SEARCH ENGINE USE AS A LITERACY IN THE MIDDLE YEARS: THE NEED FOR EXPLICIT INSTRUCTION AND UNLEARNING OLD HABITS

Abstract
The internet has provided today's middle years students with limitless, instantaneous information offering unprecedented educational benefits. Scholars have noted, however, that students frequently struggle to find information in such an overwhelming environment and exhibit a searching skill-deficit despite frequent use. Research also suggests that this deficit is rarely responded to with explicit search instruction in schools. Little is known however, about the potential benefits of exposing students to explicit search engines skills, nor the way they view their role when searching online. This paper therefore presents data from an intervention carried out with middle years students in relation to online searching skills. Data revealed that although a single intervention was not sufficient in changing the students' views of themselves as searchers, nor of perfecting search strategies, students showed a willingness to adopt all new strategies taught. This knowledge has possible implications for better equipping students for learning and assessment, especially when research and online searching are required for success.

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" (Palfrey & Gasser, 2010, p. 3), has resulted in a practically infinite amount of information being instantaneously available to students. Google alone now has an estimated 60 Trillion pages (How search works, n.d.). Many in the field of literacy education have noted 'new literacies' afforded by such a technological revolution (Jewitt, 2008; Kalantzis, Cope, Chan and Dalley-Trim, 2017). The era is also said to have brought about a new breed of learner; what Prensky (2001) coined the 'Digital Native'. This term has come to represent every student in today's classrooms—like middle years students-who have never known a world without the internet and who, in Australia are said to have spent more than 3,500 hours online by the age of seventeen (Australian Communications and Media Authority [ACMA], 2008). Such widespread use necessitates a greater understanding of the ways students interact with the internet, and of ways such use can be improved to better enable them to maximise its incredible potential.

Recent expenditure by the Australian Government of more than $2 Billion on the implementation of digital technologies in classrooms reflects an appreciation for the imperative to empower students with new digital literacies. Such an appreciation is also apparent in ACARA's (n.d.) inclusion of 'Information and Communication Technology' as one of seven overarching General Capabilities, not to mention the recent roll out of a new separate subject area, 'Digital Technologies'.

A growing body of research, however, suggests that despite such educational moves, these 'Digital Natives' who "live and breathe technology", are far from epitomising cyber-expertise (Nelson, Courier & Joseph, 2011, p. 104). Many contend there exists a lack of evidence to confirm that young adolescents are, as Prensky (2001) suggested, naturally imbued with the literacies necessary to capitalise on new technologies like the web. This potentially means educators need to continue to teach middle years students the necessary skills to utilise such a resource effectively.

This paper therefore aims to firstly identify what digital literacies middle years students currently have with regard to search engine use and secondly, to implement an intervention that aims to improve students' search engine skills. Previous research suggests that if students are not exposed to explicit search engine skills or are left to teach themselves how to search for information online, they will at best, waste time and find inaccurate information, and at worst, lack the literacies required to participate in their future, digitally-saturated world. As such, the paper aims to answer the question: To what extent does exposure to explicit skills for using search engines affect middle years students' online searching?

A brief review of the literature
What do good online searchers look like?

Search engines are unlike other traditional educational tools because they are not passive entities (e.g. pencil or rubber) which unwittingly and perfectly follow student directions. The relationship between an online information seeker and the search engine is likewise different to the more traditional author/audience relationship. That is, the student can "no longer [be] a passive entity that processes a single text mode in linear sequence" (Yus, 2011, p. 49). Far from a book, where the message is already created by the absent author and offered to the student for consumption, search engines require students to identify the information required. In this manner, effective searchers need to play an active role should they best utilise search engines' potential.

