Using Technology to Enhance the Student Assessment Experience

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Abstract—The use of information tools is a common activity for students of any educational stage when they encounter online learning activities. Finding the relevant information for particular learning tasks is the topic of this paper as it investigates the use of information tools for a group of student participants. The paper describes and discusses the results with particular implications for use in higher education, and the findings suggest that improvement in assessment design and subsequent student learning may be achieved by structuring the purposefulness of information tools usage and online reading behaviors of university students.

Keywords—Information tools, assessment, online learning.

I. INTRODUCTION

FINDING or searching for information is a human trait that has been transformed with the advent of technology. The use of common search engines such as Yahoo, Google and Bing has increased exponentially the amount of data that individuals can have access to [1], [2] and the sharing of information through platforms such as Wikipedia as well as social media networks effectively creates knowledge sharing communities, broadening the learning paradigm and exporting learning opportunities beyond the classroom. However, with so much data available it raises questions about how to effectively search for information and then just as importantly how are the search results optimised.

Customising technology use to enhance learner experience provides users with an affordance [3] to capitalize and benefit from technology. Current applications such as cloud computing, augmented reality and 3-D printing ensure that multimodal information is available at any time, experiments can be conducted through simulations and designs can be produced quickly and cheaply; these are just some examples where technology is meeting learning needs by design. The well practiced and familiar ability to use Internet search engines and social media platforms are not at the forefront of technology development as the examples quoted above when it comes to learning needs, however, the need for information is pivotal and foundational to the learning experience and there is an opportunity to customise such practices to increase the efficiency of information retrieval.

Garrison et al. [4] suggest that that there is a lack of guidance given to students when lecturers design online information seeking activities. Part of the process of harnessing the technological advantage is to recognise that students need to develop their learning capacity beyond that of the most popular responses to learning enquiries. However, if attention was given to refining technology's capacity to generate information then it is likely that students would be better able to construct and convey their understanding [5]. The pedagogy underpinning such a capacity is to design an effective integration of technology and learning that focuses on a learner centred approach. Investigating such approaches whether it is an e-learning activity or e-learning approach is the subject of this paper.

This paper depicts one aspect of information technology in education by describing a pilot study that examined how university students use information tools in conjunction with the reading and information seeking activities to undertake a e-learning task. This particular study focuses on an e-learning event which due to the parameters of student availability and the fixed setting of the eye tracking hardware at the time of the study was held in an on-campus situation. The study is significant as the results can potentially be applied to improve learning assessments across most disciplines in the early years of university education. Whilst the study focuses on students in an on campus class the activity can be applied to a completely online class as the assessment task does not require any lecturer intervention and an e-learning event can be applied in both on and off campus settings. Some initial key findings will be presented in this paper to serve as a forerunner for a larger intended piece of research.

II. METHODOLOGY

The study was undertaken at Charles Sturt University in Australia in the Faculty of Education. Ten participants from a transitional education subject volunteered to participate in the study and were required to complete two subject related tasks in a usability lab session where their learning behaviour was monitored with the help of a fixed desktop eye tracking system. The transitional education class was selected as it was one of the few classes available at the Wagga campus where the eye-tracking software was available in the usability lab. Ten students from a class of 18 elected to participate in the study and gave their consent as per the university ethics requirements.

The eye-tracking software was used because it can trace the movement of a pupil's eye actions on a computer screen as well as record keyboard movements. Another advantage of using this technology is that the data can provide an insight into the user's reading styles and preferences. A short retrospective interview was conducted immediately after the completion of the task to seek confirmation of observed information tool use patterns and to investigate the

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participants' information tool use behaviour for academic and general purposes.

These two tasks were related to the subject but not part of the authentic assessment as the researchers did not want any perception of bias for students who did not participate in the study. The tasks are described below to illustrate the type of task;

- **Task 1** (15-20 minutes duration): Examine three websites of human service organizations that provide information on the selected human services. The objective will be to evaluate the three websites of organizations that identify how your profession caters to the needs of people at specific development stages. Also in your answer state which website was the best and give two reasons to justify your answer.
- **Task 2** (15-20 minutes duration): "Using the internet, search for a blog OR a short video about your profession as it caters to the needs of the people. Choose one resource you think is the most helpful to you. Copy and paste the URL on a Word document and give it a rating from 1 to 10, with 1 being poor and 10 being excellent. *In one or two sentences, tell the reader:*
- *Why did you choose this resource and gave it this rating?*
- *How would you improve the resource you found?"*

The study employed a mixed methods research design, with a qualitative component using retrospective interview and eye-tracking observations and quantitatively using the eye tracking data. Each student completed their tasks in a usability session that was captured and recorded on a computer including all recorded eye movements on the computer screen in real time, search browsers used, search terms and techniques used, web pages visited, documents browsed, mouse/keyboard actions and any words spoken. Immediately following the task completion a short interview was conducted between the researcher, assisted by the research assistant, and the participant, gathering feedback about the task completion as well as gathering data about the participant's usual information searching practices and their opinion about social networks.

