Use of Educational Websites by Teenage Students: A Malaysian Case Study

Noor Azalina Arshad, Noraffandy Yahaya, Muhammad Sukri Saud and Abd Razak Idris

Faculty of Education, Universiti Teknologi Malaysia, Malaysia

Abstract: This study is to determine and understand the factors that influence a teenage student in choosing an ideal educational website in his/her pursuit to find additional and reinforcement of learning and information through the Web. The scope is also narrowed to see the features in educational websites that may influence teenage students’ choice. It includes the affects of arrangements of hyperlink in students’ web navigation efficiency and effects of presentation of text, animation and interactive application on students’ successful search result. As the most developing technologies the Internet has overcome the physical boundaries of traditional class-room and time restraints of class schedule. But its effectiveness in the world of education has brought up mix critics. This study is focusing on teenagers as researches by Sjöberg [1], Rosen et al. [2] and Aula and Lubomirsky [3] show that teenagers are the age group that mostly influenced by the Internet. Nine students within age of sixteen to seventeen were given an information search task on three different experimental websites. These websites are varied in features of hyperlink arrangements, text presentation, availability of animation and search tool. The students were classified into three cognitive levels of high, intermediate and low. Evaluations were made based on the search task, on-scene observation while the students were performing the search task, one-on-one semi-structured interview, observation on navigation history records generated by a screen-movement capture software and evaluation on number of correct answers from the search task. In conclusion, type of task gives great impact on students’ behaviour, motivation and distraction. Other factors like familiarity, time pressure, cognitive level, type of language also play important role in selecting an ideal educational website by them. In terms of features in a website, the availability of search tool plays a critical influence on students’ choice of an educational website as a learning resource. Arrangement of hyperlinks, animation, interactive application and text presentation are less affecting the students.

Key words: Knowledge Management • Cognitive Theory • Information Searching

INTRODUCTION

Education has grown so much along with the wave of technology. From CD Courseware, to e-learning, from websites to mobile phone, education has been struggling to embed these technologies in its effort to fulfil the ever-changing needs of learners. Among these technology, the most developing source is the Web (or some preference it as the Internet or the World Wide Web). The World Wide Web has captured the imagination and interest among all educators around the world. The World Wide Web is rich with information where students can obtain and collect all the information they are concerning in [4]. The Web has also overcome the physical boundaries of traditional class-room and time restraints of class schedule. But its effectiveness in the world of education has brought up mix critics. The amount of sources in the Web is so much wider now that without any monitoring strict control by teachers may cause students to mislead of information [5]. Some of scholars like Norjihan et al [6] and Owston [7] think that the Web has brought several paradigm shifts, give breath to our dull and forceful environment of conventional classroom teaching while others like Woodill [8] and Walraven et al. [9] have 180 degrees turned perception. So what causes the stir?

The Web is not only gives information, but also acts as medium for teaching and learning in order to provide a better learning environment [10,11]. It also helps them building and express their own perception and explore other’s view [12].

Among all level of age, teenagers are the most influenced and become internet obsessed. Teenagers are prone to use internet for activities like downloading games or MP3 music, chatting and also searching for

Corresponding Author: Noraffandy Yahaya, Faculty of Education, Universiti Teknologi Malaysia, 81310 Johor, Malaysia. Tel. +6(07)5534263, Fax +6(07)5560542, E-mail: fandymcl@gmail.com.
information and facts for school or for personal interest in artists or sports [1]. It is far from wonder why teenagers are more addicted to the Internet than older users [2]. Data collected by Aula and Lubomirsky [3] showed 73% of the participants use the Internet for music, music videos and videos, 50% of them spend time for information seeking and email, 39% for school-work purposes and 31% use it for web browsing. Pfeil, Arjan and Zaphiris [13] in their research to compare the social capital of teenagers (age range within 13 to 19) and older people (age over 60) in MySpace, found that teenagers have bigger number of social network friends than older people.