Considerable attention has also been given to comparing the behaviours of novice and unsuccessful search engine users and those more effective. Ineffective behaviours frequently reported to be used by middle years searchers include: writing ineffective search terms; not refining unsuccessful queries (Aula, 2007); reading entire websites / results pages rather than scanning (Jones & Hafner, 2012); not questioning site credibility (Keil & Kominsky, 2013; Kuiper, Volman, & Terwel, 2008; Lei, Lin, & Sun, 2013) and relying on search engine's placement of results as a measure of relevance (Blikstad-Balas & Hvistendahl, 2013). Despite such a skill-deficit, most research also describes a confidence; held by students and teachers alike; in the students' searching abilities (Barrett, 2012; Georgas, 2014; Halavais 2009; Kammerer & Bohnacker, 2012). This confidence, though potentially misplaced, could help to explain the finding that teachers are frequently failing to explicitly teach today's students online searching techniques (Combes, 2013; Ladbrook & Probert, 2011; AUTHOR).

Given the study's aim of attempting to improve students' search engine skills, of strong interest are those strategies identified as helping searchers. Most work suggests that the best results are presented to searchers who first consider their intent or the type of information sought prior to searching (Kuiper et al., 2008; Quintana et al., 2011; Waller, 2011). This, as well as findings from previous research that not all searches are alike, gives rise to suggestion that teachers should focus less on the outcomes of search and "direct their attention to the [searching] process instead"(p. 1). Lei, Lin and Sun's (2013) work, which suggests that "experienced users are more likely to employ a variety of techniques […] in order to achieve better search performance" (p. 152) adds to this argument.

There is also agreement that the way stronger searchers use their time when seeking information online differs from that of ineffective searchers (Robertson-Lang, Major & Hemming, 2011). Robertson-Lang et al. (2011) found expert searchers "adopt a depth-first

strategy […] use well-composed keyword phrases […] scan their results carefully; and adjust their queries after reviewing incoming information"(p. 635). Such findings attest to the importance of developing strong literacy skills in students if they are to capitalise on this unprecedented educational resource.

Notes about the study

In order to answer the question: To what extent does exposure to explicit skills for using search engines affect middle years students' online searching? it was necessary to first identify the existing search engine skills of middle years students and secondly, see if exposure to explicit teaching improved these skills. Phase One involved five students (3 boys and 2 girls) completing a pre-test and interview and subsequently participating in the explicit instruction intervention lesson in Phase Two. The pre-test required students to carry out a range of search activities. Post-tests and interviews were then conducted in Phase Three.

The tasks in the pre- and post-tests included open and closed questions and four different 'types' of searches based on the work of Waller (2011) and Broder (2002). Search tasks were designed to be either: informational—in response to an information need; navigational—in order to reach a particular site; or transactional—in order to "perform some […]web-mediated activity") (Broder, 2002, p. 5). The design of the nine search tasks was influenced by a desire to avoid searchers being able to successfully find the 'correct' information should they merely copy the question into the browser. Several studies have exposed this as a recurring, yet ineffectual, habit of middle years searchers (Kuiper et al., 2008; Quintana et al., 2012). All search tasks were piloted by the researcher in this manner, with tasks re-designed as needed. The researcher did not assist students with their search tasks but was on-call to help with technical issues during the tests.

The individual pre and post-interviews were conducted over approximately half an hour on the students' school site. These were audio and video recorded with permission for later transcription and analysis. Participants were asked questions, both open and closed, in a largely "standardized open-ended interview" (Cohen et al., 2000, p. 271). Questions sought insight into the students': knowledge of search engines; use of search engines; and any assistance received from possible mentors. Quantitative data were also collected during the interviews by asking participants to indicate: how often they performed certain behaviours when searching; which search terms they would most likely use given an informational need; and how they perceived their role during a variety of likely computational scenarios. This last question (Figure 1) was unique in that it asked students to choose one of two simplistic and stylised images to describe their interaction with a computer during various common computational tasks.

INSERT FIGURE 1 HERE

Both images contain a human computer user, an arrow and a computer. Drawing A represents a situation where the computer is directing the interaction or is in charge. Drawing B represents a situation where the human is directing the interaction or is in charge. Drawing A could be said to illustrate a passive computer user, whereas Drawing B illustrates a more active computer user. This simplistic design (of an otherwise complicated interaction) was utilised in an attempt to isolate purely their role as perceived by the students.

Two weeks after the pre-tests and interviews the five students attended the intervention lesson. The lesson was video recorded. Walraven, Brand-Gruwel & Boshuizen, (2013) suggest that students learn best when they perceive relevance in a lesson. As such, key findings from the students' own pre-tests were first shared. Each of the search difficulties identified were colour coded and addressed in the intervention. Students were told both of the specific difficulty and correlating colour codes for each activity thereby relating tasks to an area of deficit previously identified in their own searching.