The two researchers and one research assistant independently examined the data to determine whether it supported any common themes. The researchers came together frequently during this examination, conducted a preliminary analysis and established four themes;

I.   Question analysis
II. Information tool selection and manipulation
III. Information searching and retrieval
IV. Information synthesis for answer

The data analysis was then completed and findings were accordingly clustered into these four themes to establish patterns within the data. These findings are discussed in the next section.

III. RESULTS

A. Question Analysis

The eye tracker data showed that only the task objectives were carefully read with the heat map generated by the eye tracking software shows longer eye focus on the top and left hand side of the narrative (Fig. 1) where the objectives were situated on the assessment document. On average participants spent 30 seconds reading the task description for the first time. There were three participants that continually asked for confirmation about their interpretation of the task and as the sequence of learning is analyzed these students achieve the lowest outcomes for the task.
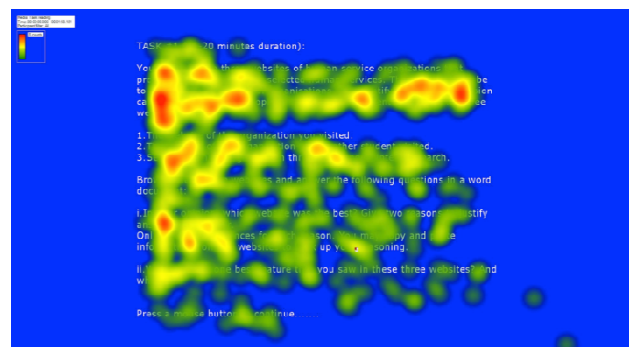

Fig. 1 Heat map showing student reading pattern of assessment task

B. Tool Selection

In the interviews, popular information tools were identified as Google, Google Scholar, YouTube and Wikipedia. Three participants stated that they would only use Google Scholar or the library database to search for information required to answer assessment tasks. Facebook was identified as being used mainly for interaction related to the subject and was generally not considered an academic tool. In most cases YouTube was only used for specific instructional tasks and text was generally preferred.

The recorded data substantiated the interview findings showing that Google was the most preferred option with 43 use instances recorded; however, it contradicted the three participants who stated their preference for the use of Google Scholar and the library data base. The pilot study findings also indicated that students focus more on the top and left hand side of the task description when reading the assessment objectives and requirements. These findings confirm previous research that users will gravitate to a commonly used simple working solution/behaviour [6], [7]. Other instances recorded were YouTube (5), Social Networking (1), Blog (1) and somewhat interestingly, trusted sites (4). It was interesting to note that even though the second task focused on a video or a blog, participants preferred Google over YouTube or any blog application in their first search instance.

C. Information Searching

The searching behaviour of the participants uncovered some interesting findings that was characterized mostly by scanning, which included bouncing around on the site and doing very

little actual reading. If any page was read, it was usually the top paragraphs with occasionally the last piece of information on the page, this pattern of behaviour replicated the reading of the assessment task by the students. Distractions were ever present, with flash images, static images and videos all contributing to diverting the attention of the student. The main findings are displayed in Table I. The findings show that some superficial search techniques were employed by these students that [10] states are part of the poor orientation skills demonstrated by first year students. Research skills are developed, according to Callinan, as students progress through different levels of subjects with increasing academic expectations.

TABLE I
SEARCHING AND BROWSING BEHAVIOUR OF 10 PARTICIPANTS

Searching Characteristics	Completely new search	Refines search	Knows target URL	Uses GOOGLE to find a site
	8	9	3	14
Website Behaviour	Pausing/Reading slowly	Comparing sites	Skipping between sites	Revisiting Sites
	9	25	3	8

Accompanying this data were findings showing that there were 14 instances of careful reading, 13 instances of skimming (fast reading) and only two instances of rereading text. There were further instances of skimming (12) to seek further information when participants revisited a site. These skimming behaviours adopt another layer of information refinement when associated with the participants' answers to the questions posed in the two tasks and is related to the grading of the participants' answers. The participants' answers were graded into three categories, poor, reasonable and good. In Table II the observed behaviour is matched against the graded responses. Elements of re-reading, comparison and reading slowly all point to a better achievement by the student and out of ten students it was determined that three students achieved a good grading.