MaKinster et al. [14] concluded that students faced difficulties in building and combining constructive keywords for their search in the Web and ended up winding in the web full with irrelevant and off-putting pages. Walraven et al. [9] showed students did not really able to process information from the web as they expected. Problems that contributed are the design of content, the nature of students which tended to pick the simplest and answer-ready information.

The aim of this research is to investigate teenage students' perspective in choosing the best educational web and what attracts them the best, to explore students capability to process and interpret information from the vast volume of information in the Web and transfer them into school assignments and to see what kind of distractions may influence the searching process. In particular, the researcher is interested in:

- To understand the aspects and features a student is looking for in an educational website in his/her pursue to find additional information and reinforcement of knowledge via the Web.
- To examine the relationship between the arrangement of content and interactive application in helping students to use the Web as medium of learning.
- To investigate the effects of links in students' web navigation efficiency.

**Literature Reviews:** Bilal and Kirby [15] used effectiveness, efficiency and quality of web moves wages to measure the differences and similarities in information seeking in children and adults as Web users and concluded that there are three factors that influence students’ ability in information searching: ability to recover from “breakdowns”, navigational style and focus on task. In the findings, Bilal and Kirby [15] found that both adults (graduate students) and children (grade 7 - 9) were experiencing “breakdowns” due to the poor structure of keyword searching of Yahoo's! Adults were faster in recovering from “breakdowns”, navigational style and focus on task compared to children.

Knowledge and information is best - although not the most favorable by teenagers- presented in text. Thus, in terms of text arrangement, it cannot be denied that it gives some impact on teenagers’ motivation to learn from the Web. It is proven by Evans et al. [16] that simply putting text on the Web is a big “no no” in learning biological science virtually. If a website is carefully designed interface does provide a significant improvement in students learning experience compared to filling a page with nothing but text and pictures.

Hölscher and Strube [17] prove that in order to have a successful search performance, it requires the combination of expertise of search strategies and domain knowledge. In the findings, they found that only ‘double experts’ (have both skills of Web experience and domain-specific background knowledge) were able to directly access the specific websites related to the task, while the rest straight away accessed a search engine and go further from there.

Cognitive-Load Theory or CLT, stated that all schemas of information are kept in long-term memory and the construction of information happens in working memory [18, 19]. Working memory is the conscious cognitive process that occurs in human brain. It involves organising, contrasting, comparing or working on the information read [20]. Madrid et al. [21] in their revision of literature found that working memory is the important key of processing memory and at the same time create links between the information the learner is having with the long-term memory.

**Long term memory (LTM)** supplies human with the capability to enormously increase the ability to process information [22]. This is the human capability to make sense of and give meaning from the information they retrieve from [20]. Human has complex, unlimited long term memory holding and they are vary from one to another. Human intellectual comes from LTM where new information is processed and relate to prior knowledge before judgement is made. It is also the place where brain keeps the permanent knowledge and skills in a form of schema. The amount of schemas in LTM can reduce working-memory load.

Artino [18] stated that cognitive can be classified into three types; intrinsic cognitive load (ineffective cognitive load that may distract one from the task), extraneous cognitive (unrelated skills to knowledge that needed during the information seeking process) load and
germane cognitive load (the effective cognitive load that stimulate the schema construction in the brain). Extraneous and intrinsic cognitive load are manipulative in nature [23]. Thus too much of interactivity and irrelevant instructional design may end up leaving very few space left for the working memory to construct on the information and the schema. And in the end, students will not only get confused, they will also endure during the learning process, thus increasing the cognitive load of the students. This statement is in line with Paas et al. [22] where he further explained that extraneous cognitive load compliments the intrinsic cognitive load. If intrinsic cognitive load is low, then the extraneous cognitive load is less likely relevant to exceed the working memory capacity. Writings by Kirschner [20] showed that the higher amount of schema or knowledge stored in one’s brain, the less working-memory load needed.