The intervention also involved introducing concepts about searching, demonstrating skills to better search performance, and time for students to practise new skills. There was a particular focus on assisting students scripting better search queries as this consistently proved difficult for study participants in Phase One. Much literature furthermore (Eagleton & Guinee, 2003; Lei et al., 2013; Quintana et al., 2012), suggests that "composing relevant search terms to a great extent determines Web searching results" (Kuiper et al.,2008, p. 7). This skill was therefore what the intervention therefore largely aimed to improve.

Research findings and discussion
Phase One: Pre-interview and pre-test

Overall, data obtained from the pre-interview and pre-test suggested that despite frequent use, students are using search engines in ways which reflect a limited digital literacy. The middle years participants were flippant, ineffective search engine users who identified themselves as innately and acceptably passive. Data likewise suggested that, although students were sometimes able to locate information online, their success is reliant on ad-hoc techniques at best and pure luck at worse.

It was found that students do not employ many of the in-built tools to aid them at various stages of conducting an online search. When scripting their query for example, the students typically: do not spend time considering their search terms; fail to use inverted commas to refine queries; fail to use the genre specific tabs (like 'News') to indicate what type of information is sought; and fail to use any 'advanced search' facilities.

Once a search engine results page (SERP) is generated, students again forego many behaviours likely to increase the efficiency of their information seeking. The pre-test illustrated that students rarely consider the number of results offered and have little experience in attempting to alter their search query to influence these numbers. The data from the pre-test also showed that students only look at the first page of results. This contrasts with students claiming they look beyond the first page "often" (20%) or "sometimes" (60%) in the pre-interview. Such inconsistency in what students report as their searching behaviour and their behaviours in practice may reflect an awareness of literacies desirable in an online searcher, albeit one not acted upon. Furthermore the choice of site from the SERP is not, by

the students' own admission, influenced by who created the website or when it was last updated; that is, by any critical literacy on their part.

This finding was strengthened by data obtained in the pre-test during which time all groups selected blogs like *answers.com*, where content goes largely unchecked. Again, students have available to them at this part of the search, information (e.g. url address) which would prove beneficial, however, do not use it. Such findings reinforce the passive stance students take when searching online.

The pre-interview also produced data which aided in understanding the way that students interact with search engines and the way they view their part in the process. The results offered by their choice of stylised images in the pre-interview reflected a common belief that they play a passive role when searching. As seen in Figure 2, when the scenario given related to students manipulating hardware (e.g. installing a printer or adjusting volume), most respondents (80%) chose Drawing B, which represents an active user directing the interaction. 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.

INSERT FIGURE 2 HERE

Table 1: Responses to pre-interview questions—your role when using a computer

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%

Phase Two: Intervention
The two-hour intervention lesson aimed at increasing the search literacies of middle years students by exposing them explicitly to searching skills. It introduced students to skills likely to remain beneficial in an ever-changing digital platform such as recognising website sources via url addresses and writing better search queries by using quotation marks and search operators like 'not', 'or' and 'site:'. Keyboard shortcuts including CTRL F were discussed in terms of their ability to improve efficiency. In addition, students were asked to consider the

fluid nature (and organisation) of content online, as well as the contextualised and time dependent qualities of the results offered by browsers.

The first 'hands on' activity asked students to physically categorise not 60 Trillion, but 12 simple cue-cards without assistance. The cards were designed in such a way that an obvious three 'categories' were initially evident (animals, modes of transport & countries). Students performed the task with ease but were challenged to recognise many other ways the cards could be sorted based on new additional categories. When the card 'kangaroo' was placed together with the 'Australia' card for example, students were quick to assemble the remaining cards in a similar fashion; whereby one animal was associated with its country of origin. This activity acted as a catalyst for discussions regarding just how many different ways 60 Trillion pages could be sorted, and as a reminder regarding the importance of students to actively and aptly script search terms. Students were also asked why (as demonstrated) the word 'Airline' was 'auto-filled' by Google when the word 'Malaysia' was typed into the search bar. Most were quick to recognise the cause: a recent event of the missing Malaysian airline plane MH370 which had dominated the news media in Australia for weeks immediately prior to the intervention. Students were helped to realise that the same query 'Malaysia', typed in even a month prior would not have been followed by an 'auto fill' of the word 'airline'. Educating students about the fluid nature of online content not only increases their digital literacy, but contextualises their need to play an active and informed role when scripting searches should they wish to be effective web searchers.