TABLE II
MATCHING OBSERVED BEHAVIOUR WITH STUDENT RESPONSE

	Seeks confirmation	Skipping between sites	Comparing Sites	Reading Slowly
Poor Response	5	3	0	0
Reasonable Response	1	0	11	2
Good Response	1	0	14	7

D. IV. Information Synthesis:

There was a range of information synthesis evident. There were nine instances noted where students formed entire responses without checking the page from which the information was gleaned. Four responses were formed with any supporting information and the justification for the answers was given in very general terms. The common traits amongst most of the participants with poor responses were those participants sought the most clarification on the tasks and did the most skipping between sites. Other participants, however, sought to confirm initial findings and answers by evaluating and analyzing responses and confirms

characteristics of higher order thinking apparent in the comparison of sites behaviour as suggested by [8], [9]. It was observed that there were 11 instances of returning to a website to justify and compare a response, and three instances of returning to a site to confirm an item when forming a response as well as reading the material slowly.

IV. DISCUSSION

The findings for this pilot study illustrate behaviours that demonstrate a range of sophistication in search techniques, the interpretation of tasks and evaluation of search results. The interviews also discovered that there was a range of opinion in the use of various search tools for different types of academic exercises as diffentiated from normal day-today activities. The first and foremost observation is that the assessment tasks should be better constructed for the online working environment to contain some cues relating to structured search terms and reading. This structuring will enable students to focus their attention on the type of content that addresses the question and better equip students initiate better a depth of learning obtained from their engagement with the online content.

Better-structured tasks should reduce behaviours such as aimlessly flicking between search results without reading thereby increasing the amount of targeted time in answering the question, or continually asking for interpretation about the question. In the study the configuration of the lab was being altered and a privacy screen was not present which meant that the researcher was always visible to the student and may have prompted questions. However, the researcher made every effort not to answer the question or provide any advice that may advantage one student over another and the other researcher and research assistant confirmed this approach. Specific guidance in the task may also assist students in selecting better applications such as the second task, which required students to look for a video or a blog. Most students took the easiest option in this task and looked for a video with a range of visual stimuli instead of focusing on the fact that a well-written blog with many entries would have provided students with more explicit answers and a better learning experience. This is despite the fact that most stated in the interview that a video was not their preferred option of searching for information, so use of videos in this study was done simply for convenience.

The various student behaviours discussed in this section illustrate that students are not selecting the appropriate information tool nor maximizing the information search capacity of the information tools available to them. This type of limitation in using information tools is in turn is hindering the quality of information synthesis by the student. It could be argued that the year level of the students selected for this study would explain the academic approach to these tasks but [11] states that online material, or material that is to use the Internet should be sufficiently structured so that students are engaged and know how to approach the particular learning required. The tasks set for these participants did not contain any cues as to the depth of learning required or indeed any

scaffolding that would indicate levels of responses. Therefore, a possibility exists for assessment designers to scaffold within the assessment task and bring students' focus to information tool(s) that will provide better learning experience for the student in context of their study level/subject.

V. Conclusion & Future Directions

This study indicates that structuring of online learning material through use of information tools is important if students are to be engaged in the thinking and learning process. These findings form a foundation for a larger study involving a greater number of students engaged in an online subject and studying at a more advanced level than the initial study. The future study will extend the findings of the initial study by focusing on the learning behaviour of students when they undertake an authentic task for a subject they are enrolled and in the natural study/education environment. The further study will also focus on the use of information tolls in online learning as well as the activity response behaviour of the students. The findings of the pilot study enables information tools to be defined as applications that can assist users to find, retrieve, interrogate, manipulate and create information. The use of an authentic task will enable researchers to examine the impact of the assessment scaffolding on the student's selection and use of information tools as well as examining the information retrieved and used.

The research goals for this future study would be extended to include investigating the types of information tools used by the students as they undertake their assessment activity. Once the aspects of information tool usage, organization and scheduling become known then the information seeking behaviour of students as related to the assessment activity will become clearer. The future study will also examine the behaviour of students studying online (distance). With the use of a mobile eye-tracking device, the data collection will take place wherever the student elects to complete the assessment. The mobile eye-tracking device will capture web pages visited, documents opened and browsed, voices and keyboard/mouse actions. This data collection is exactly the same information that the computer in the lab captured for the pilot study hence the data can effectively be compared. A researcher will arrange to be present when the recording is taking place so that the observations and interview can take place. By enabling the use of a mobile eye-tracking device it is anticipated that the findings will provide a deeper insight into the e-learning behaviours of students.

The anticipated findings will be models/indices of online behaviours of students across a range of years of study at university. The modeling will enable the development of a set of recommendations that will aid university lecturers, tutors and student support advisers, irrespective of discipline, in planning and creating better assessment activities for students. The results will also contribute to the knowledge about the online information behaviour of students and contribute to the literacies of education and information science. Finally the collated data will contribute to the collective information about typical online behaviours as well as contributing to a set of guidelines that will assist educational designers in the creating online learning activites, online degrees.

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