According to Kirschner [20], among the causal factors that influence one’s cognitive load are the features of the students themselves (cognitive ability and prior knowledge), the task given or learner interaction and the last factor is the environment including noise or condition of the surroundings. Unpleasant classroom and incomplete facilities may also influence students’ cognitive load. And in the point of this study, low speed of internet connection, or any distraction of malfunctioned of computer or software or plug-ins may also contribute to the failure of students’ cognitive load.

DeStefano and LeFevre [24] in their review of literature concluded that learning in high number of links increases cognitive load. This is not good in terms of efficient learning because the increase number of hypertexts may also impair the learning process. But filtering hypertext while reading certainly takes more than just processing information in brain. It involves decision making based on prior knowledge of the learner. This automatically increases the extraneous cognitive load and result in slower cognitive performance. This statement is supported by the findings made by Parush et al. [25].

It is important to this study to base on a theory that provides a framework for investigation into cognitive processes and instructional design for the target group of sixteen to seventeen years old learners or adolescents. Information comes in various forms and while some benefits its learners, some just make learners confused and worse of all resulting confusion and clashes with the prior knowledge built.

**Methodology:** Using Mozilla Firefox as the web navigator, three websites were chosen as the experimental websites with the aspect of similarity in terms of content. The content covered in all the three websites is Light, Colour and Sight. Despite the same content, all this three websites are different in other features. Descriptions of each website are as follow:

**Website-A:** The hyperlinks although looks like being placed in a list, there are no visible clusters can be noticed. Hyperlinks are embedded in text. Each hyperlink is described with the gist of what lies beneath the topic. Keywords are bolded to help user find them easier. On the left most area is the list of websites produced under the same developer, which has no significant relation that may help user to ease the searching process. But this website has embedded the search tool to fasten the search. Inside each link, information is presented in full-bodied text where occasional hyperlinks or hypertexts are embedded within text.

---

**Fig. 1:** Factors determining the level of cognitive load [20]
Website-B: Hyperlinks are presented in menu form but with concise description in every link listed. This way, user can have some basic idea about what will they found on the following pages. The approach may be one way for this website to give the overview to user on what are the information lying behind each link. Theoretically, this could decrease the cognitive load of learner in decision making. There is a convenience feature applied in this website which is the ‘Explore Related Concepts’ menu at the rightmost side of each of the pages. The list will change according to the topic viewed. As from its name, user can click on any of the listed hyperlinks for further understanding regarding the particular topic viewed at the time.

Another useful feature come with this website is the search tool. It may helps in faster search, but one needs the keyword-search skill in order to get the exact and precise search result.

Website-C: Hyperlinks are presented in menu where it is clustered according to the matched learning area. There is no description on any of the hyperlinks, but it is clustered according to each matched lesson. Although no description to every link could be seen, it supposedly helps learner the basic idea what will they explore in each link based on the title of the topic. However, once user click on any of the hyperlink, description of the topic is presented in text. Thus, most of the hyperlinks or hypertexts are located within the body of the text. On the lefmost, the main topics of various fields in physics are displayed permanently in every page of this website. The top of the page is where the page track is located (Example: ‘> Tutorial Room>Light and Sight> Reflection and the Ray Model of Light Chapter Outline‘). It helps user to recognize the current location he/she is viewing thus minimizing the tendency of being lost by the user. There are also several animations embedded between texts. But one has to click on it in order to play it.

As this is a qualitative research, the selection of the samples is based on criterion sampling. Participants are nine volunteered students from three different schools with three different Malaysian public examination’s Science achievement. Three students come from each school where School X was picked among the top five schools in southern region of Malaysia. School Y was among the intermediate schools while School Z was one of the bottom five achievers in the rank. But before they can proceed with the survey, it has to be sure that the three students come from different academic achievement too which is based on his/her examination result’s and their teacher’s personal recommendation. Priority was given to any volunteers that have at least had six months of experience in using the Internet. Three laptops were used in the research where each is pre-installed with Mozilla Firefox as the Internet navigator and a screen-movement capture software to record the navigation history of each student. In every school, the study took place in the schools’ science laboratory or a computer laboratory area as long as the Wi-Fi is accessible.