Data from earlier phases of the study suggested students were often overly confident in their search skills. It was anticipated, therefore, that in order for students in the study to appreciate, and ideally adopt, some of the introduced skills, the lesson would have to involve a level of 'unlearning' of previously utilised skills. Several activities in the intervention required students to 'unlearn' or disrupt their prior habitual techniques of searching online.

The vast majority of students in the pre-intervention interviews, for example, admitted to *"Rarely"* or *"Never"* considering possible search terms prior to typing their query. Indeed, the interviews indicated that students conducted no activity prior to typing their query. Such behaviours likely reflect a belief on behalf of the students that "the onus is on the search tool" (Georgas, 2013, p. 177) rather than themselves during online information seeking; a belief once again positioning the searcher as passive.

Encouraging students to physically write a list of possible search terms prior to going online can act as a precursor to them later internalising the process as more advanced searchers. The intervention in this way challenged students' previous search behaviours by asking them to conduct more steps, not less, when searching the web. Getting students to attempt to come up with not one, but 26 alternative search terms (one for each letter of the alphabet) for a particular informational need was met with excitement and proved effective in inciting a level of 'unlearning' on their behalf regarding scripting and re-scripting search queries.

The pre-tests also showed an inability among students to alter their search terms to manipulate the number (and often therefore, accuracy) of results offered by a browser. After exposing students to the idea that frequently 'less is more' when it comes to search terms (and that using natural language questions is also largely ineffective), students were asked to imagine they were on a sinking ship and must continue to reduce a distress signal to fewer

and fewer words. This activity was also met with much enthusiasm and again, served to introduce the need to sometimes use more succinct phrases in scripting search queries.

Finally, in an attempt to get students to recognise their position of power when searching, recognition not reflected by the results of Phase One, students were introduced to different types of searches based on motives held by the information seeker. It was envisioned that if students increasingly took the time to first consider their motivations to search, the importance of their role in search may be foregrounded.

The lesson described above served as a potential catalyst in changing middle years students':
- use of search engines,
- view of themselves when using search engines, and
- their attitude towards skills-based lessons like that in the intervention.

Phase Three: Post-interview and post-test
During their post-interviews, all students reported their use of search engines had changed since the intervention. Such changes were also witnessed in the post-tests. More fascinating perhaps, was the fact that these changes did not necessarily improve their success in searching, nor the way they viewed their role in the process. Nonetheless, every participant spoke positively about the potential for further exposure to such lessons involving explicit search engine skills.

As in the pre-test, there appeared no correlation between the type of search tasks students were performing and their search success post the intervention. Other changes were, however, observable. Prior to the intervention, some students tended to prefer search queries framed in the form of questions or whole sentences. After the intervention no student utilised this limiting strategy. The screen capture recordings also revealed students applying some of the query writing tips provided in the intervention including the use of inverted commas, search tools and shortcuts like ".site" and CTRL F. Despite this acceptance, however, not one of the students were witnessed successfully applying these tips in a manner that improved their overall search success. Some promising new behaviours were nonetheless observed. Students were frequently seen, for example, re-phrasing their search queries prior to a results page being displayed. Such timing suggests that they were not merely responding to any incorrect or un-useful information the browser displayed, but rather, actively and pre-emptively reflecting on their query and ways to improve it. Once faced with a results page or specific web site, students in the post-test again displayed some new habits. There was a reduction, for example, in the number of instances groups chose 'blogs' or similar sites.

