wide Web's unprecedented educational opportunities don't go wasted, and that students have the skills required to effectively participate in their future digitally driven worlds, the importance of such skills cannot be underestimated.

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