Each student was asked to perform a search task and on-scene observations were made during the task. There are four simple, direct questions of Science’s Light, Colour and Sight asked in the search task. Before students can begin, they were read a standardized protocol explaining their task and describing what would happen during this part of experiment. Students’ navigation style was also recorded by using a screen-movement capture software. These records later used in another observation to study their navigation efficiency. After they finished the search task, a series of one-on-one semi-structured interviews were conducted. The responds were recorded via audio recorder and also in a log sheets were the predetermined questions were set. Other questions in regard to any unusual behaviour exhibited by the students during the search task were also asked. It is important in this study that all the participants have the prior knowledge of Science syllabus’s Light, Colour and Sight. This is because the search task that be performed by the students is based on this topic.

RESULTS AND DISCUSSIONS

When they sat in front of the computer to start the task given, they started by browsing, backtracking, looping, scrolling screen, locating target and deviate just like observed by Bilal and Kirby [15]. Within the first ten to fifteen minutes of the search task, they spent it with the search style mentioned and shift from one website to another. At this moment, they were trying to find which among these websites could give them the best answers in shorter time and lesser text to be read. However, the navigation style changed when they realized the search style consumed time. For students with high cognitive level, they haphazardly changed the previous search style to keyword search. At this moment, the three students of high cognitive level have made their decision on which website they wanted to use for the rest of the questions to be answered.
Students with intermediate and low cognitive level displayed the same pattern of search style, except that it took them longer time before they realized that they had spent half of the time provided only to explore every website. But one student did use one awkward move in attempt to find answers he thought would be faster than keyword searching. He was using Website-A when he did that unusual search behaviour in attempt for faster searches results. What he did was he amended the URL and typed the keyword he was looking for in between words in the URL. But after several attempts, he finally realized that it did not work and he returned to his previous searching style which was keyword-searching. Later in the interview, I asked him regarding the behaviour:

**Adan:** It was difficult using keyword search especially when I had to read a lot in a short time. I saw that some words in the URL changes whenever I moved to another page. That particular section changes into different words, so I thought of giving it a try and change them to keywords I could think of. But it did not work. So I had to use keyword search again.

It was surprising that from the recorded navigation history that none of the students paid any attentions on the interactive application which in this study the Java Applet enclosed in Website-A or the animations as enclosed in Website-C. The only time a student clicked on one of the animations (in Website-C) was by Amanda. She did explore it only when she realized that she had already finished up the task. But she closed the animation before she could look at it when she found that it took longer time that she expected. She said during the interview that it was important to her to finish up the task rather than spending time exploring the rest of the websites. The same situation was observed with the rest of the students. Students did not report any difficulties of using hyperlinks within their search task. Many of them quoted of easily use ‘back’ button whenever they felt like they are about to lose the track. Melur added she thinks that the arrangement of hyperlinks in Website-B is a little unorganized compared to Website-C.

It is very interesting to see how the students involved in this study were able to focus on the task given without having any distraction. Students did not wandering around off the task on any website even once. Although for students with low cognitive level seemed to be having some trouble determining the keywords of searching, they kept exploring to the mean of the task regardless the frequency of failure of searching. This was shown from the navigation history patterns. They did have hard times finding the right answers, back and forth to the same page over and over again, but never once they were seen distracted with the advertisement banners enclosed on the side or top of the websites. This pattern is contrast to what was found by Naidu [26] when she was testing the usability of three websites for children age of 7 to 11.
The numbers of pages visited were much lesser than the number of pages visited by students with low cognitive level. Melur was using screen scrolling, looping and back-tracking for her first search. The success of the first attempt motivates her to use not only the same search style, but she determined to use the same website that gave her the first answer and use it again for the second round. This pattern continues as she reached the third question. The search style was later changed to keyword search when she realized that after several times of trying that the style she was using has a drawback. But in the case of Adan, he showed a very strong determination on finding the correct answers rather than answering all the questions with uncertainty. Thus, he spent more time exploring the websites, reading every text one by one.