Regarding searcher role, Figure 3 shows the stylised images students chose to describe their interaction with the computer in the same manner as prior to the intervention. When compared with those selected in the pre-phase (Figure 2) only minor variations are witnessed. Students continued to view their role as largely 'active' (choosing Drawing B) when manipulating hardware. There was little change observed between pre and post results for the statements referring to searching Google. Somewhat surprisingly perhaps though, while 80% of students saw themselves as 'passive' when searching for a video in the post test, 40% saw themselves in this way when searching for a recipe. This may reflect a newfound understanding on the students' behalf that searches can differ but ultimately does not reflect a strong sense of their active role when seeking information online.

Implications and conclusion

Findings from this study showed that middle years students do not use search engines in class for explicit skills lessons or lessons where effective use of the net itself is the focus. Their digital literacy in this area (or lack thereof) has resulted from repeatedly 'searching to learn' and very rarely 'learning to search'. It was found, nonetheless, that students are willing to change their usage after exposure to explicit skills. The intervention showed that students perceive benefit in being slowly taught how to use search engines quickly. It also revealed that they are not satisfied with mere time online in class and would prefer if they were taught explicit skills. Though it was found a single intervention lesson was not sufficient to perfect the searching skills of the participants, students expressed an appreciation for the intervention and attempted the skills exposed to them. Several recommendations can be made regarding the nature of beneficial lessons in future based on data collected in the study.

Scenario Given	Drawing A selected	Drawing B selected
Installing a new scanner	20%	80%
Adjusting the screen brightness	20%	80%
Copying a file to a CD	0%	100%
Using a Theme Park touch screen	100%	0 %
Using a transport website to top up your bus pass balance	60%	40%
Searching Instagram for a friend's photo	20%	80%
Searching Google video for an instructional film	80%	20%
Searching Google for a recipe	40%	60%

Table 2: Reponses to post-interview questions--your role when using a computer

Lessons must be built on a strong knowledge regarding the existing skillset of the middle years students. Despite prevalent beliefs that 'Digital Natives' already know how to use search engines, data from this study suggest this is a dangerous assumption and one that does not accurately reflect the existing skills of today's middle years student. If curriculum developers and teachers continue to assume that students are more proficient in searching online than they are, there is real risk that individuals will be disadvantaged, and that Australia will forego the countless opportunities online information can offer.

Lessons must also be explicit and ongoing. Several phases of this research indicated that students prefer, and benefit from, lessons that specifically address skills to utilise when searching the World Wide Web. This concurs with previous work (Argelagos & Pifarre, 2012; Davidson, 2011; Eynon et al., 2012) which suggests simply giving students time online is not enough to support them in developing crucial skills for their digital future. Beckman et al. (2014) suggest it is quite concerning in fact "that education policies and schools are

overlooking the opportunity […] to expand students' experience with technology in formal learning contexts" (p. 18).

The students in this study appreciated activities which introduced them to a variety of online skills with which to do a variety of online searches, as well as those helping them understand the nature of the net and ways that search engines organise information. The current intervention lesson's emphasis on writing effective search queries, though justified (Misirli et al., 2009; Portmann et al., 2012) could have been complemented with other activities, time permitting. Given it proved harder to change student attitudes than behaviours, for example, activities more explicitly discussing their attitudes, both towards the internet and their role in using it, could prove beneficial. Lessons regarding effective use of mobile phones when searching the Web may also be advantageous.

Lastly, given the current findings that teachers can be influential in addressing the shortcomings of our middle years searchers, it would be remiss not to advocate further training for teachers in effective search engine use. Surely, in order to equip "students with a repertoire of tools and cognitive capabilities [necessary] to live in a technologically oriented society", the teachers must first possess the same (Ng, 2012, p. 1077). Research in Australia suggests that many teachers currently do not possess these skills necessitating a call for further training in this area (Macpherson, 2013). Ladbrook and Probert suggest "the importance of addressing students' information literacy skills […] by developing the knowledge and skills of their teachers, cannot be understated" (2011, p. 118).

This research showed some change in the online searching behaviours of the participants post exposure to explicit skills, but there was little to no change in the way the students viewed their role in the search process. Despite these shortcomings it can be concluded that middle years students benefit from explicit teaching episodes to improve their search engine skills and therefore research skills, better equipping them for the future.

Literacy learning: The middle years
3000-5000words

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