From Table 2, we can see that students with high cognitive level had no problems in finding the information they were assigned to. In contrast, students with low cognitive level seemed to have difficulties in processing the information on the Internet and relating it to the prior knowledge they have. In the case of Melur, she answered one question wrongly, which is on the first question:

**Question 1:** State the Laws of Reflection

**Answer:** When a ray of light hits a surface, it bounces off or reflects and then reaches our eyes. This phenomenon by which a ray of light changes the direction of propagation when it strikes a boundary between different media through which it cannot pass is described as the reflection of light.

She clearly misunderstood the question from listing out the Laws of Reflection and stating the definition of reflection of light. But she did not fall off from the topic related to reflection. In her case, she was still able to differentiate between reflection and refraction. She was also able to find the relationship of reflection of light and the cognitive demand of the question. This has shown that students with high cognitive level still have the tendencies of making misconceptions in processing the information, but they are still able to differentiate one topic to another. One of the reasons this may happens is because of the language. Malay students especially in suburban areas are not custom to English language. But as they do learn Science in English, this has lessened the language barrier. But still, error of interpreting information may occur due to this factor. One of the students, Shah had commented regarding to this matter:

"I did not understand well the questions and also the information on the websites due to the language. I am not good at English language, so it was difficult"

The potential of a student to become distracted by the environment of the Web in this study is very low. Although in MaKinster et al. [14] they did mention on how the participants became distracted, it was probably because of the slight difference in our method. While I provided students with three experimental websites and let them find the answers for the search task, MaKinster et al. [14] asked the participants to use various search engines to find for the answer of Newton’s Third Law from any websites listed by that particular search engine. This can be seen through the cognitive load theory, where one of the main factors that affect one’s cognitive load is the task. Different task may produce different behaviour and performance of a learner.

In cognitive theory, cognitive load depends on causal factors and assessment factors. The causal factors are task, learners and task interaction and the learner him/herself. While assessment factors are including mental load and mental processing. In this study, time provided, type task do affect the selection of a website. Any website that offers search tool will be the first to be chosen as a learning resource. Only then comes the choice of text presentation. If the task given is all about finding information, especially within a limited time, then students prefer point form text presentation. But as for learning resource generally, they prefer an educational website that has touch of descriptions on how a science phenomenon occurs. This confirmed the findings made by Madrid et al. [21] regarding on how high text coherence helps in reducing the cognitive load of a learner. Students clearly tried to avoid the increase in cognitive load while sifting through the texts.

Time pressure and type of task also influence the behaviour of the students. Animations and interactive application give no affect on students’ selection of a website. Level of motivation and determination of the students increased rapidly as they were so focused on finishing the search task and care less on the animations and interactive application provided in any of the experimental websites.

Familiarity is another point that influences not only the selection of a website as a learning resource, but also the success of information searching. As one becomes familiar with certain parts or structure of a website, he/she will become comfortable, working memory will be reduced and students will be able to use the intrinsic load and build a memory structure of the website in his/her brain.
CONCLUSION

This study is only focusing on what are the aspects and features in a website that influence students’ choice of an educational website as a learning resource, specifically for teenagers. It would hope to clarify few things that web developers, who are mostly adults, which would have oversee while constructing a site especially for adolescents. If we can understand our children’s thinking through the Web, so many things we can manipulate from there. In terms of implementation, this study may helps in building better educational websites for children and young adults. While in deeper perspective, it may becomes the scaffolding to future educational system developments.

As to further the investigation of the effectiveness of adolescents cognitive search strategy, we suggest the focus on developing an educational website specifically for this age range. In this future site, put in all the features identified and test it again with the type of participants. From here, the accountability of these features and criteria are able to be tested. As learning is a long-life process, another study can also be conducted regarding multiple tasks and/or with unlimited time to eliminate the time pressure. Any outcome from either behaviour or success of search results may indicate some more explanations.

REFERENCES